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Volume 21, issue 1

Canadian Medical Association

QUILL ON SCALPEL

This section provides a medium through which Canadian surgeons can declare themselves, briefly and informally, on the day-to-day affairs of surgery.

The Journal Comes of Age

The Canadian Journal of Surgery commences its 21st year with a new and enlarged format.

Not only has the Journal increased its size to the more popular 8¼ x 11¼, but because of smaller type size there is a substantial increase in the amount of editorial content even though the number of pages has not increased.

More editorial material was received during 1977 than at any time in the Journal's past. While the rejection rate has increased, the number of accepted manuscripts, panel discussions, symposia, review articles and other submissions requires far more space than was available in the "old journal". The result has been that there is almost a year between acceptance of a manscript and its publication.

This issue presents subjects of interest to general surgeons, the panels and symposia of the inaugural meeting of the Canadian Association of General Surgeons. Short papers by experts on peptic ulcer disease, carcinoma of the colon and rectum, pancreatitis and intensive care are all followed by a panel discussion recorded at the time of the meeting. These presentations are designed to meet the needs of the surgeons in practice who were not able to attend the meeting, but those who did attend may wish to organize their thoughts on management in these four important areas. The panel discussions are valuable additions to the papers and help to place each topic in perspective.

The objectives of the Journal are: a) to serve in the effective continuing education of Canadian surgical fellows, b) to provide an effective vehicle for documentation of their clinical and scientific observations and c) to upgrade the international image of Canadian surgery. This issue serves a and b and, while designed for the readership rather than the author, we think will gain international approval as well.

If the receipt of editorial material is a measure of interest in this form of continuing medical education, the Journal appeals to general surgeons, cardiovascular and thoracic surgeons, and orthopedists. We hope other surgical specialists will also use the Journal to record their efforts in continuing medical education.

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C. BARBER MUELLER, MD, FRCS[C]

Physician Manpower Planning: An Urgent Problem

There is concern among medical educators and health-care organizers that Canada may soon have an excess of physicians. A planning document prepared by the health economics and statistics division of Health and Welfare Canada provides data to support these concerns.[1] When the requirements committee of the physicians manpower planning committee submitted its final report in April 1976, it contained recommendations for optimal 1981 physician requirements based on the reports of 32 working parties representing the medical specialties in Canada.[2] Although the possibility of maldistribution is obvious, the requirements committee suggested an overall physician/population ratio of 1:665. In June 1977, the federal/provincial advisory committee on health manpower planning accepted this ratio. However, since the graduating class of 1980 had already been enrolled, the Department of Health and Welfare projected physician requirements based on the anticipated situation for the period 1982 to 1986.

The current physician/population ratio in Canada is 1:679 (excluding interns and residents) — rich, in the light of world requirements. The medical schools of Canada will produce 1717 physicians in 1978; the number will increase from 1839 students in 1984 to 1869 students in 1986. If our present immigration policies maintain the number of immigrating physicians at 400/yr, in 1981 there will be 915 physicians too many; this figure will increase to 2096 in 1984, and the excess by 1986 will be 2807 (a ratio of 1:621). These projections assume an intermediate growth rate in population and that the number of intern and resident positions remains at 6500/yr.

An alternative proposal is that if the immigration of physicians be limited to 1 for every 665 immigrants, and immigration remain at about 100 000/yr, then 150 more physicians would enter Canada each year than would

leave the country. If medical school output reached the goal of 1869 students, there would be, by 1986, 807 too many physicians.

The planning document is admittedly a statistician's concept. However, it is based on realistic estimates and its implications must be seriously considered. If immigration is not controlled, then medical schools should produce fewer physicians if we are to avoid the predicted excess. There are some obvious difficulties to this policy. While some "have-not" provincial governments might accept this as an excuse to reduce the amount of money spent on health education, to reduce the number of available positions in the local medical school might not be politically palatable at the constituency level. Further, there is the problem of reducing the size of medical school staff, and who is to decide which schools should, in fact, reduce their student intake? Controlled immigration seems the most feasible step. If one were assured that the 150 immigrating physicians would be selected to restore our current deficiencies, that is, to fill positions where there is immediate need but in which we are not yet sufficiently productive (e.g., anesthesiologists, radiation therapists and microbiologists), medicine might be in a healthy and vigorous state in 1984. This solution, however, is unlikely to happen since many countries have shortages similar to our own. However, these calculations ignore the problem of distribution. Politicians are concerned with the availability of primary physicians in remote areas, but postgraduate teachers are concerned with the inappropriate overproduction of specialists. To have completed one's medical course at the age of 25 and find oneself redundant is a problem, but to have accepted the challenge of another 4 or 5 years of study to become a specialist only to find that there are no openings in one's field is a catastrophe! True, general surgeons may locate in smaller towns to provide a first-class service to their community, but if an ophthalmologist or neurosurgeon cannot locate in a community of adequate size in Canada, the only option would be to emigrate or practise in circumstances that limit the potential as well as the quality of practice.

The class of 1982 is already becoming acquainted with the rigours of 1st year medicine. Some forthright planning is therefore necessary and accurate statistics are required. The physician requirements committee recommended that a registry be established to document the major areas of practice of each physician in Canada. It is understood that federal and provincial governments are instituting a "national grid" to document disparities in distribution (Lang OE: Personal communication, 1977). This is encouraging, but such data must be available to directors of residency programs so that they can advise postgraduate students of the potential openings in their specialty when they complete their training. Admittedly, some of the data may be "soft", but surely they constitute a more sensible guide than the current "market-place pressures", which influence many residents when they select their specialties.

Some training programs should be reduced and others increased within the limits of the 6500 resident/intern positions per year. These decisions should be made by responsible medical educators rather than imposed by provincial governments (on the basis of fiscal expediency), lest we find, once again, that the government solution to a problem has itself become the problem!

We must note the concern of the Association of Canadian Medical Colleges of Canada[3] at the "possible balkanization of the country, creating internal restrictions on the movement of physicians from province to province, even though they may be graduates of Canadian schools. Self-sufficiency should be considered in the national context, not in provincial aspirations." Parochial interests, therefore, must be made subservient to national needs by responsible cooperation between educators and government so that residency programs are modified nationally rather than provincially to meet the predicted needs in each specialty. Eventually Canadian graduates from whatever province may locate with the assurance that their newly acquired expertise will be a valuable contribution to the medical needs of their communities.

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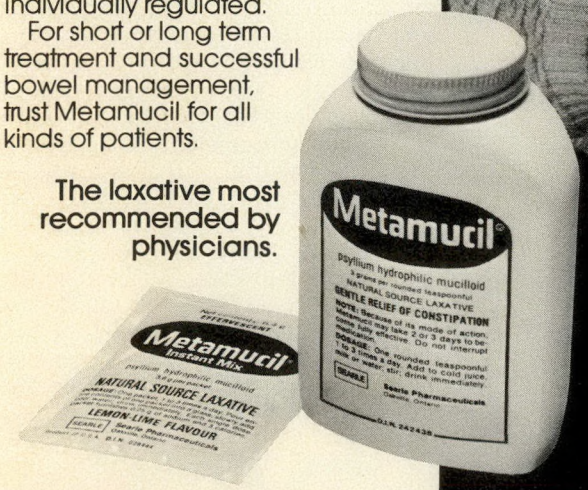

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Visualizing the Spectrum of Parameters

The standard of medical writing and speaking must have improved over the last generation, because so many books and courses have been made available to remedy the ineffective usage of English by educated people. Then why is sloppy, incorrect and cliché-ridden prose still a conspicuous feature of medical communication? Doctors often are hurt and resentful if authorities on speaking and writing group them in a class of educated illiterates; the individual doctor's response is that it may apply to many, but certainly not to him. Many are unaware that hackneyed expressions and barbarisms can be just as distracting as any other unpleasant mannerism of speech or writing. Words and phrases have their times of fashion, and doctors can be as trendy as politicians.

I would like to cite a few examples of effete fashions in medical writing.

"Parameter" is defined in various dictionaries as an arbitrary constant or an independent variable through functions of which other functions may be expressed. "Dorland's Illustrated Medical Dictionary" describes it as "a variable whose measure is indicative of a quantity or function that cannot itself be precisely determined by direct methods". Wilson Follett, in "Modern American Usage", says, "parameter, in mathematics, is a quantity that varies with the conditions under which it occurs. Hence in ordinary life a pedantic substitute for the task before us, the limits of our problems." In medical communication it is most often used as a fashionable word to mean variables, dimensions, factors, size, scope, measurement, features, findings, but the vogue seems to be to put it into the text somewhere, and it scarcely matters where it is inserted.

"Spectrum" originally meant the distribution of a physical system or phenomenon, and came from the Latin *spectere,* to look at. In medical usage it has now almost entirely replaced range, distribution, variation, gamut, extent.

"Emergent", the adjective, has two meanings defined in dictionaries: a) coming to attention or into existence; b) demanding prompt action. The difficulty in medical communication is in understanding which of the two definitions is meant by the writer at all times. Every emergent condition does not necessarily require prompt action, and some emergent situations have been in existence and recognized for some time. It would be helpful if writers would reserve the word for its original purpose, to mean "appearing", or "coming out of", or "coming to one's attention", and use the noun emergency to denote anything demanding immediate attention.

The radiologists have gradually corrupted a large segment of the profession into preferring "visualize" to see, demonstrate, define, observe. Now when we form a mental image we cannot use visualize to express the idea lest our meaning be mistaken. Similarly they have persuaded many of us that "image" used as a verb is superior to copy, portray, or record.

We are often told by a speaker that there was no "mortality" in a series he is presenting, when really he means that there were no deaths, or that the mortality was zero. In expressing results in medical reporting the term mortality should be used to express the death rate. One cannot expect immortal prose from those who use "mortality" to mean "death".

Most surgeons would never think of using an osteotome as a screwdriver, yet some see no incongruity in blunting our tools of communication and think it pedantry to be concerned with precision in speech or writing. We must look to editors of professional journals to give us guidance and insist upon better standards. Would it really matter if some articles were rejected because the authors refused to have their manuscripts edited?

In addition to knowing and insisting upon good English usage, editors also could help us eliminate the tiresome clichés that were once colourful or expressive of ideas but have become distracting repetitions.

"A high index of suspicion" has become one of the most jaded phrases in medical literature, when all the writer is trying to say is "keep this condition in mind". We should compile an index of suspicion to include the names of all writers found associating with this jade.

"Meticulous attention to detail" is another favourite banality. The speaker merely recommends conscientious or precise care, or exacting measures, or punctilious attention, or scrupulous care, or just close attention. Better still, the phrase could be left out entirely; it is gratuitous as it suggests, obliquely, that "most of you clods had better watch out, this has to be done carefully".

When a medical author reports a series of instances of some unusual condition that he has collected from an intensive search of the medical literature and added a case or two of his own, he often becomes impressed with the number he has collected and warns us "this condition is commoner than usually acknowledged". When one considers the number of items that have borne this saturnine message, we can count ourselves lucky that we have not been afflicted with more strange maladies that few can recognize.

One can expect some bias in the reports of results of treatment. An author has a point to make, and it is difficult to be completely detached in reporting one's own work. None the less, to state that "there were *only* two deaths in the series" does beg the question. At best this is not being objective and at worst presumptuous.

There are many other faults in medical writing, so many indeed that we are delighted when we encounter an author who chooses his words with an understanding of their meaning and only uses clever words or phrases when he has coined them himself, before they have become tedious. But such authors are uncommon, and as compensation one can still obtain enjoyment from some of the most pedestrian presentations by keeping count of redundancies, clichés and solecisms. I have mentioned here a few of the common irritants, but each of us has his own anathemas with respect to speaking and writing, and keeping a tally of them during an uninspiring paper can be pleasantly diverting.

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SELF – ASSESSMENT

SESAP II Question

600. Fatalities in intensive care units resulting from pseudomonas infections are most often associated with the use of

(A) central venous pressure catheters
(B) urethral catheters
(C) intravenous hyperalimentation
(D) mechanical ventilators for respiratory assistance

For this incomplete statement select the *one* completion that is BEST from those noted above.

For the critique of Item 600 see page 74 of this issue.

REVIEWERS, 1977

The coeditors and members of the Editorial Board of the Journal wish to acknowledge, with thanks, the services of the following reviewers of manuscripts for the year 1977.

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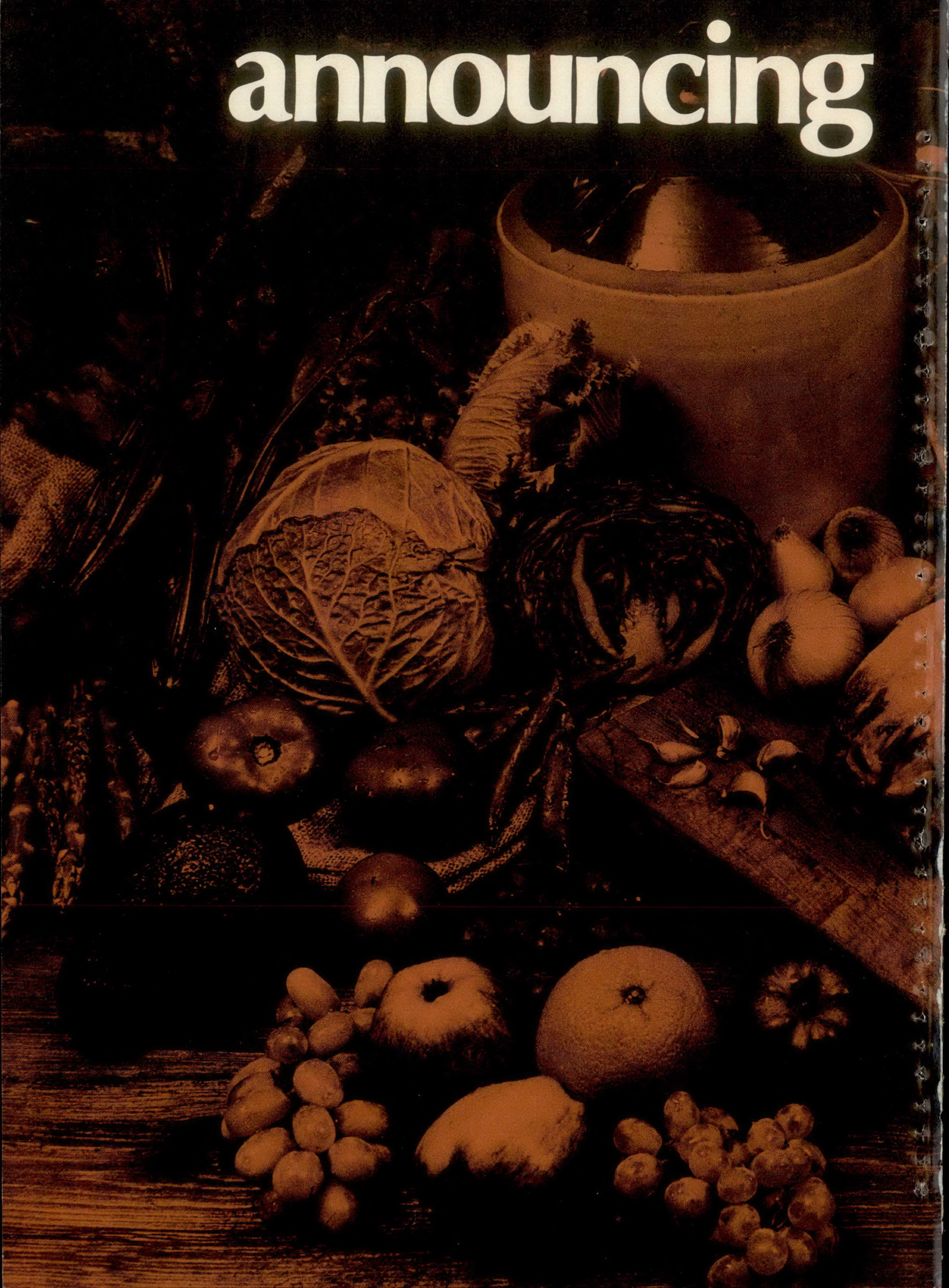

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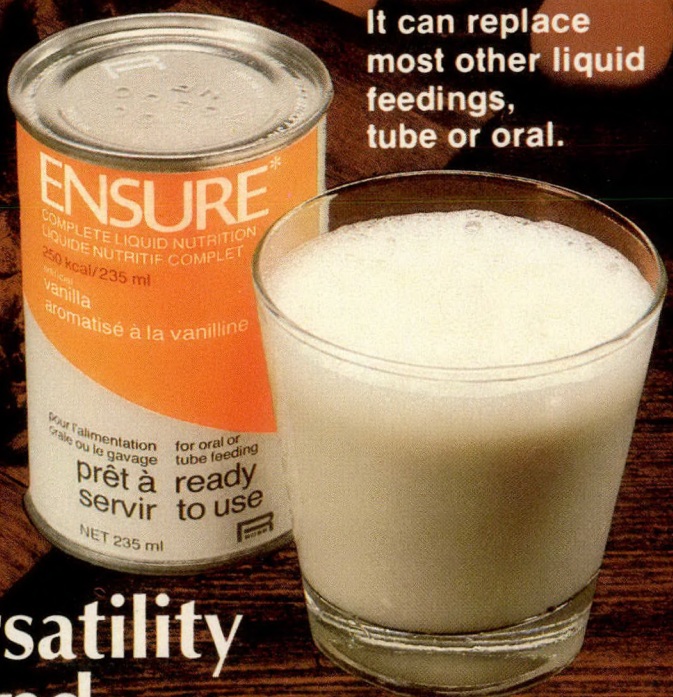

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CORRESPONDENCE

Carcinoma of the Esophagus

To the coeditors: I have read with interest Dr. Mulder's editorial comment on carcinoma of the esophagus (*Can J Surg* 20: 400, 1977). I believe that it is of great importance that some centres adopt an individual approach to this problem although the weight of evidence favours another direction. After all, the rest of us may be totally wrong. Certainly I will await with interest the final presentation of the figures from McGill University teaching hospitals; however, though I appreciate that the figures quoted by Dr. Mulder are preliminary and incomplete, it looks as if those for 5-year survival will be little different from the figures in other published series. Of greater interest is the outcome for the remaining 50 patients who did not complete the "curative" phase of his protocol. It is my contention that the answer to this question is extremely important and can only be obtained through a prospective grading system as I outlined in my paper (*Can J Surg* 20: 454, 1977). Dr. Mulder is, of course, absolutely correct in pointing out that the grading score is time-related and changes quickly with recurrence of disease. This is as I would have expected since I believe that this disease has an inexorable course and one's palliative efforts can be expected to fail sooner or later.

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To the coeditors: Dr. Stoller has correctly pointed out that the final results of carcinoma of the esophagus protocol at McGill University are very preliminary, and at the present time it is impossible to predict a 5-year survival figure. The most striking finding to date in the small group of patients is that it is possible to use radical surgical treatment in selected patients with an acceptable operative mortality. This is in contrast with the experience of the previous 10 years when the operative mortality was high and case selection was poor.

The patients who did not complete the curative phase of the protocol usually received a course of radiotherapy if their general condition warranted it. The preliminary results would suggest that their mean survival was under 5 months, the same as reported in the surgical literature for cases in which celiac axis or supraclavicular lymph nodes are involved by tumour.

I cannot comment on the degree of palliation provided for this group of patients. We are at present in the process of re-evaluating this group and it would be interesting to apply Dr. Stoller's grading system.

It is only through a prospective treatment protocol, whether palliative or curative, that our effectiveness in managing this difficult disease can be assessed.

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Symposium on Peptic Ulcer Disease
1. Medical Treatment of Peptic Ulcer*

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The conventional treatment of peptic ulcer disease with special dietary regimens, antacids or anticholinergics has been found wanting. Recently introduced agents show considerable promise in the benefit they can render. Carbenoxolone accelerates the healing of gastric ulcers by increasing gastric mucosal resistance. Cimetidine, a histamine H_2-receptor antagonist, is an effective suppressant of acid secretion and therefore promotes healing of duodenal ulcers. Metoclopramide hastens gastric emptying and increases the tone of the gastroesophageal sphincter, and is valuable in cases of reflux esophagitis and gastric ulcer.

Le traitement classique de l'ulcère gastrique à l'aide de régimes alimentaires spéciaux, d'anti-acides ou d'anti-cholinergiques s'est avéré insatisfaisant. Certains médicaments nouvellement lancés se montrent fort prometteurs en ce qui a trait aux bénéfices escomptés. La carbénoxolone accélère la cicatrisation des ulcères gastriques par augmentation de la résistance de la muqueuse gastrique. La cimétidine, un antagoniste des récepteurs histaminiques H_2, est un inhibiteur efficace de la sécrétion d'acide et, de la sorte, favorise la cicatrisation des ulcères duodénaux. Le métoclopramide accélère la vidange gastrique et augmente le tonus du sphincter gastro-oesophagien; il est utile dans les cas d'oesophagite de reflux et d'ulcère gastrique.

The conventional treatment of peptic ulcer disease has consisted of diet and antacids. Traditionally the diet has been a so-called "low residue bland diet" and the patient has been instructed to take antacids usually before or with meals. During episodes of acute pain frequent small feeds have been advocated. Milk has been considered especially useful in treating ulcers. However, none of these regimens has received critical study until recently. In addition to these measures new drugs have appeared on the market that can alter profoundly the metabolism of gastric mucosal cells, reducing acid secretion and affecting gastric motility. These drugs have shown greater promise for healing peptic ulcer than the plethora of antacid or antacid–anticholinergic compounds. Their efficacy has been demonstrated by rigorously controlled trials.

The average physician has now to choose from a variety of different regimens claimed to cure ulcer disease. This paper will attempt to place the role of such regimens in proper perspective on the basis of currently available evidence.

Diet

Doll, Friedlander and Pygott[1] showed that the healing of gastric ulcers was unaffected by the administration of so-called gastric diets. Likewise, the use of belladonna and antacids, while perhaps relieving pain, did not influence the rate of healing of gastric ulcers.

Other investigators[2-5] showed that frequent feedings with milk and cream did not reduce gastric acidity and might even increase the mean acidity above values obtained with three meals a day. Various diets such as "gastric II diets" did not reduce acid below the value observed while taking three normal meals. More recently Ippoliti, Maxwell and Isenberg[6] have shown that milk actually increases acid output in patients with duodenal ulcer and that the calcium in the milk appears to be responsible for stimulating acid secretion.

Antacids

Antacids in vitro will neutralize gastric acid, but when given according to a random schedule they do not aid the healing of peptic ulcers.[7] In the studies from which these conclusions were drawn, the effect of buffers in a meal, to aid and prolong the effect of antacids, was not investigated.

Fordtran, Morawski and Richardson[8] showed that antacids have to be given in doses of 80 meq (e.g., Maalox, 30 mL) 1 and 3 hours after a meal and at bedtime to suppress acid secretion continuously. When given in this dosage antacids have improved significantly the rate of ulcer healing.[9] However, to attain this objective the patient must ingest the equivalent of 240 to 300 mL of Maalox daily. Such a dose often causes diarrhea and is inconvenient for ambulatory patients.

Anticholinergic Medications

These agents are effective in reducing acid secretion, but the doses required often result in side effects such as dry mouth, cycloplegia and urinary retention, which may be intolerable to the patient. It has been claimed that Robinul (glycopyrrolate) may suppress acid secretion preferentially[10] and may improve the rate of healing of gastric ulcer.[11] Other studies have not shown unequivocally that anticholinergic drugs aid the healing of duodenal ulcers.[12,13]

It is quite clear from the above evidence that peptic ulcer disease has not been favourably influenced by conventional medical means unless the drugs are used in such a way as to be inconvenient or associated with side effects.

New Therapeutic Agents

Recently there have become available three new agents (carbenoxolone sodium, cimetidine and metoclopramide), which are clearly effective in the healing of peptic ulcers.

Carbenoxolone Sodium

This drug is a derivative of glycyrrhizic acid, itself a derivative of licorice.[14] It reduces the turnover of gastric

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Presented at the inaugural meeting of the Canadian Association of General Surgeons, Toronto, May 11 and 12, 1977

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mucosal cells,[15] increases mucous secretions,[16] protects the gastric mucosa from the injurious effects of bile salts[17] and seems in general to act by increasing gastric mucosal resistance. In clinical trials it has been shown to accelerate the healing of gastric and duodenal ulcer.[18,19] Its effect is especially evident in ambulatory patients. It is of interest that this drug requires the presence of aldosterone to be effective so that the use of aldosterone antagonists, such as spironolactone, will inhibit its healing action on gastric ulcers.[20]

The main side effects are related to the retention of sodium, which causes edema, weight gain and congestive failure in patients with cardiac disease. These effects can be avoided by careful monitoring of the patient, using lower doses of the drug (e.g., 50 mg *tid*), avoiding its use in patients with cardiac disease and by using thiazide diuretics.

The regimen recommended is 100 mg *tid* for 1 week and then 50 mg *tid* for 6 to 8 weeks. After that period it is not clear if maintenance doses will prevent recurrence. Should there be a relapse after discontinuing the drug, the recurrent ulcer will heal at the same rate as the initial ulcer.

Cimetidine

Cimetidine[21] is the latest compound in a series of agents called histamine H_2-receptor antagonists, developed to block the stimulating effect of histamine on gastric acid secretion. The first in the series of drugs, burimamide and metiamide, were not satisfactory, especially since metiamide caused agranulocytosis.

Cimetidine in a single 300-mg dose will completely suppress acid secretion in response to food and pentagastrin for a 3-hour period; the gastric pH tends to remain high for up to 6 hours after ingestion of the drug. This effect is noted when the agent is given either orally or intravenously. Its use is not associated with serious side effects. A slight rise in serum creatinine is noted, not due to any demonstrable kidney damage. A few instances of gynecomastia have been reported.

Given in doses of 300 mg *qid* (after meals and at bedtime), it significantly accelerates the healing of duodenal ulcers,[22] and by continuing to administer one dose at night the physician may reduce the incidence of recurrence. Cimetidine is likely to be of value also in the treatment of bleeding stress ulcers and the bleeding duodenal ulcers seen in patients following renal transplantation.

Metoclopramide

This drug hastens gastric emptying and reduces the flow of bile into the duodenum. It also increases the tone of the gastroesophageal sphincter[23] and reduces bile reflux significantly. Clinical trials have indicated that it also helps reflux esophagitis appreciably[24] and hence is of value in treating peptic ulceration of the esophagus. It favourably influences the course of gastric ulcer disease[25] and gastritis. Uncontrolled observations suggest that it is useful in the management of postsurgical bile reflux gastritis with gastric ulceration (by contrast with its effect on stomal ulcers involving the anastomosed intestine). Possible side effects are depression, lethargy and parkinsonism, which may be unacceptable to some patients. The dose recommended is 10 mg after meals and at bedtime, but in thin subjects it is not advisable to exceed a total dose of 0.5 mg/kg•d.

In conclusion the drug of choice for gastric ulcer is carbenoxolone sodium and for duodenal ulcer, cimetidine. Antacids should be given in large doses if they are used in an attempt to heal ulcers. A dose of 30 mL, 1 and 3 hours after food and at bedtime, is the only logical way to use these agents.

While the results of controlled trials are not yet available, it may be practical in some situations to combine drugs to treat special situations. For example, where esophageal reflux is a major problem or where there is gastric retention, as with pyloric channel ulcer, as well as hypersecretion, a combination of cimetidine and metoclopramide will afford symptomatic relief.

Finally, it should be recognized that there is no place for restricted and unpalatable diets in the treatment of peptic ulcer disease. These are more therapeutic for the psyche of the physician (? surgeon) than for the patient.

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2. Vagotomy and Its Variations*

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All the forms of vagotomy that are used in the treatment of peptic ulcer disease lower the acid secretion by the gastric parietal cells. The preferred operation is the proximal selective vagotomy in which the innervation to the antrum and pylorus is undisturbed. Therefore the necessity for any type of drainage procedure is obviated. The results of a number of clinical trials can be considered highly satisfactory. The undue rate of ulcer recurrence sometimes reported after the operation is possibly attributable to its incorrect performance.

Toutes les formes de vagotomie qui sont utilisées dans le traitement de l'ulcère de l'estomac abaissent la sécrétion d'acide par les cellules pariétales de l'estomac. L'opération de choix est la vagotomie proximale sélective qui permet de conserver l'innervation de l'antre et du pylore. On évite de la sorte la nécessité de toute forme de drainage. Les résultats d'un bon nombre d'études peuvent être considérés comme très satisfaisants. Le taux indu de récidives ulcéreuses parfois signalé après l'opération est possiblement attribuable à son exécution imparfaite.

Currently there are three forms of vagotomy that are recommended for the surgical treatment of peptic ulceration.[1-4] The rationale for each type is the lowering of acid secretion by the gastric parietal cells subsequent to their denervation, thereby allowing ulcers to heal and preventing their recurrence. The various forms of vagotomy differ from each other only in the extent of the denervation of the other abdominal organs.

A truncal vagotomy (TV) involves a denervation of all intra-abdominal structures innervated by the vagus nerve, whereas a selective vagotomy (SV) denervates only the stomach. A new type of vagotomy introduced by Holle, Johnston and Amdrup brings about denervation of only the proximal portion of the stomach, so that the innervation to the antrum and pylorus as well as the other abdominal organs is preserved.[2] This last operation is variously referred to as highly selective vagotomy, parietal cell vagotomy, proximal gastric vagotomy or, the term I propose to use, proximal selective vagotomy (PSV).[5]

Acid Secretion

All three forms of vagotomy, TV, SV and PSV, reduce acid secretion to an equivalent degree provided a technically adequate operation has been performed.[6] The retention of innervation to the antrum by PSV might be thought to be associated with vagal release of gastrin and higher acid production, but this has not been borne out in clinical studies and must be considered only a theoretical objection to PSV.[7,8]

Motility

The major differences between the forms of vagotomy are to be found in the alterations caused in motor function of the abdominal viscera.

Proximal Stomach

Denervation of the proximal portion of the stomach, produced by TV, SV and PSV, results in a failure of receptive relaxation of this part of the organ leading to higher intragastric pressures[9] and causing a more rapid emptying of liquids from the stomach.[10] In addition, the decreased distensibility may result in the symptom of early satiety.

Distal Stomach

Denervation of the distal portion of the stomach, brought about by SV and TV, impairs the antral mill leading to incomplete mixing of solids and by its effect on the pylorus retards the emptying from the stomach of solid foods.[10] As a consequence a drainage procedure is necessary, which is not the case when PSV is performed since it preserves innervation to the distal stomach.[6]

Intestine

The motor activity of the small intestine is disturbed following vagal denervation in experimental animals. The characteristic normal wave of motor activity beginning in the antrum and sweeping down the whole of the small intestine has been demonstrated to be disorganized by vagotomy of the small intestine.[11,12] The role of this interdigestive myoelectrical complex has yet to be determined in man. It is preserved by SV and PSV and altered by TV.

Clinical Trials

In clinical practice it would be expected from consideration of the functional effects of the various types of vagotomy that PSV would cause the least number of postoperative side effects. There are now several reports of randomized clinical trials comparing the various operations that have justified this premise.[7,13] Sawyers,[14] in a study comparing PSV with SV combined with pyloroplasty, found a significantly decreased incidence of the early dumping syndrome following PSV. Devries and colleagues[15] recently reported on a randomized clinical trial comparing PSV with TV plus antrectomy; in the PSV group there was a significant increase in the number of patients in the "excellent to good" category postoperatively.

In summary, all forms of vagotomy lower acid secretion and, in the short term, control duodenal ulceration to an equal degree if the operation is technically adequate. Likewise all forms of vagotomy lead to loss of receptive relaxation in the proximal stomach and more rapid emptying of liquids from the stomach. The operations that denervate the antrum and pylorus must be accompanied by either a drainage procedure or a pyloroplasty. PSV is associated with the lowest incidence of postvagotomy side effects and avoids the complications that may be associated with pyloroplasty or gastroenterostomy.

Discussion

Proximal selective vagotomy appears

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to have many advantages in its favour. Nevertheless this is not the most common operation for peptic ulcer disease in Canada or in North America. The main argument against its adoption is the relatively short duration of follow-up in the studies that compare it with other forms of vagotomy, so that there is a possibility that the true incidence of ulcer recurrence may be unacceptably high. The high rates of recurrence after PSV in some reports have led to scepticism concerning the value of this type of vagotomy.[13] Since the main reason for recurrence is related to technical aspects of the operation, it is obvious that if the operation is not performed correctly, the initial rate of recurrence will be unacceptably high. At the moment, the incidence of delayed recurrence appears not to differ from that for other forms of vagotomy although it may be slightly higher than for vagotomy and antrectomy.[6]

Another concern regarding PSV (without pyloroplasty) relates to gastric emptying. Although inadequate gastric emptying occasionally may be present after PSV and either gastric retention or gastric ulceration may develop, if the innervation to the antrum has been preserved, the distal stomach in most patients retains the normal mechanism of emptying,[16] a drainage procedure is not required and tests for gastric emptying show normal indices.[17]

A specific complication of PSV has been lesser curve necrosis with perforation, presumably due to the extensive devascularization of this area of the stomach.[1,4] Although it is uncommon, this possibility must receive attention in the postoperative period and the complication recognized so that reoperation may be performed as soon as it is suspected.

The final objection to PSV has reference to the technical aspects of the operation and in particular the length of time required for its performance. On average a PSV takes longer than a truncal vagotomy and antrectomy and certainly much longer than TV plus drainage.[18] When done as an elective procedure a longer operative time is not an important consideration, but if required as an emergency operation or when done for a poor-risk patient, then an alternative operation to PSV should be considered.

On the other hand there are cogent arguments in favour of PSV, particularly that this operation has the lowest operative mortality to date.[7,19] In randomized clinical trials, as well as in numerous reports of retrospective analyses, it has been found that PSV is effective in preventing recurrence of duodenal ulceration and is associated with a significantly lower incidence of postoperative side effects than the alternatives,[1,2,6,7] Continued investigation into the role of the vagus nerve in affecting motility, endocrine activity and extragastric secretion may reveal unexpected benefits from reducing the extent of intra-abdominal vagal denervation.

Recommendations

Proximal selective vagotomy has advantages over other forms of vagotomy and should be introduced as routine surgical practice in Canada. However, unless this operation is performed to adequate technical standards an unacceptably high rate of ulcer recurrence will follow. Therefore PSV should be performed only by surgeons who have received instruction in its performance, and some form of either intraoperative or postoperative testing is required.

Vagotomy and drainage retains an important role in the treatment of ulcer disease in that the operation can be performed quickly and it is the safest operation in the hands of a surgeon not trained in the performance of PSV.

Vagotomy and antrectomy should be performed when the rate of recurrence must be kept as low as possible. Of the various operations that have been devised, it has the highest potential mortality. Also it has a higher postoperative morbidity than PSV.

For any individual patient the data are still insufficient to indicate in objective terms which operation is most appropriate. The continued process of randomized clinical trials is required to determine the answer to the question, "Which operation for which patient?"

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3. Practical Management of Recurrent Peptic Ulcer*

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Recurrent peptic ulcer usually develops as the result of an ill-advised or poorly executed operation. The commonest surgical error is an incomplete vagotomy. Diagnosis is made best by endoscopy. Mandatory investigation includes determination of serum gastrin and calcium, and measurement of basal and maximal acid output. Management is surgical and depends on the initial ulcer operation. Decision-making is aided by the Hollander insulin test, the secretin infusion test and occasionally by a technetium scan. There is no place for procedures that do not reduce acid output. Emergency treatment of a complication should be followed by full investigation and the appropriate operation. Recurrent gastric ulcer should be treated by gastrectomy and excision of the ulcer.

La récidive d'un ulcère de l'estomac est souvent le résultat d'une opération peu judicieuse ou mal exécutée. L'erreur chirurgicale la plus fréquente est une vagotomie incomplète. L'endoscopie est le meilleur moyen de diagnostic. Les examens obligatoires comprennent la détermination de la gastrine et du calcium sériques, et la mesure du débit basal et maximal d'acidité. Le traitement est chirurgical et dépend de l'opération initiale. La prise de décision est aidée par le test à l'insuline de Hollander, le test de perfusion à la sécrétine et, occasionnellement, par une scintigraphie au technétium. Toute intervention qui ne vise pas à réduire la sécrétion d'acide est à proscrire. Le traitement d'urgence d'une complication doit être suivi d'un examen complet et de l'opération appropriée. L'ulcère gastrique récidivant doit être traité par la gastrectomie et l'excision de l'ulcère.

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Recurrent peptic ulcer is probably the best term to describe the development of an ulcer following primary peptic ulcer surgery and is preferable to the common synonyms, stomal, anastomotic and marginal ulcer. It is a serious condition, carrying a much greater complication rate and mortality than the primary ulcer. While the incidence appears to be declining it still poses a difficult problem in management. This review focuses on recurrence after treatment of duodenal ulcer with the intention of offering the surgeon a practical guide to the management of what is often a complex problem.

The incidence and timing of recurrent ulcer varies considerably depending on the initial surgical procedure (Fig. 1). Unquestionably the most successful operation in terms of the prevention of recurrence is vagotomy and antrectomy. There is no single correct treatment for recurrent ulcer. This will depend on the etiology of the lesion, which in turn is usually determined by the nature of surgery for the primary ulcer.

Etiologic Factors

Responsibility for the development of a recurrent ulcer can almost always be attributed to the surgeon who performed the initial operation. Either the decision to operate was ill-advised because the patient was, for example, drug dependent or severely neurotic, and an "albatross" results,[1] or because the operation was badly executed (Table I). Gastroenterostomy alone has now been overtaken by incomplete vagotomy as the commonest cause of recurrent ulcer. Gastroenterostomy is unsatisfactory because it does not reduce gastric acid secretion. An inadequate vagotomy means there is continued vagal stimulation of acid secretion, continued potentiation of gastrin release and unimpaired parietal cell responsiveness.

Less than a two-thirds gastrectomy without vagotomy is inadequate and was once a common cause of recurrent ulcer. This is becoming an increasingly rare cause as this operation gradually disappears from the surgical scene. Recurrent ulcer is rare after vagotomy and antrectomy and then is usually due to incomplete vagotomy, since even a 40% resection will successfully remove the antrum.

Poor gastric drainage is another con-

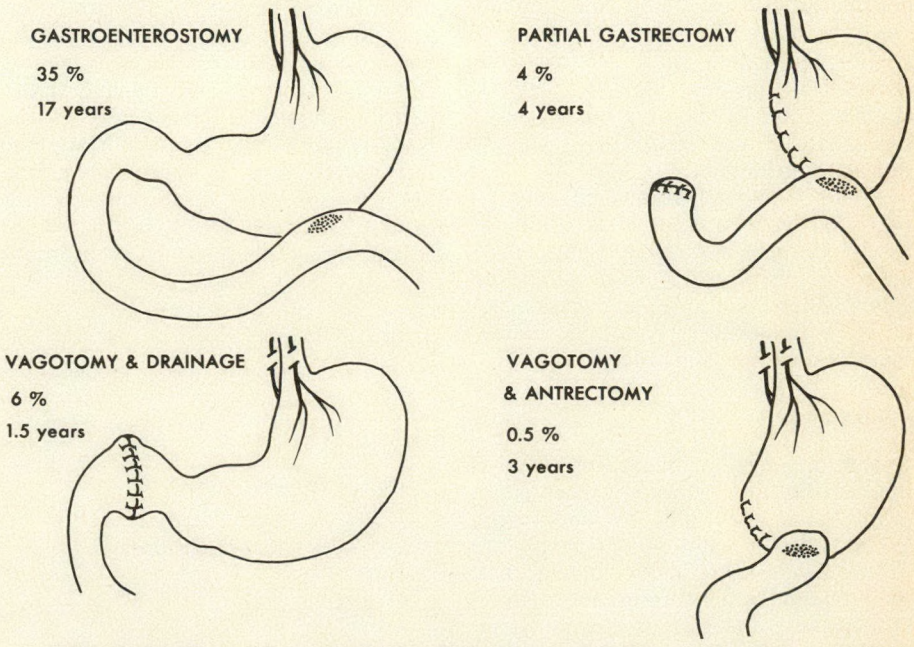

FIG. 1—Incidence of recurrent ulcer following each of four main ulcer operations and mean time interval between first and second operation.

Table I—Recurrent Ulcer: Etiologic Factors

Inadequate operation
Gastroenterostomy
Incomplete vagotomy
Inadequate gastric resection
Inadequate gastric drainage
Retained antrum
Nonabsorbable sutures
Endocrine factors
Zollinger-Ellison syndrome
Hyperparathyroidism
Pituitary–adrenal tumours
Ulcerogenic drugs

tributory factor since gastric retention stimulates acid secretion. It is more likely to follow pyloroplasty than gastroenterostomy and probably explains the slightly higher rate of recurrent ulcer after the former.[2]

While antrum retained in continuity with the duodenum after a Billroth I gastrectomy is not hazardous, the arrangement effected by Billroth II gastrectomy is highly ulcerogenic.[3] The continuous bathing of the antral mucosa in alkaline duodenal juice produces a continuous gastrin hypersecretion and a clinical situation resembling the Zollinger-Ellison syndrome (ZES).[4] Fortunately, there appears to be a decline in the prevalence of this complication of Billroth II gastrectomy.

Extruded nonabsorbable suture material at the anastomosis is a rarely reported but important cause of recurrent ulceration and can be readily dealt with by endoscopic removal of the suture material.

Although endocrine abnormalities are rarely the cause of recurrent ulcer[5] it is essential that this possibility be considered in every case and actively ruled out. Gastrinomas (ZES) are usually not recognized until recurrent ulceration occurs and such ulceration is classically of a fulminating variety.[6] Less than 2% of recurrent ulcers are due to gastrinomas.[7]

There is a well-established relation between hypercalcemia and peptic ulcer.[8] Treatment of an underlying hyperparathyroidism will often cure the ulcer.[9] There is also an association between multiglandular endocrine adenomatosis and recurrent ulcer.[10]

Diagnosis

The diagnosis of recurrent ulcer is made from the history, by roentgenography and especially by endoscopy. While secretory and other studies are of enormous value in the management of individual proven cases, the opinion that these investigations are of diagnostic value should be abandoned. Recurrence of epigastric or left upper quadrant pain relieved by antacid is highly suggestive of recurrent ulceration. However, many patients with proven recurrence deny pain[11] and present with frank hemorrhage or, more usually, chronic anemia due to occult blood loss.[12] Weight loss, diarrhea and feculent vomiting should suggest the diagnosis of gastrojejunocolic fistula.[13]

Roentgenography after ingestion of barium is usually the initial investigation and will provide the diagnosis in rather more than half the cases.[14] However, it is notoriously difficult to interpret the findings in the region of the anastomosis, and endoscopy must be performed on all patients in whom the findings are negative or equivocal. In our experience an ulcer previously suspected but missed will often then be clearly visualized.

It has recently been suggested that it may be possible to diagnose recurrent ulceration by detecting an increase in serum pepsinogen group I values in response to betazole,[15] but this is a difficult determination, and the observation requires confirmation.

Management

In every case of proven recurrent ulcer it is essential to exclude the use of ulcerogenic drugs and an underlying endocrine abnormality. A meticulous inquiry should be made into the use of drugs such as acetylsalicylic acid, indomethacin, phenylbutazone and steroids. These agents must be scrupulously avoided while the remainder of the investigation is completed and if the ulcer heals nothing further need be done. The 1-hour basal acid output (BAO) and pentagastrin-stimulated maximal acid output (MAO) are measured. If the patient is achlorhydric the diagnosis of recurrent ulcer is almost certainly incorrect and alkaline reflux gastritis should be considered. If the BAO is more than 5 mmol/h and the ratio BAO/MAO is greater than 0.6, ZES is suspected.[16] In any event, in all cases of recurrent ulcer, fasting serum gastrin should be determined on 3 consecutive days. If the values for acid secretion and serum gastrin are equivocal the diagnosis can be established by means of the secretin infusion test.[17] In ZES there is an immediate increase in serum gastrin in response to intravenous secretin whereas in other patients with recurrent ulcer, including those with retained antrum, there will be the expected fall in gastrin concentration.[18]

Serum calcium is measured in all patients with recurrent ulcer to rule out the rare parathyroid adenoma.

If the ulcer is not drug-induced, medical treatment is usually unsatisfactory[7] and should be reserved for patients in whom the risk of operation is too great. If ZES is proved, the correct treatment is total gastrectomy. A retained antrum should be excised. Hyperparathyroidism should be treated surgically before surgical treatment of recurrent ulcer is considered.

An excellent review of the literature[7] from 1950 to 1974 yielded reports of over 3400 surgically treated cases of recurrent ulcer; the important results are summarized in Table II. The authors make the valuable observation that any operation that does not reduce acid output will fail in an unacceptably high proportion of cases.

There is, however, no single correct surgical treatment of recurrent ulcer. Surgical management depends entirely on the nature of the initial operation (Table III).

Recurrent Ulcer after Gastroenterostomy

No additional investigation is required. While the logical treatment is vagotomy alone — and indeed this has a very low mortality — the rate of second recurrence is prohibitive (24%). The combination of vagotomy and antrectomy has been performed very infrequently and carries an unacceptable operative mortality (9%). The operation of choice therefore is partial (two thirds) gastrectomy, after which the recurrence rate is 11%. Vagotomy alone should be reserved for patients

Table II—Overall Results of Surgical Treatment for Recurrent Ulcer

Operation	No. of patients	Operative mortality, %	Second recurrence, %
Vagotomy or repeat vagotomy	888	1.1	15
Resection	957	2.9	12
Repeat resection	387	6.5	21
Vagotomy or repeat vagotomy and resection	76	7.9	8
Vagotomy or repeat vagotomy and repeat resection	241	5.4	8
	2549	3.2	14

who are poor risks or hyposecretors and in whom the ulcer is uncomplicated.

Recurrent Ulcer after Partial Gastrectomy

The first step is to exclude the possibility of retained antrum if the anastomosis is of a Billroth II type. This will usually have been achieved by the essential investigations noted above. In addition, it may be useful to obtain a technetium pertechnate scan, which will identify a "hot spot" to the right of the main stomach uptake if as little as 1 cm of antrum is present.[19] Direct proof is theoretically possible by endoscopic visualization and biopsy of antral mucosa by way of the afferent limb of the stoma. If retained antrum is identified it should be excised, but if it can be ruled out then vagotomy alone is sufficient. Vagotomy carries a low mortality (1.0%) and an acceptable recurrence rate (12%). Repeat resection is accompanied by a prohibitive mortality (7%) and is much less likely to provide a permanent cure.[20]

Recurrent Ulcer after Vagotomy and Drainage

The underlying cause is always an incomplete vagotomy (if ZES has been excluded). There are only three case reports in the literature of properly performed insulin tests giving persistently negative results and it is not known if these patients with recurrent ulcer after vagotomy were using ulcerogenic agents.[21,22] It can therefore be argued that an insulin test is unnecessary as its result can be predicted. Most investigators nevertheless continue to use the insulin test to assess completeness of vagotomy in this situation. Certainly, if the MAO data obtained before the initial operation are available, a repeat MAO study is simpler and quite adequate — a reduction in acid output of less than 50% and a BAO of more than 2 mmol/h are indicative of incomplete vagotomy.[23] The converse does not follow. It cannot be assumed that in the patient with an incomplete vagotomy as determined by tests of acid secretion a recurrent ulcer has developed, or inevitably will develop. It is quite wrong to reoperate on an asymptomatic patient to complete a vagotomy.

The approach we have adopted in recurrences following vagotomy is to explore the hiatus abdominally. If a substantial vagal trunk is found (and there is usually a large posterior trunk) we perform vagotomy alone, provided there is no stomal stenosis. If no vagal trunk can be identified we employ antrectomy. There is insufficient reported experience of this approach to provide data on its results. It must carry a lower morbidity and mortality than the alternative of antrectomy in all cases.

Recurrent Ulcer after Vagotomy and Antrectomy

As this occurs much less frequently than recurrence after vagotomy and drainage the reported experience is even more limited. Again, the cause is almost always incomplete vagotomy, and the insulin test will be positive. In this event the patient should be managed in the same way as after vagotomy and drainage. The hiatus should be explored and if a vagal trunk is found vagotomy alone is performed; if no significant nerve is identified, repeat resection should be undertaken. In the rare event of the insulin test being negative on two occasions (and assuming that drug and hormonal factors have been excluded) there is little alternative but to perform subtotal gastrectomy.

Emergency Management of Recurrent Ulcer

Hemorrhage

This is a common presenting symptom of recurrent ulcer, and massive bleeding is more likely to require surgical control than bleeding from a primary duodenal ulcer. If at laparotomy the surgeon is astute enough to recognize an ulcerogenic tumour of the pancreas then unquestionably the correct treatment is immediate total gastrectomy.[24] Fortunately, this lesion is rare.

Under normal circumstances the first step will be to obtain control of the bleeding vessel by direct suture using a large needle mounted with nonabsorbable material. If the patient's condition is still unstable, a pause at this stage while blood is replaced often pays dividends. In the very poor-risk patient the operation can be terminated at this point with a view to elective reoperation. Otherwise, the next step is determined by the nature of the previous operation. If vagotomy has not previously been performed, or is found to be incomplete, vagotomy alone is added. If there has been what appears to be a complete vagotomy, resection or repeat resection is performed.

Perforation

Unlike hemorrhage this is quite rare, representing only 1% of all perforations.[25] Experience is meagre and suggests that this complication should be handled like any other perforation, namely by simple patching. If the patient is young and otherwise healthy, if it is less than 8 hours from the time of perforation, and if contamination is minimal, definitive surgery can be considered. Rarely, a large perforation will demand immediate gastrectomy. If there is concern about gastric emptying it is advisable to fashion a gastrostomy for long-term gastric suction, and a jejunostomy for enteral feeding. Patients who have been treated by patching should be fully investigated in the convalescent period and managed surgically, exactly as any other case of recurrent ulcer.

Gastrojejunocolic Fistula

This condition should be suspected in any patient who presents with diarrhea, steatorrhea and weight loss after gastric surgery,[13] and especially after a gastroenterostomy. The diagnosis is confirmed by barium enema and by endoscopy. With the advent of safe total parenteral nutrition there should be no need for the former staged procedures. Once the metabolic disorders have been resolved and the bowel prepared, the surgeon should proceed to a one-stage resection of the fistula and en-bloc revision gastrectomy.[26]

Recurrent Gastric Ulcer

This is quite uncommon unless the initial gastric ulcer was treated by vagotomy and drainage.[27] As with a recurrence after surgery for duodenal ulcer,

Table III—Investigation of Proven Recurrent Ulcer

Indication		Test	Diagnosis
Mandatory tests	—	Serum gastrin	ZES or retained antrum
		Serum calcium	Hyperparathyroidism
		BAO/MAO	ZES or retained antrum
Optional tests	Abnormal or equivocal serum gastrin and BAO/MAO	Secretin infusion test	ZES
	Previous vagotomy	Hollander insulin test	Incomplete vagotomy
	Previous Billroth II resection	Technetium scan	Retained antrum

ZES = Zollinger-Ellison syndrome; BAO/MAO = basal acid output/maximal acid output.

it is first mandatory to exclude ulcerogenic agents, retained antrum and hormonal causes such as hyperparathyroidism and ZES. The surgical treatment will then depend on the initial operative procedure. If the first operation was vagotomy and drainage, partial gastrectomy should be performed; if it was vagotomy and antrectomy, then repeat vagotomy and revision gastrectomy are undertaken; and if the initial operation was partial gastrectomy, the operation of choice is vagotomy and subtotal gastrectomy. In every instance the gastric ulcer should be excised along with the gastrectomy specimen.

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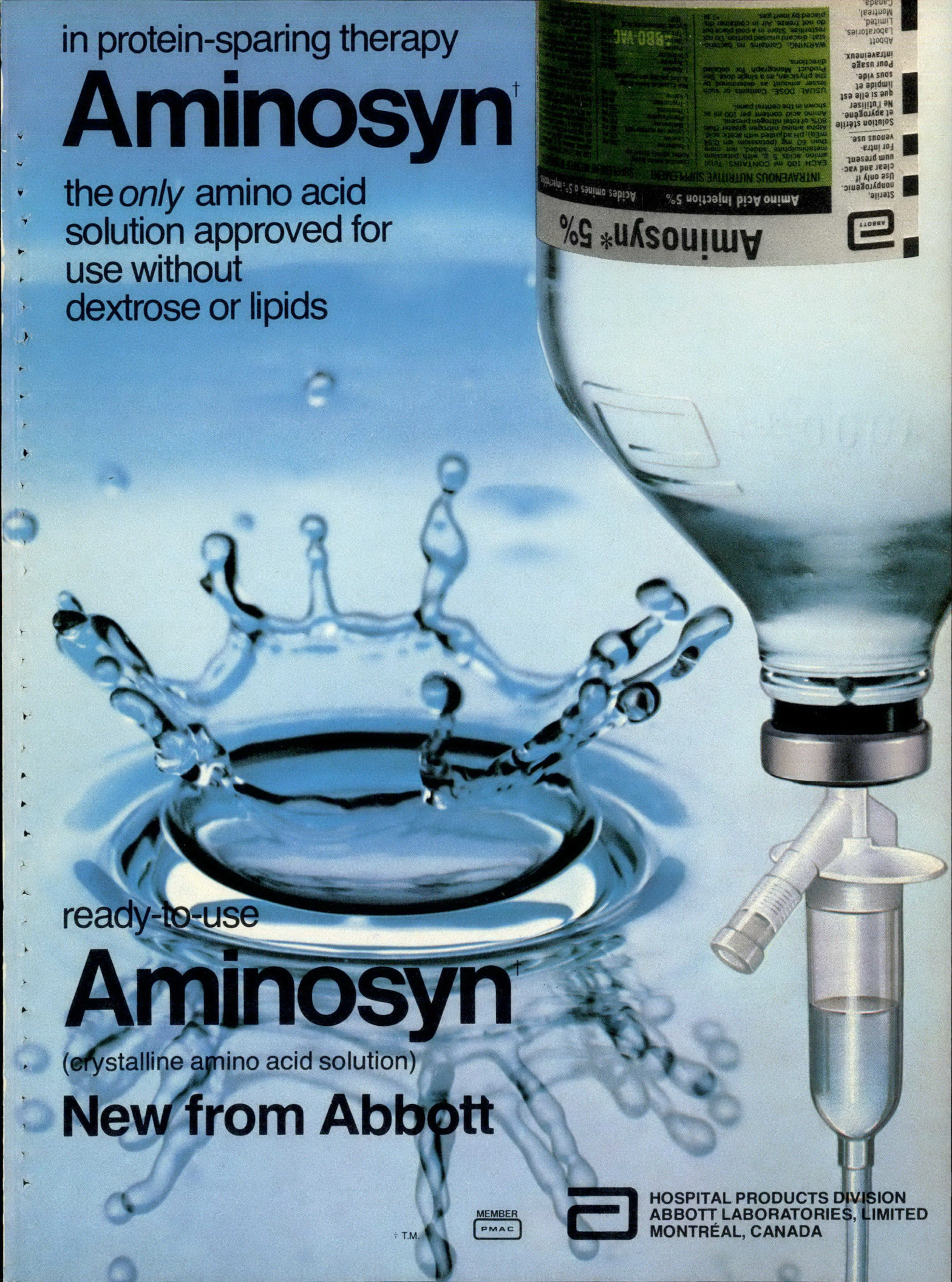

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4. Panel Discussion on Peptic Ulcer Disease*

Chairman: B.J. PEREY, MD, FRCS[C]†

Panelists: M.M. COHEN, P.J. DORIS, J.C. GOLIGHER AND K.N. JEEJEEBHOY

Dr. Perey: I would like to welcome Professor Goligher of Leeds, who has agreed to join our panel. Professor Goligher, we have always been interested in the results of various prospective randomized studies that you have conducted over the years in the field of gastrointestinal surgery. Have you conducted or are you currently conducting such a study of this new operation of proximal selective vagotomy, which allows you to decide how good an operation it is?

Prof. Goligher: Although we are very attracted to controlled trials in gastric surgery, we did not conduct such a trial of proximal selective vagotomy. When we began, we couldn't get enough surgeons to participate in a controlled trial of this rather peculiar operation, but when the trial got underway and the results seemed so good, surgeons were so happy with it that they wouldn't agree to do any other operation. So a controlled trial was out of the question and though we have performed this operation now in nearly 600 patients (about 400 of them with duodenal ulcer), we have no properly controlled data. We have to make retrospective comparisons with the results of other operations. Of course we have been interested in the trials carried out by other surgeons, like Kennedy. He has recently found a 10% recurrence rate following this operation, which is rather daunting, and I think that's the only question that remains. It is safer than most operations, it has fewer side effects and gives wonderful functional results. How often does it prevent recurrences? That's the thing we want to know.

Dr. Perey: I would ask Dr. Jeejeebhoy what he foresees as happening to the role of surgery in duodenal ulcer in years to come in view of the new drugs now available?

Dr. Jeejeebhoy: I can only guess. I think that there will continue to be a place for surgery in the foreseeable future. There will continue to be ulcer complications, and patients who do not tolerate the medication for long periods of time. Also, we do not know what are the long-term effects of cimetidine. Recent reports suggest that low-dosage prophylaxis with cimetidine probably is not very effective.

Prof. Goligher: I don't know to what extent cimetidine is used in Canada. It is certainly used a great deal in Britain at the moment. Many surgeons find that fewer patients are now referred for surgery because internists and general practitioners are now treating ulcers with cimetidine, so that there has been a considerable diminution in the number of surgical cases. I have a feeling that this medical treatment cannot go on for ever and that persons with chronic ulcers will eventually require surgery.

Dr. Perey: Dr. Cohen, would you also comment on the influence of cimetidine on the role of surgery?

Dr. Cohen: I think it is irrational to expect that cimetidine will be the answer to the treatment of peptic ulcer because the patient has to continue taking the drug for the rest of his life. Walmsley has reported on seven patients who were maintained for 1 year on metiamide, which acts like cimetidine. One of them had bleeding while taking the drug metiamide. As soon as treatment was stopped, the ulcer recurred dramatically in two other patients and an asymptomatic recurrence developed in the other four. I think the only way to cure an ulcer permanently is by surgery.

Dr. Perey: Dr. Jeejeebhoy, is there any place for cimetidine in the management of the Zollinger-Ellison syndrome? Should it be tried first before resorting to surgery, and does it work?

Dr. Jeejeebhoy: Reports have suggested that patients with the Zollinger-Ellison syndrome will benefit from cimetidine, but with time there is a fairly high incidence of breakthrough. I think that breakthroughs have occurred because of the presence of significant metastases. The drug would probably be useful in cases where preservation of the stomach is particularly desirable, as in patients who have difficulty in gaining weight. However, if a breakthrough occurs, the necessity for surgery is obvious. We have two patients with proven Zollinger-Ellison syndrome who currently are taking cimetidine and they are doing quite well. One of them had an inadequate operation in the past and he doesn't want to have another one.

Dr. Perey: Let us now go on to something else. Is there any test of gastric secretion that helps in deciding whether an operation is indicated, or in choosing the best type of procedure? Let us hear from Dr. Doris.

Dr. Doris: In general terms, secretory tests do not provide sufficient information that allows me to select the type of operation. However, I do use secretory tests to detect the rare patients with the Zollinger-Ellison tumour, although serum gastrin determinations make these tests less necessary. Also, marked acid hypersecretion is significant in the case of patients who have typical ulcer symptoms but no ulcer visible on roentgenographic or endoscopic examination. In routine practice, gastric analysis is of little practical consequence.

Dr. Perey: So you're telling us that secretory tests are important to establish whether or not we are dealing with a common garden variety of duodenal ulcer, but beyond that they don't help much. Professor Goligher, would you like to express your view?

Prof. Goligher: I would go along with Dr. Doris. We've done hundreds or even thousands of these secretory tests in my department over the last 25 years and they've had some academic interest but they haven't really helped us in deciding on the type of operation to perform or whether operation was necessary, because we haven't tried to tailor the operation to the patient. We've always chosen the smallest

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possible and the safest operation that would be reasonably effective. So even if we knew the patient had high acid secretion we would still do a relatively limited operation. I haven't been very impressed with the efforts of groups who have tried to select the patients for different types of operations. I would also add that it is almost easier to perform a satisfactory gastric operation than a satisfactory secretory test. You need a good organization for doing a satisfactory test.

Dr. Perey: So in these days of financial and budget constraints, you two gentlemen are suggesting that perhaps we are wasting the taxpayers' money on these tests. But there may be other viewpoints. I understand, Dr. Cohen, that you may consider this matter differently.

Dr. Cohen: Yes, in part. I do not believe that you can specifically tailor the operation on the basis of the acid secretory data, but I do believe that it is mandatory to obtain acid secretory data, in particular the maximal acid output (MAO), before operating on a patient with duodenal ulcer. As Dr. Doris has said, this can prevent you from doing the wrong operation on a patient with the Zollinger-Ellison syndrome. Also, you do not want to operate on a patient who is achlorhydric. Finally, by measuring the maximal acid output both pre- and postoperatively, you can avoid having to do the insulin test, which is more hazardous. When vagotomy produces a 70% reduction in the MAO, it is complete and the insulin test is not needed. I also think that the most restricted operation should be done, and as far as I'm concerned, that is truncal vagotomy and drainage. If, however, the patient is a really massive hypersecretor — by that I mean putting out 50 mmol/h or more — then I think that an antrectomy should be done as well.

Dr. Perey: On what basis do you hold that opinion?

Dr. Cohen: Because the data provided by Kronborg show that patients who have acid secretion of more than 45 to 50 mmol/h do badly with vagotomy and drainage.

Dr. Perey: Are the other members of the panel aware of studies such as Kronborg's that would support Dr. Cohen's approach?

Prof. Goligher: I'm well aware of this work. We recently analysed our cases that were treated by proximal gastric vagotomy (parietal cell vagotomy). Using Kronborg's criteria we did not find that there was a higher incidence of recurrence in the patients with very high acid secretion or a lower incidence in the patients with low acid secretion, so we regard the verdict as unproven. I have a high regard for this Danish surgeon's work, but I must say our results haven't been in agreement with his.

Dr. Perey: But Professor Goligher, do I understand that you have recurrences?

Prof. Goligher: Naturally, we do have recurrences. But most of our recurrences after proximal gastric vagotomy have occurred in the last year. Among 300 male patients we now have 7 proven recurrences and about 10 others that are dubious. We do not know what the number will be when our follow-up period reaches 5 years as for other operations. I can't see why the recurrence rate with this operation should be any less than after truncal vagotomy and drainage.

Dr. Perey: We all probably agree on this. Before we leave the subject of gastric analysis I would like to ask Dr. Jeejeebhoy, as a gastroenterologist, what he thinks about the value of this test?

Dr. Jeejeebhoy: From what I have heard from the panel members, I would say that much of the evidence on which we have estimated the worth of gastric analysis is anecdotal. Whether there is any advantage in modifying the operation according to gastric acid output remains to be shown by well-controlled randomized studies. Without that kind of data it remains unproven at this time. I would like to enlist surgeons who would be prepared to cooperate with me in carrying out clinical trials.

Dr. Perey: Should we select the best operation and employ it in almost all patients or is it your opinion that we should choose from a number of possible procedures the one most appropriate for each patient? May we put this question first to you, Professor Goligher?

Prof. Goligher: I have already declared that I am a believer in the most limited operation that is likely to be reasonably effective, for if this fails you can always reoperate and perform a more major one. I think that for practical purposes this is a good doctrine, but it is not one that is popular in the United States. You can do 400 of these new operations with no deaths, but you cannot do 100 vagotomies and antrectomies as a rule without at least one death and perhaps more. It's a much more dangerous operation. You can always operate on a patient again for recurrent ulcer. That is my philosophy, stated quite boldly and unequivocally.

Dr. Perey: So you're in favour of the minimal operation, whichever it may be, for everybody. Dr. Doris?

Dr. Doris: I agree with Professor Goligher's statement. This is a matter of philosophy. I feel that there is a specific place for each of proximal selective vagotomy, vagotomy and pyloroplasty, and vagotomy and antrectomy in duodenal ulcer disease. But I know of no way to decide which patient should get which operation. Therefore, my philosophy is to start off with a proximal selective vagotomy.

Dr. Perey: But does this mean you are going to use all the others afterwards on the same patient?

Dr. Doris: Quite possibly. I have not had to reoperate on any patient after my very short follow-up.

Dr. Perey: Dr. Jeejeebhoy, would you like to venture some comments on this topic?

Dr. Jeejeebhoy: I think that in the presence of a duodenal ulcer one could first try cimetidine. You would have no morbidity and no deaths with that! If you examine Walmsley's data, the recurrence occurred after an interval of about 7½ months and I would say that if it were my ulcer, I would be prepared to take cimetidine for 6 weeks every 7½ months. Many diseases require more medication than that, and I do not consider this to be a major imposition on most patients. I think that recurrent ulcer disease can also be managed with cimetidine — we have done this in four patients — although controlled trials will be required in this regard.

Dr. Perey: Dr. Cohen?

Dr. Cohen: The important point is, can you keep them healed?

Dr. Perey: If we had eight panelists we would probably have eight different opinions. Before closing, I have a few short questions from the audience. Dr. Jeejeebhoy, is there any acid rebound after stopping cimetidine?

Dr. Jeejeebhoy: It is difficult to give an answer because there are no good data on which to base it.

Dr. Perey: Are there uses for cimetidine in other acid peptic conditions such as reflux esophagitis?

Dr. Jeejeebhoy: Oh yes! We are in the process of carrying out a controlled trial ourselves and there is now increasing evidence that it is significantly useful.

Dr. Perey: Thank you gentlemen. On behalf of the Canadian Association of General Surgeons, I would like to thank the panelists for their excellent presentations.

Current Status of Surgical Treatment for Ulcerative Colitis and Crohn's Disease of the Large Bowel*

J.C. GOLIGHER, CH M(EDIN), FRCS, FRCS(EDIN), HON FRCSI, HON FACS†

In ulcerative colitis surgery is most often indicated because of frequent relapses when there is evidence of total or subtotal colitis. It may be performed as prophylaxis against the development of carcinoma of the large bowel, especially when rectal biopsies show epithelial dysplasia. The preferred operation would seem to be colectomy with ileorectal anastomosis, but the results obtained by most surgeons have been unsatisfactory. Therefore the procedure most favoured is ileostomy with proctocolectomy. Ileostomy is now more accepted by patients because of modern improvements in its management. To obviate the necessity of an external appliance, a continent or reservoir ileostomy with a valve mechanism has been devised, but this requires a highly intricate operation which should be performed only when the disease is in remission.

When surgery is required during a severe attack that has not responded to intensive medical treatment, the mortality rate is much higher than after an elective procedure.

In Crohn's disease the type of operation necessary depends on the extent of the disease. Often an ileorectal or ileosigmoid anastomosis is possible, even when the possibility of a recurrence is recognized, since the recurrence may be long delayed.

La colite ulcéreuse est très souvent une indication de chirurgie à cause des rechutes fréquentes lorsqu'il y a signe de colite totale ou quasi totale. L'intervention chirurgicale peut être effectuée prophylactiquement contre le carcinome du gros intestin, spécialement lorsque la biopsie du rectum révèle une dysplasie épithéliale. L'opération de choix semble être une colectomie avec anastomose iléorectale, mais les résultats obtenus par la plupart des chirurgiens ont été peu satisfaisants. Donc, l'intervention qui lui est préférée est l'iléostomie avec rectocolectomie. L'iléostomie est maintenant mieux acceptée par les patients grâce aux améliorations récentes apportées à son maniement. Pour parer à la nécessité d'un dispositif externe, une iléostomie avec contrôle de continence, ou iléostomie avec réservoir et système de soupape, a été mise au point; toutefois, celle-ci exige une opération très compliquée qui ne devrait être effectuée que lorsque la maladie est en rémission.

Quand on doit recourir à la chirurgie pendant une crise grave qui n'a pas cédé à un traitement médical intensif, le taux de mortalité est beaucoup plus élevé qu'après une intervention élective.

Dans la maladie de Cröhn, le type d'opération nécessaire dépend de l'étendue de la maladie. Souvent, une anastomose iléorectale ou iléosigmoïde est possible, même lorsque l'on reconnaît la possibilité d'une récidive, puisque celle-ci peut être longuement retardée.

In this survey of the contemporary role of surgery in the treatment of ulcerative colitis and Crohn's disease of the large bowel I should like to devote particular attention to a few of the outstanding controversial issues.

Ulcerative Colitis

Choice of Operation

One controversial question concerning ulcerative colitis, at least in the United Kingdom, is, What is the place of *colectomy with ileorectal anastomosis* in the management of this disease? It should be emphasized that the term "ulcerative colitis" is a misnomer; the condition ought to be called "ulcerative proctocolitis", for the rectum also is almost always involved. Consequently, to preserve the rectum and its function by means of an ileorectal anastomosis would seem an invitation to further trouble. But what matters in medicine is not so much what should happen as what actually does happen, and it must be admitted that the results reported by Aylett,[1-3] the leading advocate of this operation for ulcerative colitis, are remarkably good. At one stage almost 90% of about 300 patients treated by this method were highly satisfied with the results of the procedure. No one else seems to have been able to obtain results quite as good as these, although Turnbull[4] and Watts and Hughes[5] have had up to 60% and 70% rates of success, respectively. On the other hand Muir,[6] Ault,[7] Anderson,[8] Griffen, Lillehei and Wangensteen,[9] Baker,[10] Adson, Cooperman and Farrow[11] and I[12] have been much less impressed by the results of ileorectal anastomosis — about half the patients eventually needed rectal excision and ileostomy. However, there has been a revival of interest in this procedure in Britain recently (Parks AG: Personal communication, 1975; Hawley PR: Personal communication, 1975).

One of the difficulties concerning the controversy over the use of colectomy with ileorectal anastomosis is the absence in published reports of any clear guidance as to which patients may do particularly well after this operation and which will do badly.[10] It seems reasonable to restrict the use of this method of treatment to patients with relatively mild changes in the rectum. The ileorectal anastomosis should be located at the upper end of the rectum and, because of the considerable risk of subsequent anastomotic dehiscence, it would appear wise to follow Aylett's[3] advice to establish a temporary covering loop ileostomy until the suture line has healed (Fig. 1).

The operation favoured by most surgeons is *ileostomy with proctocolectomy or subtotal colectomy*. To those familiar with the synchronous combined abdominoperineal technique for rectal excision, as is widely practised in Britain and many countries of the British Commonwealth, it is simple to extend this operation upwards to include a

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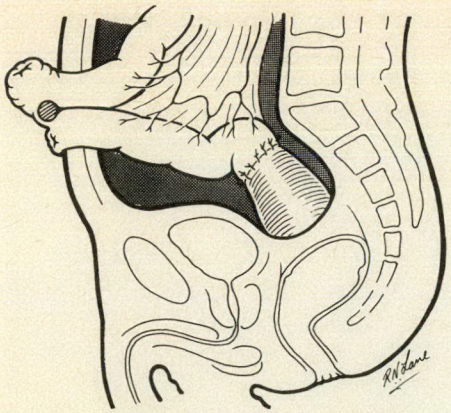


FIG. 1—Diagrammatic representation of ileorectal anastomosis with proximal loop ileostomy to protect anastomosis. Note projecting active opening and receding inactive opening of loop ileostomy.

colectomy and ileostomy. But if the surgeon lacks this familiarity or is inexperienced in treating patients with colitis, he should restrict the initial intervention to a subtotal colectomy and ileostomy. In this case the sigmoidorectal stump is brought out in the suprapubic region as a mucous fistula or, if the tissues are considered strong enough to hold sutures, it is closed and dropped back into the pelvis. It is preferable to suture the stump to either the anterior or posterior abdominal wall to keep it readily available in case a secondary ileorectal anastomosis is ever required. But in most cases, although the patient makes a good recovery of general health, the persistent inflammation in the rectal wall makes an anastomosis unwise. Indeed, the continued discharge of blood, mucus and pus from the rectum may cause so much inconvenience as to necessitate its excision within a few months. Because of the risk of malignant change, the likelihood of eventual rectal excision should always be considered, although regular sigmoidoscopic review with rectal biopsy to confirm the absence of epithelial dysplasia may permit a more conservative attitude to this problem (see below).

What is so daunting to the patient about a proctocolectomy is the ileostomy, which initially impresses the lay person, particularly a young woman or teenager, as repulsive and unnatural. Unquestionably the best way to overcome the patient's apprehension is to arrange for a confidential talk with an ileostomist of similar age and social background. This plan seldom fails to secure the patient's consent for operation.

Ileostomy

The success of the operation depends mainly on the ability of the surgeon to provide a good ileostomy and to ensure that the patient receives proper instruction on its management.

Operative technique.—The siting of the stoma is extremely important because the patient will subsequently wear an appliance adherent to the skin immediately surrounding it. The surgeon should make a separate circular wound for the ileostomy away from the main incision and not too close to the umbilicus, the anterior superior iliac spine, or the groin in order to ensure a smooth flat skin surface to which the bag can be affixed. Popular sites for this wound are shown in Fig. 2, the lower one being preferable because it is not at the waistline. The surgeon should choose a tentative site for the ileostomy before operation, while the patient is both lying and standing, and mark this point for his guidance at the operation.

For ileostomy most surgeons now use the technique of eversion and primary mucocutaneous suture, first described by Brooke[13] (Fig. 3), which

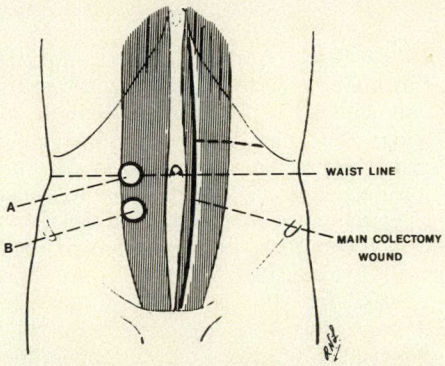


FIG. 2—Common sites for circular or trephine wound for terminal ileostomy in relation to main laparotomy wound and anatomical structures of anterior abdominal wall. Site A is inconvenient because it lies on waistline; site B is preferable.

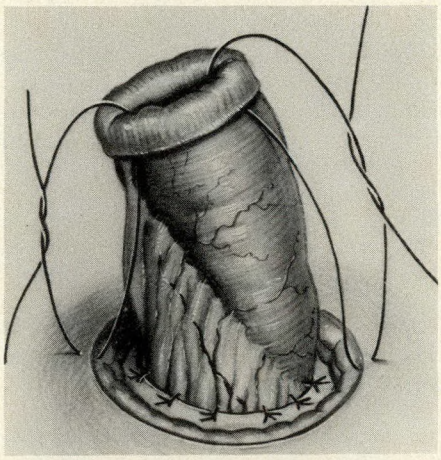


FIG. 3—Ileostomy technique. Ileal stump is fixed by circumferential row of 3-0 silk sutures between anterior rectus sheath and superficial layers of ileal wall and leaf of mesentery, about 7.0 cm from cut distal edge. End of bowel is then everted by sutures between it and edges of skin wound to produce ileal spout about 3 cm long.

provides a soft, supple, projecting ileostomy spout that shows no tendency to stenose. It is probably wise to aim for a completed ileostomy protrusion of 2.5 to 3 cm; therefore the ileal stump should extend 5 to 7.5 cm beyond the skin before it is everted.

Appliances and care of the stoma.—One of the great innovations in regard to ileostomy was the introduction of the adherent bag by Koenig and Rutzen.[14] The original bag was made of rubber and was stuck to the skin by a double-sided adhesive plaster or a cement, similar to that used for repairing bicycle tires. The ileostomy appliances fashionable today are made of a plastic, odour-resistant, rustleproof material that is disposable; they are often fixed to the skin in part by washers of karaya gum. Many patterns are available — two of the more popular ones are illustrated in Figs. 4 and 5.

Of the complications that may occur after an ileostomy, the most common and troublesome is that of the soreness of the skin around the stoma. This may be due to sensitivity to the material of the appliance or adhesive, or to leakage of ileal contents with resulting digestion of the skin. Factors predisposing to leakage are a poor standard of care in the fixation of the appliance, loose watery motions and, occasionally, a poorly constructed stoma, for example, one that does not project adequately, or protrudes too much, or is associated with a depressed scar in the immediate peristomal skin or with some other structural defect. Whatever the initial cause of skin soreness, the difficulty in keeping the appliance stuck to a raw oozing surface predisposes to leakage and a vicious circle is established. The best way to break this circle is for the patient to wear karaya gum washers, or Stomahesive (Squibb) or Reliaseal (Davol International) squares between the flange of the appliance and the abdominal skin. These are good adhesive agents and at the same time are nonirritating and soothing to the raw cutaneous surface. If the feces are particularly loose, antidiarrheal drugs such as codeine phosphate (60 to 120 mg *qid*) or diphenoxylate hydrochloride and atropine (Lomotil) (2 tab, *qid*), may give them a firmer consistency. Occasionally severe structural abnormalities of the stoma may necessitate refashioning or resiting of the ileostomy.[15,16]

Although transient skin soreness occurs in 10% to 20% of ileostomy patients, it can be eliminated or greatly reduced with the aid of the measures mentioned above in all but a small proportion of the patients. A notable advance in colorectal surgery in recent years has been the evolution of enterostomal therapy as a recognized aux-

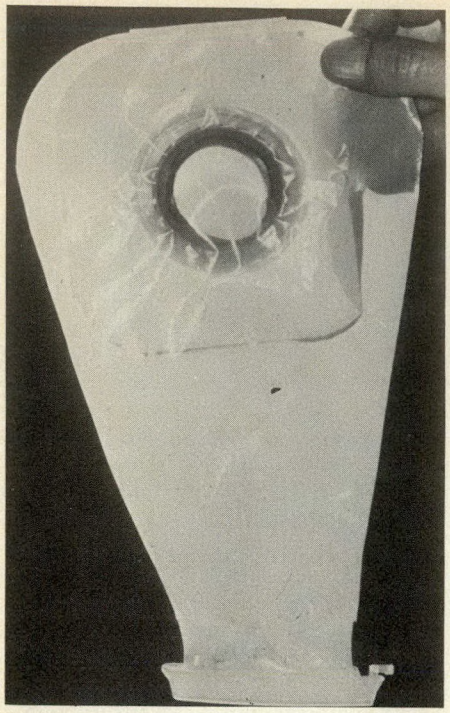


Fig. 4a

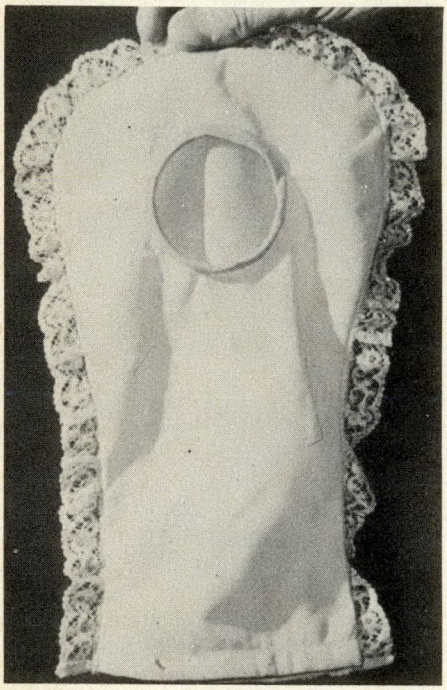


Fig. 4b

FIG. 4—(a) Rear view of Hollister draining bag. (b) Frilled cloth covering bag worn by some patients over Hollister bag to conceal feces.

iliary service for ileostomy and colostomy patients. We owe this advance mainly to the foresight and energy of Turnbull[4] and Gill[17] of Cleveland, Ohio. The availability of a keen enterostomal therapist can undoubtedly improve the recognition of stomal difficulties and help to bring them more quickly under control.

Reservoir or continent ileostomy.—Kock (personal communication, 1976)[18-20] of Gothenburg has devised the method of the continent or reservoir ileostomy, in which a length of ileum (40 to 50 cm) immediately proximal to the stoma is folded on itself, opened and anastomosed to make a pouch or sump in which the feces can accumulate and from which they can be evacuated three or four times a day by the passage of a tube through the stoma into the reservoir. Between intubations, if the operation has been successful, there is no leakage from the stoma and no need for an external appliance, merely a piece of gauze held in place with strapping. This is naturally an attractive method to many patients. Originally Kock[18] thought that by constructing such a reservoir an aperistaltic intestinal bag would be produced, which would exhibit no tendency to expel feces spontaneously. Experience soon showed that this was not so, and that to achieve anything like complete continence, a nipple valve mechanism, in the form of an intussusception of the base of the exit conduit into the reservoir (Figs. 6 and 7) producing a sort of "unspillable inkwell" effect was necessary. Then it was discovered that prolapse of the intussusception valve could take place (Fig. 8) resulting in loss of continence and inability to pass the tube into the reservoir (Kock NG: Personal communication, 1976).[20,21] In his explanation for this prolapse Kock (personal communication, 1976)[20] drew attention to the existence of a gap in the circumferential row of sutures at the base of the valve, corresponding to the coinciding mesenteries of the in-

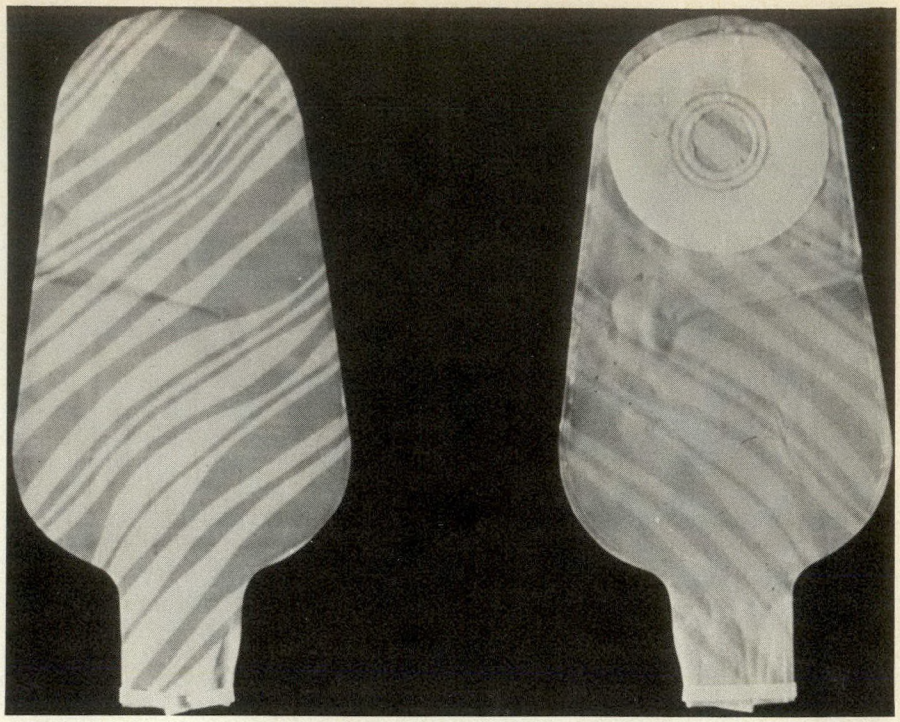


FIG. 5—Coloplast patterned draining ileostomy bag.

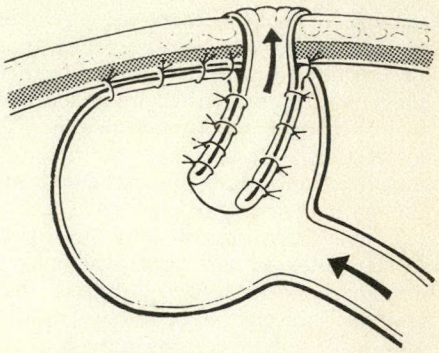


FIG. 6—Diagram of reservoir ileostomy with 4- to 5-cm nipple valve on exit conduit projecting into interior.

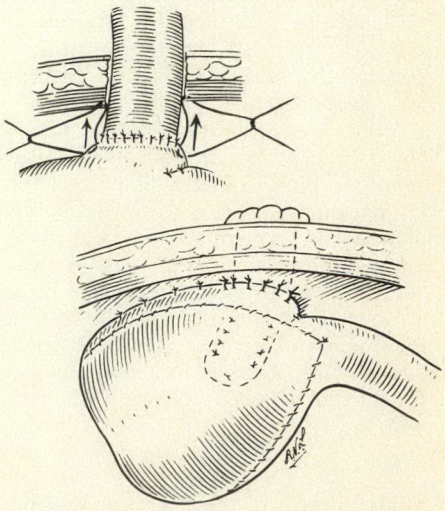


FIG. 7—Completed reservoir fixed to anterior abdominal wall.

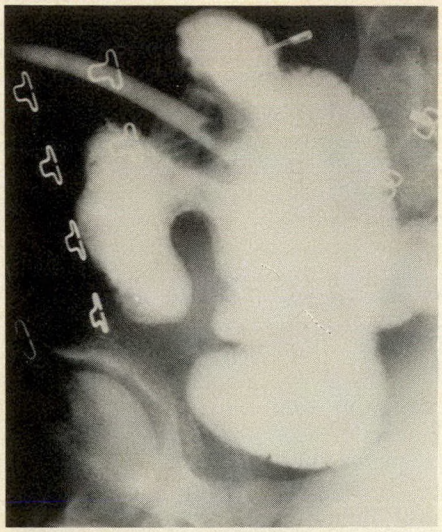


Fig. 8a

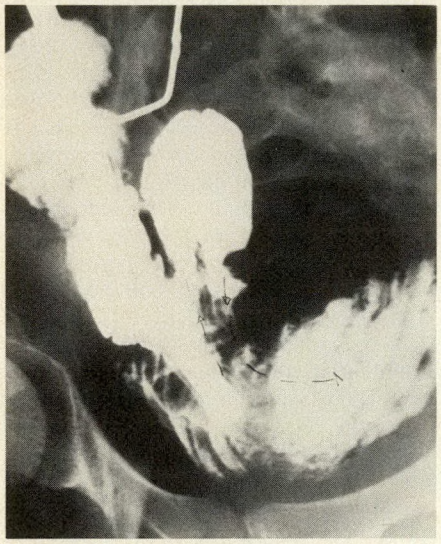
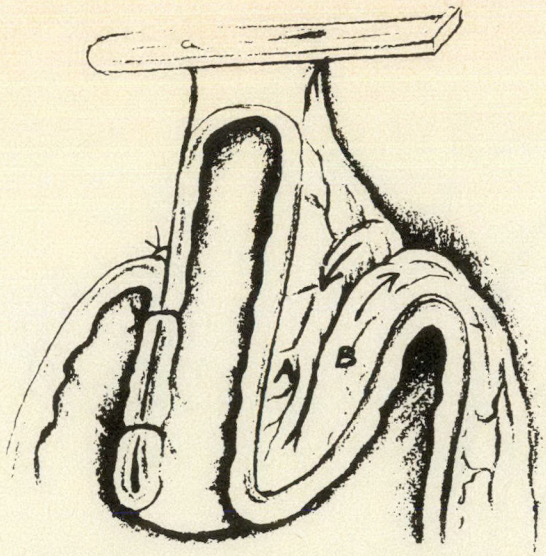


Fig. 8b

FIG. 8—Radiograph showing reservoir ileostomies. (a) Well-formed nipple valve, indicated by clear area around tube on upper part of reservoir. (b) Displaced nipple valve producing sharp kink in exit conduit.



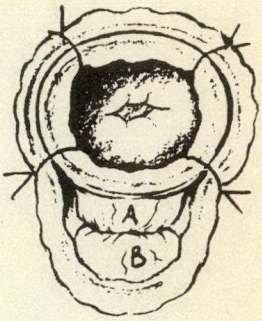


FIG. 9—Diagrammatic drawing of completed nipple valve demonstrating potential gap at site of ingoing (A) and outgoing (B) mesentery, through which prolapse of valve is thought to take place.

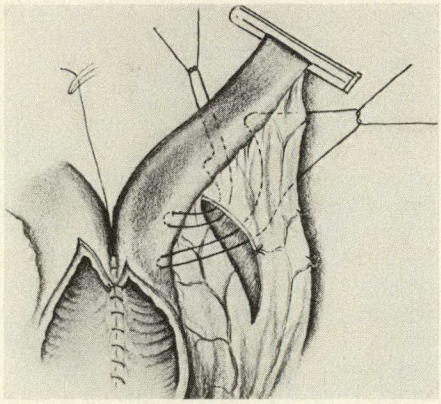


FIG. 10—Preparation of nipple valve by technique designed to rotate bowel as it is intussuscepted and to separate ingoing and outgoing mesentery. Mesentery corresponding to 8- to 10-cm segment of bowel that will be used for manufacturing valve is divided at its middle. Fine silk sutures are then inserted in one side of bowel, proximally, they are passed through mesenteric gap and are then inserted in opposite side of bowel, distally.

going and outgoing portions of bowel (Fig. 9). He believed that the valve might extrude through this weak spot. To counter this weakness he proposed a modified technique for constructing the nipple valve: as the bowel is intussuscepted into the reservoir it is rotated 60° to 90° to separate the mesenteries of the entering and leaving segments. In this new technique the mesentery of the 8- to 10-cm length of ileum earmarked for making the nipple valve is split exactly at its middle (Fig. 10). One or two silk sutures are then inserted on one side of the bowel proximally and passed through the mesenteric gap to be inserted on the other side distally. Then, as the ileum of the exit conduit is drawn into the lumen of the reservoir, these sutures are tied, the effect being to rotate the bowel and separate the two portions of mesentery. Further Lembert sutures of silk are inserted around the basal part of the intussuscepted bowel (Fig. 11).

Before the ileum is intussuscepted, its peritoneal and muscle coats are scarified by diathermy to encourage the development of adhesions between the apposed serosal surfaces after intussusception. Kock (personal communication, 1976) has recently abandoned his technique[19] of suturing the tissues of the nipple valve together with two or three longitudinal rows of silk stitches inserted through both layers of bowel from within the lumen of the reservoir, because it sometimes led to the development of a fistula through the substance of the valve with nullification of its valvular effect.

Certainly the major difficulty with the reservoir ileostomy is to provide an effective valve mechanism that will endure. It remains to be seen whether this new technique for manufacture of the nipple valve will prevent it prolapsing later, but the experience with this innovation so far reported by Kock (personal communication, 1976) is encouraging, and this method has given improved results in my own smaller group of patients, although subsequent extrusion of the valve has still occurred in a few cases.

In this connection it is appropriate to discuss the legitimate role of the reservoir ileostomy in the surgical management of colitis. Obviously this procedure, which involves extensive and complex intestinal suturing, carries risks of contamination, dehiscence, leakage and sepsis that do not apply to a conventional ileostomy operation. These risks are greatly increased in patients seriously ill during severe acute phases of ulcerative colitis; therefore a reservoir ileostomy is contraindicated at the time of the initial excisional surgery unless the disease is temporarily in full remission. The ideal candidate for a reservoir ileostomy is, in my view, one who has already undergone proctocolectomy and conventional ileostomy but who wishes the latter to be converted to a reservoir ileostomy because of persistent problems in the management of the stoma, or for various deeply felt psychologic or social reasons. It is certainly important that the patient who wants a reservoir ileostomy should be firmly dedicated to this idea, for complications after this operation are common; even in very experienced hands at least half the patients need one or more additional operations before a satisfactory con-

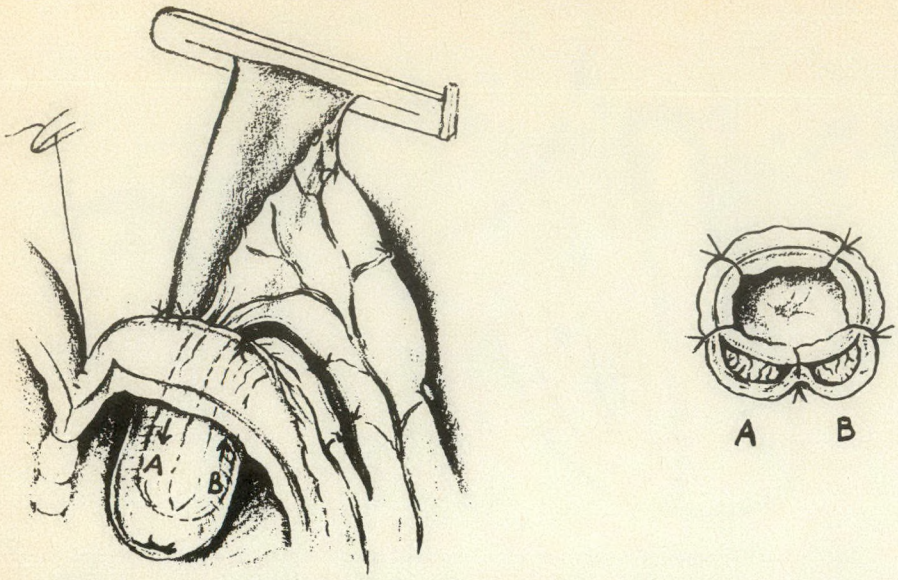


FIG. 11—Preparation of nipple valve by rotation technique. As exit conduit is drawn into lumen of reservoir, sutures are tied and produce rotation of bowel and separation of ingoing (A) and outgoing (B) mesentery, best seen in diagrammatic cross-section.

tinent ileostomy is obtained. A reservoir ileostomy is generally considered inadvisable in patients undergoing colectomy for Crohn's colitis because if the disease recurs the recurrence is most likely to be located just above the stoma. In a patient with a reservoir ileostomy that would mean in the reservoir itself, and its removal would thus necessitate sacrifice of a considerable segment of precious lower ileum. Finally the construction of an efficient reservoir ileostomy is technically a highly demanding operation and unless the surgeon is engaged in the exercise fairly frequently, he is unlikely to master its intricacies.

Indications for Surgery

Elective operation.—The commonest indication for elective surgery is chronic invalidism and the occurrence of frequent relapses, generally in patients with radiologic evidence of a total or subtotal colitis. However, especially in older patients, a more limited distal proctocolitis confined to the rectum and sigmoid colon may produce enough recurrent problems to require operation.

A debatable issue is the use of surgery as a measure of prophylaxis against the well-recognized risk of carcinoma of the large bowel in patients with long-standing and extensive colitis. Certainly in the past we have advised ileostomy and complete proctocolectomy to patients who have had total colitis for 10 or more years,[16,22] but, as Svartz and Ernberg[23] pointed out, many of these patients have learned to handle their disease satisfactorily and to lead a reasonably normal existence with relatively few symptoms. Consequently it is often difficult, as I have found, to induce them to accept an operation involving an ileostomy, and I have had the mortifying experience of seeing several such patients, who refused operation, return a few years later with established and sometimes incurable "colitis carcinoma". More recently some clinicians[24] have considered the presence of epithelial dysplasia in rectal biopsy specimens as an indication for prophylactic operation in patients with a long history of extensive colitis or, more correctly, the absence of dysplasia as an indication that it is safe, so far as risk of development of a carcinoma is concerned, to continue with conservative management for a further period of 6 to 12 months. Just how reliable this plan may be is questionable,[25] but Lennard-Jones and colleagues[26] have given an encouraging account of the conservative management of patients with ulcerative colitis monitored by rectal biopsy in this way.

Physical retardation in children with severe extensive ulcerative colitis is possibly another indication for resorting to elective surgery, which should always be borne in mind in managing these young patients. Contrary to expectation, proctocolectomy and ileostomy are usually well tolerated by children.

Arthritis, eye complications and skin manifestations in association with colitis often respond well to adequate medical treatment of the underlying bowel condition, but troublesome systemic and local anorectal complications may necessitate proctocolectomy.

Urgent and emergency operations.—These are life-saving operations undertaken at the height of severe attacks that have not responded to medical treatment. Unfortunately they are not always successful in their objective, for some of these patients are extremely ill at the time they undergo operation and the operative mortality may be four or five times greater than that after elective operations (Table I). In most patients admitted with a severe attack of colitis it is usual to give a short course of intensive medical treatment with high doses of steroids. If at any stage during this treatment there is toxic dilatation or perforation of the colon, immediate operation is required. If no such complications occur, the medical treatment is continued, but if by the end of about 1 week there are no unequivocal signs of commencing remission of the attack, urgent laparotomy is advised.

A procedure that has attracted much attention in recent years for the management of such cases, is that of *loop ileostomy with decompressing transverse or sigmoid colostomy,* recommended by Turnbull and associates[27] specifically for patients with toxic megacolon. It is particularly suitable for the management of megacolon when there is an associated sealed perforation, for, if a colectomy is performed, the perforation is unsealed and inevitably there is a contamination of the peritoneum by feces. But if there is no colonic dilatation (and in my experience more than half the patients requiring urgent surgery for colitis have no megacolon), or if there is megacolon but no sealed perforation is present. I prefer to perform an ileostomy and subtotal colectomy or complete proctocolectomy, as I do also for patients with free perforation into the peritoneal

Table I—Operative Mortality in Ulcerative Colitis According to Urgency of Operation, 1952 to 1977

	No. of patients	Operative mortality (and %)
Elective operation	420	13 (3)
Urgent and emergency operations	135	22 (16)
All operations	555	35 (6)

cavity. But the results reported by Turnbull, Weakley and Hawk[28] for ileostomy with decompressing colostomy are challengingly good; there was only one operative death in 57 patients so treated.

Crohn's Disease

Crohn's disease has a wide distribution in the alimentary tract and occasionally occurs elsewhere, but in most cases the lesions are found in the lower portion of the small bowel or, increasingly in the last 10 to 15 years, in the large bowel.[16] I shall consider only Crohn's disease confined mainly or entirely to the colon and rectum (Fig. 12). Medical measures, as for ulcerative colitis, with steroids and salicylozosulfapyridine are, in my experience, often effective in securing a remission of exacerbations of symptoms, but often surgical treatment is required eventually. Occasionally, in patients with localized lesions, this may entail a restricted colonic resection with colocolonic or ileocolonic anastomosis, or an abdominoperineal excision of the rectum with terminal iliac colostomy, but far more frequently one of the standard operations for colitis is needed — colectomy with ileosigmoid or ileorectal anastomosis, or ileostomy with subtotal colectomy or complete proctocolectomy. Often these operations must be combined with resection of a variable amount of terminal ileum if there is associated ileal involvement. One consequence of this ileal resection is that the ileostomy tends to be more active, and antidiarrheal agents such as codeine phosphate are often required to make it manageable. The other consequence is that owing to disturbance of the enterohepatic circulation of bile salts these patients are predisposed to the development of gallstones.[29] The fact that the rectum (or rectum and sigmoid) is spared in about 30% of patients with Crohn's disease of the large bowel makes a colectomy with ileorectal or ileosigmoid anastomosis fairly frequently a logical and attractive means of treating this condition. Although recurrence, usually just above the anastomosis or in the rectal stump, is not uncommon after this operation,[11,30-33] a reasonable argument can be advanced for its use, where feasible, at any rate as a temporary measure. It has generally been considered, however, that ileostomy and complete proctocolectomy yield superior results with respect to recurrence in Crohn's disease of the rectum and colon.[34,35] Indeed, soon after the pathological and clinical features of Crohn's disease affecting chiefly the large bowel were first clearly defined by Lockhart-Mummery and Morson,[36,37] many gastroenterologists formed the impression that the results of its surgical treatment, particularly by ileostomy and complete proctocolectomy, would be much better than the 50% 5-year recurrence rate after resection for Crohn's disease affecting mainly the small bowel.[34,38] But during the 15 years that have elapsed several careful follow-up studies have been published of the outcome after ileostomy and proctocolectomy for Crohn's disease, with widely varying findings (Table II[30,31,33,39,40]). It is not clear why there should be such variations in the recurrence rate, especially since the lowest incidence of recurrent disease was in the study of Nugent and colleagues,[39] which had the longest follow-up (every patient had been operated on at least 10 years previously). Certainly in my own series the striking feature was the increasing recurrence rate as the length of follow-up increased (Fig. 13). Unfortunately, because the number of cases available for follow-up of more than 12 years is small, the validity of the curve beyond this period is extremely dubious. By far the most frequent site for recurrence was immediately above the ileostomy (Fig. 14). It is emphasized, however, that a large number of patients enjoy freedom from recurrence for many years, or indefinitely, after ileostomy and proctocolectomy and that when recurrence does take place a second resection and establishment of a new ileostomy can be followed by further relief of symptoms for quite long periods.[33]

While the results of surgical treatment for Crohn's disease of the large intestine appear to be better than those of surgery for this condition in the small intestine, they do not provide any grounds for complacency. But until more effective medical treatment is developed the surgeon will continue to

Table II—Recurrence after Large Bowel Excision and Ileostomy or Colostomy According to Various Authors

Author	Cases followed	Incidence of recurrence, %
Nugent and associates, Boston, MA, 1973[39]	28	3.6
Ritchie and Lockhart-Mummery, London, UK, 1973[31]	80	6.2
Steinberg and associates, Birmingham, UK, 1974[30]	70	33.0
Korelitz and associates, New York, 1972[40]	67	46.0
Goligher, Leeds, UK, 1976[33]	167	10.2

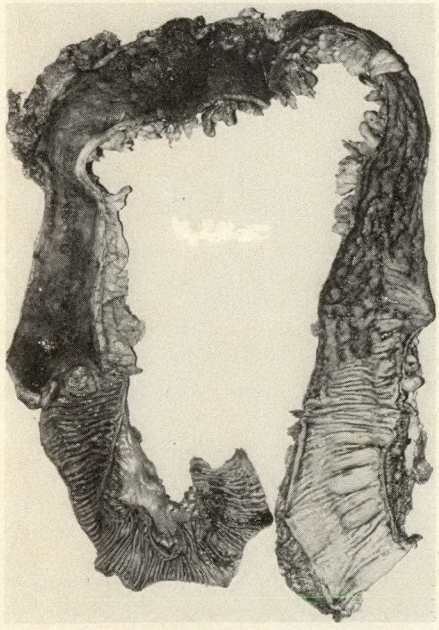


FIG. 12—Subtotal colectomy specimen showing typical gross appearance of Crohn's disease.

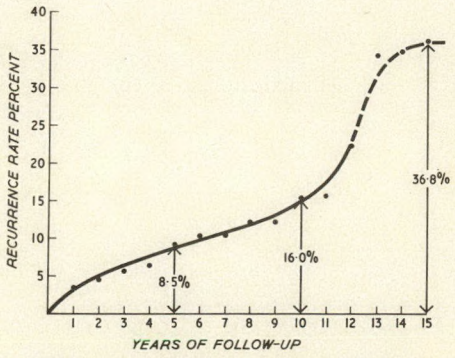


FIG. 13—Graph showing cumulative risk of recurrence after large bowel excision and ileostomy (or colostomy) for Crohn's disease.

FIG. 14—Appearance of recurrent Crohn's disease just proximal to site of ileostomy.

play a major role in the management of this disease.

Figs. 2, 4, 5 and 6 are reproduced by permission from GOLIGHER JC: Surgical treatment, in *Colitis Ulcerosa,* KREMER K, KIVELITZ H (eds), Stuttgart, Georg Thieme, 1977, p 87. Fig. 3 is reproduced by permission from GOLIGHER JC: The ostomy reconstruction. *Br J Surg* 50: 259, 1962. Fig. 13 is reproduced by permission from GOLIGHER JC: Results of resection for Crohn's disease. *Dis Colon Rectum* 19: 584, 1976. Fig. 14 is reproduced by permission from GOLIGHER JC: Ileal recurrence after ileostomy and excision of large bowel for Crohn's disease. *Br J Surg* 50: 253, 1972.

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BOOKS RECEIVED

This list is an acknowledgement of books received. It does not preclude review at a later date.

Annual Review of Birth Defects, 1976. Part A. Numerical Taxonomy of Birth Defects and Polygenic Disorders. Sponsored by The National Foundation–March of Dimes at The University of British Columbia, Vancouver. Edited by Daniel Bergsma and R. Brian Lowry. 163 pp. Illust. Alan R. Liss, Inc., New York, 1977. $20. ISBN 0-8451-1011-X.

Annual Review of Birth Defects, 1976. Part B. New Syndromes. Sponsored by The National Foundation–March of Dimes at The University of British Columbia, Vancouver. Edited by Daniel Bergsma and R. Brian Lowry, 268 pp. Illust. Alan R. Liss, Inc., New York, 1977. $32. ISBN 0-8451-1011-X.

Symposium on Carcinoma of Colon and Rectum

1. Results of Standard Surgical Treatment of Colon and Rectal Carcinomas*

ANDRÉ B. PÉLOQUIN, MD, FRCS[C], FACS†

A review is presented of 1550 cases of cancer, 545 of the rectum and 1005 of the colon, treated at Hôpital Notre-Dame, Montreal.

A survey of the patients with rectal cancer treated during successive periods shows that over the years there has been no improvement in survival after standard surgical treatment.

On the contrary, in patients with colonic cancer there has been a significant improvement in the crude survival rate, from 32.5% to 63.2%. Over the 28-year period studied, we noted also an increase in the resectability rate (from 71.8% to 90.4%) and a decline in the operative mortality rate (from 12.1% to 2.9%). Moreover, the number of patients over 70 years of age tended to increase. These three factors combined can explain, at least partly, the rise in the crude survival rate.

The corrected survival rate excludes these factors since it is based on only the resected cases and excludes postoperative deaths and deaths from intercurrent disease. Nevertheless we found an evident improvement in this survival rate as well, which rose from 46.2% to 75.4%. These gratifying results can therefore be attributed to an improvement in surgical technique: more extensive resection with high ligation of the pedicle thereby preventing dissemination of cancer cells.

On présente une revue de 1550 cas de cancer, dont 545 du rectum et 1005 du côlon, qui ont été traités à l'Hôpital Notre-Dame de Montréal.

Une étude des patients atteints du cancer du rectum et traités pendant diverses périodes successives, montre que, au cours des années, il n'y a eu aucune amélioration des taux de survie, suite à la chirurgie conventionnelle.

Au contraire, dans le cas du cancer du côlon, il y a eu une amélioration significative du taux de survie brut, celui-ci passant de 32.5% à 63.2%. Au cours de la période de 28 ans étudiée, on a aussi observé une augmentation de la possibilité de résection (le taux passant de 71.8% à 90.4%) et une baisse du taux de mortalité opératoire (de 12.1% à 2.9%). De plus, le nombre de patients de plus de 70 ans a montré une tendance à augmenter. L'association de ces trois facteurs peut expliquer, au moins en partie, l'amélioration du taux de survie brut.

Le taux de survie corrigé exclut ces trois facteurs puisqu'il ne tient compte que des cas où il y a eu résection et qu'il élimine les décès postopératoires et les morts dues à une maladie intercurrente. On a néanmoins trouvé une amélioration évidente de ce taux de survie qui a augmenté de 46.2% à 75.4%. Ces résultats encourageants peuvent donc être attribués à une amélioration des techniques chirurgicales: une résection plus étendue avec ligature haute du pédicule, prévenant de la sorte la dissémination des cellules cancéreuses.

From 1942 to 1969 inclusive, carcinoma of the colon or rectum, or both, was diagnosed and treated in 1550 patients at Hôpital Notre-Dame, Montreal. The author has reviewed personally all their records. Only three patients (0.19%) were lost to 5-year follow-up. The location of the carcinomas in the large bowel is shown in Fig. 1. In eight cases it was impossible to fix the exact location of the tumour because advanced carcinomatosis was present; these patients are included in the group of cancer of the colon. Cancers of the rectosigmoid treated by anterior resection are included in the group of sigmoid cancers.

Staging was by Dukes' classification, established on pathological findings.[1] Patients who were not operated upon all had advanced disease with distant metastases proved either by biopsy or at autopsy.

Operability refers to the percentage of patients operated upon, whether the operation was laparotomy, a bypass procedure, colostomy or resection. Resectability refers to the percentage of patients operated upon who had a resection. The crude survival rate is based on the total number of cases. The corrected survival rate is calculated from the number of patients in whom resection was performed. Therefore the operative deaths, the deaths from intercurrent disease and the three patients lost to 5-year follow-up are excluded from this figure, as suggested by Bacon.[2] Operative mortality includes all deaths occurring before the 30th postoperative day. By obstruction we mean complete obstruction, and by perforation, those patients with symptomatic abscess formation or generalized peritonitis.[3]

Global Results

There were 545 patients with cancer of the rectum. The operability was 94.3% and the resectability of stages A, B and C was 85.3%. The operative

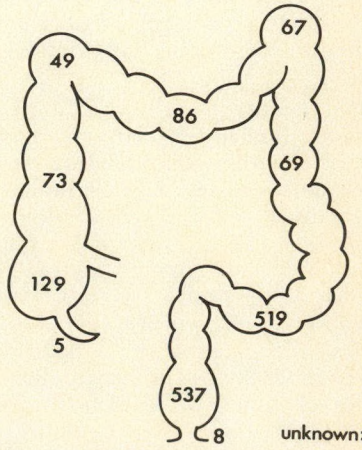

FIG. 1—Location of tumour in 1550 cases of colorectal carcinoma.

**Presented at the inaugural meeting of the Canadian Association of General Surgeons, Toronto, Ont., May 11 and 12, 1977*

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Table I—Cancer of the Rectum: Crude Survival Rate by Stage for Patients Treated in Each Time Period

Dukes' stage	1942-1946 (n = 48)*	1947-1951 (n = 102)	1952-1956 (n = 111)	1957-1961 (n = 99)	1962-1966 (n = 119)	1967-1969 (n = 66)	χ^2	P values††
A	7 (50.0)†	12 (75.0)	20 (71.4)	14 (48.3)	16 (66.7)	14 (82.3)	8.42	< 0.2 (NS)
B	3 (33.3)	10 (30.3)	12 (44.4)	10 (47.6)	11 (30.5)	3 (14.3)	7.119	< 0.3 (NS)
C	0	7 (25.9)	4 (16.7)	7 (24.1)	6 (19.3)	3 (23.1)	4.984	< 0.5 (NS)
Total	10 (26.3)	29 (38.1)	36 (45.6)	31 (39.2)	33 (36.3)	20 (39.2)	4.278	< 0.7 (NS)

*Numbers (n) include patients with stage D cancer (distant metastases) not considered in this table.
†No. (and %) surviving.
††NS = not significant.

Table II—Cancer of the Rectum: Corrected Survival Rate by Stage For Each Time Period

Dukes' stage	1942-1946	1947-1951	1952-1956	1957-1961	1962-1966	1967-1969	χ^2	P values
A	7 (63.6)*	12 (92.3)	20 (90.9)	12 (63.1)	16 (80.0)	14 (87.5)	8.701	< 0.2 (NS)
B	1 (33.3)	10 (50.0)	12 (57.1)	9 (56.2)	11 (40.7)	3 (23.1)	5.1	< 0.5 (NS)
C	0	7 (41.2)	4 (36.4)	7 (31.8)	6 (21.4)	3 (33.3)	3.118	< 0.7 (NS)
Total	8 (50.0)	29 (58.0)	36 (66.6)	28 (49.1)	33 (44.0)	20 (52.6)	7.394	< 0.2 (NS)

*No. (and %) surviving.

mortality for resection was 10.6%. The corrected survival rates for stages A, B and C were 80.2%, 46% and 30.3%, respectively. For patients with a stage A, B or C lesion considered as a group, the corrected survival rate was 53.1%.

There were 1005 patients with cancer of the colon. The operability was 97% and the resectability for stages A, B and C was 85.1%. The operative mortality for resection was 6.5%. The corrected survival rates for stages A, B and C were 83.1%, 65% and 37.7%, respectively. The corrected survival rate for all patients with stage A, B or C lesions was 61.7%.

These results of what is termed standard surgical treatment of colorectal carcinomas are similar to those reported in the literature.[4-8] As in other series, they apply to a large number of patients treated over a considerable period.

It is logical to study the outcome in patients treated at different periods: accordingly the total period of 28 years was subdivided into five 5-year periods and a final one of 3 years. Many factors can influence survival after standard surgical treatment, and in each period of the study one can notice a variation in the number of cases, the age of the patients, the proportion of cases in each Dukes' stage, the incidence of complications (obstruction or free perforation), the operability, the resectability, the operative mortality, and possibly the surgical technique.

Cancer of the Rectum

The crude survival rate on the six time periods for patients grouped according to Dukes' classification is shown in Table I. The percentage of lesions belonging to each stage is shown in Fig. 2. Most of the patients were aged between 60 and 70 years; in successive periods we noted a small rise in the number of patients aged over 70 years.

The operability varied between 90.9% and 95.8% and did not change significantly over the years ($\chi^2 = 2.703$, $P > 0.7$).

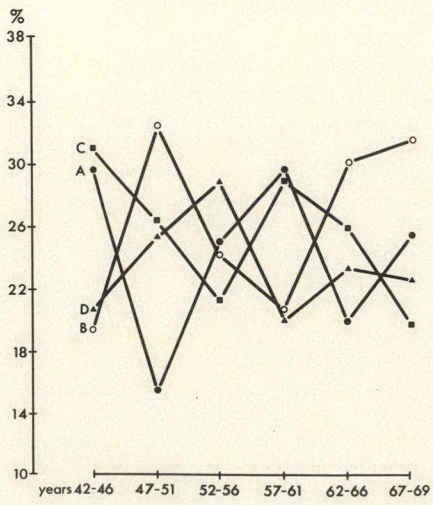

FIG. 2—Carcinoma of rectum: percentage of lesions in each stage for each time period.

The resectability for stages A, B and C rose significantly; in successive periods it was 50%, 84.2%, 88.6%, 87.2%, 94.4% and 87.7% ($\chi^2 = 42.98$, $P < 0.001$).

A considerable decrease in the operative mortality was noted as the series accumulated. For the various periods it was 10.5%, 18.3%, 18.9%, 6.8%, 4.5% and 2.2%. This improvement is statistically significant ($\chi^2 = 18.334$, $P < 0.01$).

In cases of rectal carcinoma the incidence of complete obstruction and of obstruction associated with perforation has always been low. For the former it ranged between 4.2% and 0% ($\chi^2 = 4.096$, $P > 0.5$) and for the latter between 2.1% and 0% ($\chi^2 = 3.013$, $P > 0.5$). These variations are not statistically significant.

At first sight, the crude survival rate seems to improve with the years, but neither the variations for the individual stages nor for the group as a whole are significant (Table I).

The corrected survival rates for resected rectal cancer are set forth in Table II. Again, the differences in successive periods were not statistically significant, whether one considers the various stages individually or the group as a whole. We noted for cases of stages A, B and C a corrected survival rate varying from 63.6% to 87.5%, from 33.3% to 23.1% and

Table III—Cancer of the Colon: Crude Survival Rate by Stage for Patients Treated in Each Time Period

Dukes' stage	1942-1946 (n = 63)*	1947-1951 (n = 139)	1952-1956 (n = 176)	1957-1961 (n = 183)	1962-1966 (n = 267)	1967-1969 (n = 177)	χ^2	P values
A	5 (62.5)†	11 (55.0)	13 (86.6)	17 (56.7)	28 (78.4)	34 (79.1)	9.932	> 0.05 (NS)
B	7 (38.9)	20 (38.5)	34 (58.6)	17 (41.5)	33 (45.8)	36 (66.6)	13.07	< 0.05
C	1 (7.2)	4 (14.3)	2 (6.9)	8 (20.0)	24 (36.9)	16 (41.0)	19.62	< 0.01
Total	13 (32.5)	35 (35.0)	49 (48.0)	42 (37.8)	86 (49.4)	86 (63.2)	27.747	< 0.001

*Numbers (n) include patients with stage D cancer (distant metastases) not considered in this table.
†No. (and %) surviving.

Table IV—Cancer of the Colon: Corrected Survival Rate by Stage for Each Time Period

Dukes' stage	1942-1946	1947-1951	1952-1956	1957-1961	1962-1966	1967-1969	χ^2	P values
A	4 (66.6)*	11 (68.7)	13 (100.0)	17 (68.0)	29 (96.6)	34 (85.0)	14.22	< 0.02
B	7 (58.3)	20 (52.6)	34 (69.4)	17 (56.7)	33 (63.5)	36 (80.0)	8.63	< 0.2 (NS)
C	1 (12.5)	4 (36.4)	2 (14.3)	8 (25.0)	24 (46.2)	16 (55.2)	12.99	< 0.05
Total	12 (46.2)	35 (52.8)	49 (64.5)	42 (48.3)	86 (64.2);	86 (75.4)	20.72	< 0.001

*No. (and %) surviving.

from 0% to 33.3%, in the first and final time periods respectively. These differences also are not significant. Totally for carcinomas of stages A, B and C the corrected survival rate, which was 50% in the first period, was only 52.6% in the last one, a variation that is not significant.

Even if, over the years, we noted an improvement in the resectability and the operative mortality, there was no change in the duration of survival after the standard surgical treatment of rectal cancer. The treatment, namely Miles' abdominoperineal resection, was the same throughout the 28 years of our study.

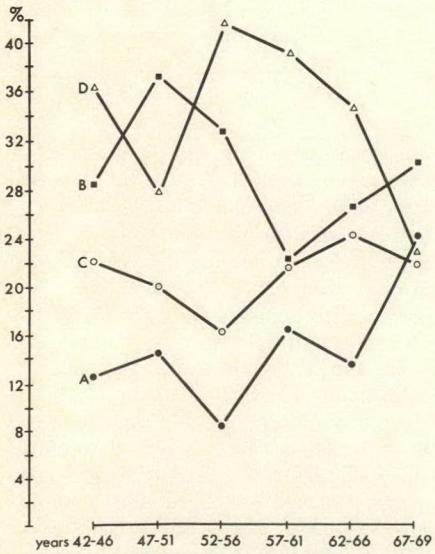

FIG. 3—Carcinoma of colon: percentage of lesions in each stage for each time period.

Cancer of the Colon

The numbers of patients treated in the six periods of the study are set forth in Table III where they are grouped according to the stage of disease. In each period the distribution of patients according to age decade was the same. The incidence was highest in persons in the seventh decade, but in the latter years of the study more patients were aged over 70 years. The percentage of patients in each stage is indicated in Fig. 3.

The operability remained fairly constant over the years, varying only between 96.6% and 97.3% ($\chi^2 = 0.179$, $P > 0.8$). The resectability, regardless of stage of disease (A, B or C) changed significantly. For successive periods it was 71.8%, 72%, 86.1%, 88.2%, 88.9% and 90.4% ($\chi^2 = 24.972$, $P < 0.001$). We noted also a decrease in operative mortality after resection of cancers of the colon, from 12.1% in the first period to 2.9% in the final one ($\chi^2 = 5.375$, $P > 0.3$).

In cases of colonic carcinoma the incidence of complications (complete obstruction or free perforation, or both) has always been high. Successively for each period it was 22.2%, 21.6%, 19.3%, 15.8%, 18.7% and 17.4%; these variations are not statistically significant ($\chi^2 = 2.461$, $P > 0.8$).

The crude survival rate showed an increase in all three stages (Table III). These improvements are statistically significant for stages B and C cases. For the group as a whole the crude survival rate increased from 32.5% in the first period to 63.2% in the final one. This improvement is highly significant. The corrected survival rate also increased (Table IV) significantly for cases belonging to stages A and C. The increase in the corrected survival rate for the group as a whole, from 46.2% to 75.4%, is also significant.

Discussion

Our study of results obtained over a 28-year period demonstrates that, in the case of rectal cancer, even if we noted an increase in the resectability and in the operative mortality, there was no increase of duration of survival after standard surgical treatment.

However, when we take account of the results in our study of cancer of the colon, we can conclude that both crude and corrected survival rates have improved significantly. During the 28 years the resectability improved significantly (from 71.8% to 90.4%) and the operative mortality dropped from 12.1% to 2.9%. Both factors can influence the survival rate.

The corrected survival rate, as defined by Bacon,[2] evaluates more accurately than the crude rate the form of surgical treatment. The former excludes the nonresected cases, and thus avoids the influence of the resectability rate. Operative deaths are also excluded and thus the effect of the variation in operative mortality rate is eliminated. The corrected rate also excludes deaths from intercurrent disease during the

5-year follow-up and thus it is not influenced by the age of the patients.[9]

A definite improvement is evident over the years. For stages A, B and C cancers the corrected survival rate rose from 46.2% to 75.4%. During the entire 28-year period neither radiation therapy, nor chemotherapy nor immunotherapy were ever used as an adjunct to surgical treatment. None of our surgeons ever utilized the Turnbull's no-touch isolation technique. Nevertheless over the years the surgical technique was gradually modified. In the final period covered by our study all surgeons concerned were performing more extensive resections with high ligation of the pedicle. All were following the practice of Cole intended to prevent dissemination of cancer cells.[10]

Our latest results for 5-year survival in cancer of the colon in stages A, B and C of 85%, 80% and 55.2%, respectively, are comparable to those obtained in other centres.[11-14] A high resectability rate, extended resections and the use of Cole's measures to prevent cancer cell dissemination are, we believe, common to all series from which superior results are reported.

We finally suggest that, *grosso modo*, the survival figures for standard surgical treatment for stages A, B and C should be 75%, 50% and 25% for rectal carcinomas, and 90%, 80% and 55% for colonic carcinomas. These results should be the base from which improvement of survival should be calculated in any further investigation or experiment.

I thank the Centre d'Oncologie de l'Hôpital Notre-Dame and its present director, Dr. Yvan Méthot. I acknowledge my debt to the surgeons of the department of surgery, to Mr. Jean and Dr. Christian Smeesters who were responsible for the statistical analyses, and to Mrs. Claudette Voet for secretarial assistance.

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2. Sphincter-Preserving Operations for Rectal Cancer*

Ian P. Todd, MS, MD(TOR), FRCS

At St. Mark's Hospital in London, England there has been a steady improvement over 20 years in the results of treatment of rectal cancer. The resectability rate has reached 95% and the overall operative mortality rate has declined to 2%. The corrected 5-year survival rate is about 70% for all who recover from the operation. It is unlikely that these figures can be bettered, so attention has been directed to the use of radiation therapy and adjuvant cytotoxic therapy, but so far no firm conclusions are possible on the benefits of either modality. In order to spare the patient a colostomy, local excision of the growth or the use of a transsphincteric approach can be considered, but few cases are suitable for either procedure or their more radical alternatives.

Au St. Mark's Hospital de Londres, on a constaté, sur une période de 20 ans, une amélioration constante des résultats du traitement du cancer rectal. Le taux des tumeurs opérables a atteint 95% et la mortalité opératoire totale est descendue à 2%. Le taux corrigé de survie à 5 ans est d'environ 70% pour ceux qui survivent à l'opération. Comme il est quasi impossible que ces statistiques puissent être améliorées, l'attention s'est portée vers l'emploi de la radiothérapie et des agents cytotoxiques d'appoint mais, jusqu'à maintenant, aucune conclusion définitive n'est possible sur les bénéfices de ces deux modes de traitement. Dans le but d'éviter une colostomie, on peut envisager une excision locale de la tumeur ou le recours à une voie d'abord à travers le sphincter, mais peu de cas se prêtent à ces modes opératoires ou à leurs alternatives plus radicales.

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The management of carcinoma of the rectum has altered slowly but continuously since Dukes[1] made the important observation that spread occurred primarily upwards towards the inferior mesenteric pedicle and only later in a retrograde or lateral direction. This observation was confirmed by Gilchrist and David[2] and is the basis of surgical practice today. As a direct outcome of this teaching, anterior resection and the modifications of pull-through, sleeve resection and peranal anastomoses have evolved. Local operations, such as peranal and transsphincteric (York Mason) excisions,[3] have gained ground even more recently, again largely through application of the original Dukes' classification,[1] stages A and B, to clinical practice.

To put into focus the place of the newer conservative excisions and sphincter-saving procedures in the management of rectal cancer it is essential to have some idea of resectability, operative mortality and 5-year survival rates for routine procedures such as combined excision of the rectum and anterior resection. At St. Mark's Hospital, London, England, the resectability rate for all rectal cancer is around 95%. The overall operative mortality for rectal cancer is 2%; it is less than 1% for combined excision and about 4% for anterior resection, the principal surgical techniques used at this hospital. The figures for these procedures have improved steadily over the past 20 years and any further improvement seems unlikely. Our corrected 5-year survival rate for patients with cancer of the rectum is around 70% for all who recover from the operation. It is 64% when combined excision is performed and 80% when anterior resection is selected. To obtain some idea of the chances for an individual patient one can break down these figures to apply to every computation of grade of malignancy, Dukes' staging, degree of local spread and presence or absence of venous involvement.

Since operative mortality and resectability figures are unlikely to change, treatment regimens must be reconsidered. Can more be done and can the quality of life be improved? All major centres in the world are now concentrating on these issues. Should preoperative or postoperative radiotherapy be given and in what dosage? Toronto has been foremost in conducting one of these trials, but there is still no definite answer. At St. Mark's we abandoned, halfway through its course, a trial of postoperative radiotherapy, mainly because of the morbidity induced. We still use radiotherapy for young patients when there is a high grade of malignancy but have no figures in its support. At present the British Medical Research Council is conducting a multicentre controlled trial of preoperative radiotherapy, but as yet no figures are available. Three regimens are being studied: no treatment; 850 rads immediately preoperatively (as, I believe, was the practice in Toronto); and up to 2200 rads over a 10-day period immediately preoperatively.

Many trials are being conducted of early cytotoxic adjuvant therapy, but the results of those reported so far have been unimpressive. At St. Mark's Hospital the trial proposed is concerned with the use of neuraminidase-treated cells, but the results will not be available for several years.

We have therefore to consider improving the quality of life. It is unlikely that dramatic changes will be made in the techniques of combined excision and anterior resection. We firmly believe in attention to detail: careful and early ligation of the pedicle, gentleness of dissection, painstaking control of bleeding and, above all, irrigation of the perineal cavity in the case of excisions or of the lumen of the bowel when resection has been performed. Eighty percent of perineal wounds are now completely healed in 2 weeks through use of the Shirley drain and a sump suction apparatus. We have thus been able to reduce hospital stay, expense and morbidity. But because every patient wants to avoid having a colostomy we are trying other restorative procedures.

Certain other operations can be performed for tumours very low in the rectum and for those at that difficult location, 6 to 8 cm from the anus. Physical factors have to be taken into account: size of the patient and whether he or she is obese, sex, breadth of the pelvis, size and grading of the tumour, condition of the blood vessels, presence of other diseases such as diabetes and so forth. These are fairly obvious factors that may militate against some operative procedures.

Local excision is now being done more often, but figures to some extent reflect the recent increase in colonoscopic removal of malignant polyps. We surgeons still take a fairly serious view of the surgical local excision procedure, even though our peranal techniques have improved greatly. Of our 143 patients with colorectal cancer only 24 had a local excision of a sessile lesion. In two less than 5 years have passed since the operations, so they cannot be included in a report. In 6 of the other 22 the local excision was thought to be incomplete, so immediate radical reoperation was undertaken. Two had a late reoperation (combined excision) for recurrence and both are well. Only 14 of the 22 have survived 5 years without further procedures. Our method of local excision was mainly removal per anum of a full-thickness wedge with at least 1 cm clearance, and closure by direct suture. We have treated only four patients using the transsphincteric approach, rediscovered and popularized by York Mason.[3] We think this operation has little place in the surgical management of rectal cancer, though certainly it is useful for other problems. The selection of patients for local excision depends upon the presence of certain obvious features: the tumour must be small (diameter, < 2.5 cm), proliferative and protuberant, not ulcerated, mobile over the deeper layers and accessible. It must not be of high grade as determined from a biopsy. Hence it is not a common lesion. Clinical selection and staging can be difficult and mistakes must be expected.

There are a number of more radical alternatives: pull-through procedures, sleeve resection and abdominoperanal resections where the anastomosis is done per anum. We have abandoned the old Bacon-Babcock-Black type of pull-through procedure and also the Maunsell-Weir or Swenson type of abdominoanal anastomosis. The Kraske procedure has been done only once in the last 10 years but perhaps it has a larger place. Our own experience with pull-through operations for rectal cancer is small, comprising only 32 patients up to 1967. Of the 23 patients who underwent a radical procedure 15 survived for 5 years. Only six more procedures have been done since 1967, of which five were considered radical and one palliative. In this small series totalling

Table I—Selection of Operative Procedure for Rectal Carcinoma

Height of tumour from anal margin, cm	Preferred operation
13-15	High anterior resection
9-12	Low anterior resection
6-8	Abdominoperineal excision Anterior resection and peranal anastomosis Pull-through Local excision Peranal Transsphincteric Kraske Fulguration
3-5	Abdominoperineal excision Local excision

38 patients there were three postoperative deaths. Since 1972 there has been a tendency to treat the smaller rectal tumours at 6 to 8 cm from the anus by an abdominoperanal operation. This is preferred to the abdominotranssphincteric operation or the abdomino-Kraske procedure or even the Localio operation as being somewhat less dangerous, less traumatic and providing a more satisfactory anastomosis. Obviously it is too early to report results, but we are reasonably pleased with the procedure.

Table I summarizes our position. Remember that the grade of malignancy and the size and type of tumour must be taken into account whenever a sphincter-saving operation is undertaken for cancer of the rectum. At St. Mark's Hospital we do not yet feel completely confident about these newer procedures, although we are using them to an increasing extent. We shall wait until a larger series provides us with statistically sound figures before advocating their general use.

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3. Radiation Therapy in Rectal Cancer*

B.J. CUMMINGS, MB, CH B, FRCP[C] FRCR, MRACR†

In a number of studies preoperative irradiation of cancer of the rectum has procured 5-year survival rates higher than those obtained with conventional surgical techniques, whether or not the tumour has spread to lymph nodes. There appears, as well, to be a lower rate of local recurrence and possibly of the development of distant metastases. Also, some tumours of questionable operability are reduced in size to make resection possible. The effectiveness of postoperative radiation therapy is not yet firmly established.

Radiation therapy as the primary method of treatment of rectal carcinoma has been used at the Princess Margaret Hospital in Toronto in 79 patients over a period of 18 years. The overall 5-year survival rate is 28%; this rises to 38% when the tumour is not fixed but falls to half this figure when fixity of the growth is evident. These results offer grounds for investigating radical radiation therapy as an alternative to surgical methods of dealing with low-lying carcinomas of the rectum.

Dans un certain nombre d'études, l'irradiation préopératoire dans le cancer du rectum a procuré une survie à 5 ans supérieure à celle qui est obtenue avec les techniques chirurgicales conventionnelles, qu'il y ait envahissement des ganglions lymphatiques ou pas. Egalement, il semble y avoir un plus faible taux de récidives locales et une moins grande possibilité d'apparition de métastases à distance. De plus, quelques tumeurs difficilement opérables sont réduites de taille, rendant la résection possible. L'efficacité de la radiothérapie postopératoire n'a pas encore été parfaitement établie.

La radiothérapie a été utilisée au Princess Margaret Hospital de Toronto comme traitement primaire du carcinome rectal chez 79 patients, en 18 ans. La survie à 5 ans a été de 28%; ce nombre augmente à 38% lorsque la tumeur n'est pas adhérente, mais il diminue de moitié lorsqu'il y a fixation évidente de la néoplasie. Ces résultats offrent des raisons pour examiner la radiothérapie radicale comme alternative aux méthodes chirurgicales pour traiter les carcinomes bas du rectum.

Survival rates for patients presenting with carcinoma of the rectum and treated by surgery alone have not improved substantially over the past 20 years.[1]

Patients rarely present early in the course of their disease when preservation of the rectum and anal canal by local excision of the growth might be possible. Most patients with cancer of the lower part of the rectum must still undergo a surgical procedure that requires a colostomy. Spread of the tumour to lymph nodes or through the bowel wall means that more than half the patients will die because of their cancer, and in many a local recurrence will develop.[2] For many years it has been apparent that better methods of treatment are needed, not only to improve survival rates but also to save the rectum and anus and thus spare the patient a colostomy. There is evidence that radiation therapy may achieve these aims.

Morson and Bussey[3] reported that 80% of local recurrences followed the removal of tumours of the lower two thirds of the rectum that had penetrated the bowel wall or spread to the local lymph nodes. Their 9.7% overall incidence of local recurrence with clinical examination is a minimum figure. This is well below the incidence reported in autopsy and surgical series. For example, Gunderson and Sosin[4] found local recurrences in 65% of pa-

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tients undergoing a "second-look" operation. The range of these figures reflects the difficulty of assessing the pelvic contents by clinical means and the lack of an accepted definition of local recurrence.

Radiation therapy has been added to conventional surgical techniques and has also been used as the sole treatment for rectal carcinoma.

Preoperative Irradiation

The rationale of preoperative irradiation is based on experimental evidence that suggests that such treatment will reduce the risk of implantation of cells dislodged at surgery, sterilize unrecognized local tumour extension and reduce the bulk of large tumours to make resection technically easier. Comparison between patients who receive preoperative irradiation and those who are treated by surgery alone is made difficult by the lack of a clinical staging system for carcinoma of the rectum.

However, all trials of preoperative irradiation for cancer of the rectum, with only a single exception, have brought about improvement in survival, although not always in the same subgroups of patients (Table I[5-8]). A variety of radiation doses and field arrangements have been used. In the retrospective Memorial Hospital study[6] a dose of 1000 to 1500 rads was given to the pelvis, and increased survival rates were reported at 5 and 10 years for patients who had involved lymph nodes. A later nonrandomized study at Memorial Hospital,[9] in which a dose of 2500 rads was given in 12 days, showed no apparent difference in survival rates at 5 years. The large randomized trial conducted by the Veterans Administration Group[7] employed a preoperative dose of 2000 to 2500 rads in 12 days. Their patients who had abdominoperineal resection after preoperative irradiation had improved 5-year survival. In this trial patients with and without lymph-node involvement benefited. In a Toronto study[5] a single dose of 500 rads was given on the day of operation, and improved survival was demonstrated in those who had an abdominoperineal resection in the presence of positive lymph nodes. Stevens, Allen and Fletcher,[8] reported increased overall survival rates with the use of 5000 rads given over 5½ weeks to the primary rectal tumour.

Local recurrence rates after preoperative irradiation have been lower, although again not all subgroups seem to have derived equal benefit. In the high-dose study of Stevens and colleagues[8] not a single local recurrence developed in the 40 patients who had curative resection after 5000 rads. Studies in which a lower radiation dose was given suggest a greater benefit when lymph nodes are positive. However, these are the patients in whom local recurrence rates are highest, and it may simply be easier statistically to detect improved results in this group.

The effect of preoperative irradiation on rates of development of distant metastases is difficult to assess, because occult metastases may be missed at surgery. The Veterans Administration Trial[7] does suggest that such rates are lower in irradiated patients. More effective systemic therapy is needed to deal with distant metastases, and also to help improve control rates for local metastases.

Marginally operable tumours have been reduced to resectable size in some studies. Higher dose radiation therapy in the range 5000 to 6000 rads in 5 to 6 weeks has been used, sometimes with additional chemotherapy. Stevens and colleagues[8] reported the results of treatment of 35 patients with locally fixed tumours; of the 20 who subsequently underwent surgery 3 lived longer than 5 years without tumour and 2 others died without evidence of tumour activity. Kligerman and Urdaneta-Lafee[10] treated 15 patients with fixed tumours; in 13 the tumour became operable, and 3 of the 9 who subsequently underwent resection survived 5 years.

Postoperative Irradiation

Postoperative irradiation has been advocated by those who believe adjunctive therapy should be offered only to those with a statistically high risk of local recurrence. The difficulties of selecting such patients on the basis of operative and pathology reports have been demonstrated.[11] Also, on theoretical grounds, the disturbance to the pelvic blood supply caused by surgery might produce areas of local hypoxia with reduction in the radiosensitivity of malignant cells. Postoperative irradiation cannot affect cells that are not within the radiation field, and after surgery the whole abdominal cavity and perineum become potentially contaminated. High-dose, wide-field radiation therapy carries a risk of irradiation-induced small-bowel complications. None of the preliminary studies have progressed far enough to provide significant information as to survival,[12] but on clinical grounds local control rates appear to be improved. Current trials are also studying combinations of radiation therapy and chemotherapy following surgery. The irradiation of established local recurrences produces good palliation but few cures.

Primary Curative Irradiation

The use of radiation therapy as a primary curative method for cancer of the rectum has been reported in three widely differing situations. The first of these is one in which patients regarded as likely to receive only palliation of their disease have been irradiated, and a small percentage has been cured.[13] Also, Papillon[14] has demonstrated that, in carefully selected patients, contact radiotherapy or the insertion of radioactive implants provides local tumour control rates similar to those obtained with local excision or electrocoagulation.

In the third situation, external supervoltage radiation therapy has been employed as curative treatment for rectal carcinoma. Results in some series have been disappointing, with 5-year survival rates of about 5%,[13] but the radiation techniques used may have been inadequate. Studies at the Princess Margaret Hospital, Toronto, show that results much better than these can be achieved with primary curative radiation therapy. Seventy-nine patients were so treated between 1958 and 1975. Of these, 60 were over 60 years of age,

Table I—Positive Results at 5 Years in Patients with Adenocarcinoma of Rectum, some of whom Received Irradiation Preoperatively

Reference no.	Preoperative irradiation		5-year survival following		Group with improved results
	Dose, rad	Time, d	RT + surgery	Surgery alone	
5	500	1	40	10	AP, LN +
6	1000 - 1500	6 - 12	39	25	LN +
7	2000 - 2500	10	41	28	All AP
			47	34	Curative AP
			32	24	AP, LN +
8	5000	33	53	38	Curative resection, all stages

RT = preoperative irradiation; AP = abdominoperineal resection, combined resection etc., but excluding anterior resection; LN + = lymph nodes involved by tumour.

and 30 were over 70 years. Most of these patients had locally advanced tumours. Those with smaller tumours had refused abdominoperineal resection or were medically unfit for surgery. In general, there was only a clinical search for distant metastases. It is now recognized that in treating some of these patients adequate radiation fields and doses were not used. The Princess Margaret Hospital techniques for irradiating carcinoma of the rectum are now standardized as far as possible. Most of the pelvic contents are irradated to a tumour dose of 4500 to 5000 rads given in 18 to 20 fractions over a 4-week period using anterior and posterior opposed fields on a 25 MeV linear accelerator.

The effect of tumour fixation on patient survival is shown in Fig. 1. The 5-year survival for patients with tumours that were not fixed was 38%. The results for a comparable group are not reported in the surgical literature, since tumour spread beyond the limits of a curative resection cannot be discovered in those patients treated by radiation therapy. Those with fixed tumours had a 5-year survival of 19%. This figure obtained with radiation therapy is comparable to published results for extended pelvic resection for locally advanced tumours, and to the results obtained from planned high-dose preoperative irradiation and surgery for marginally operable tumours.

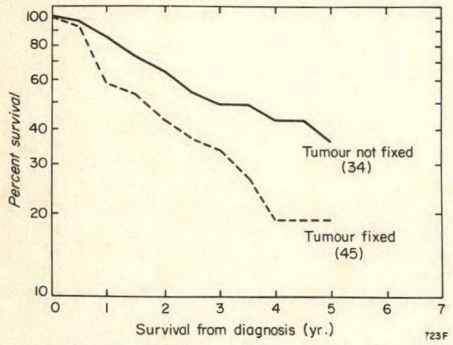

FIG. 1—Princess Margaret Hospital 1958 to 1975. Effect of tumour fixation on actuarial survival of patients with primary carcinoma of rectum. Patients treated by primary radiation therapy.

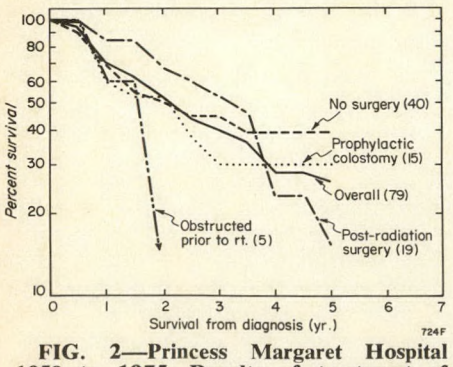

FIG. 2—Princess Margaret Hospital 1958 to 1975. Results of treatment of primary carcinoma of rectum by radiation therapy (actuarial survival).

Fig. 2 shows that the overall 5-year survival rate was 28% and also the results when patients are grouped according to the surgical management they received. Those who had postradiation surgery did not fare unexpectedly worse than those who did not; they include those patients whose tumours were not controlled by radiation therapy. They also include a group of patients who probably underwent unnecessary surgery. An important observation by Rider[15] has been that the rate of regression of some irradiated adenocarcinomas of the rectum is much slower than that seen in many other irradiated tumours, for example, squamous cell carcinoma. Of those patients for whom regression information was available, in only about 20% had the rectal carcinoma disappeared clinically 3 months after irradiation, and in 10% the tumour was still palpable and visible 12 months or more later. Neither the slow rate of regression nor the finding of morphologically identifiable carcinoma cells in the irradiated areas, is in itself proof of failure of irradiation. Those patients who underwent radical surgical procedures after radiation therapy did not appear to have an unusual incidence of surgical complications.

Conclusion

A practical scheme for the management of patients with rectal carcinoma may be developed from the reported studies. An effective form of systemic adjuvant therapy has not yet been discovered. Preoperative irradiation offers improved local control and survival rates, especially if it should be proved that the patient has involved lymph nodes or spread of the tumour through the bowel wall. Postoperative irradiation cannot be given in high doses over a wide abdominal field, and until more adequate trials are completed it should be reserved for known residual tumour or be given only in moderate doses.

The evidence from the Princess Margaret Hospital experience is that radical radiation therapy should be investigated as an alternative to surgical techniques for low-lying carcinomas of the rectum that require removal of the rectum and anal canal. Surgery would then be used only for locally uncontrolled tumours.

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4. Place des Traitements d'Appoint Complémentaires de la Chirurgie dans les Cancers du Côlon et du Rectum

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Le traitement chirurgical des cancers du côlon et du rectum, en dépit de certains raffinements techniques, semble avoir atteint ses limites: le taux de survie à 5 ans est d'environ 50%. On ne peut guère espérer guérir chirurgicalement un patient que si la maladie cancéreuse est locale. Lorsqu'il y a atteinte générale, il y a lieu de recourir aux thérapies adjuvantes visant à augmenter l'efficacité du traitement conventionnel par destruction des cellules tumorales résiduelles et des micrométastases.

Les auteurs passent en revue les études publiées sur l'utilisation prophylactique de la chimiothérapie—thiotepa, 5-fluorouracil et methyl-cyclohexyl-chloroethyl-nitrosurea—et de l'immunothérapie—bacille Calmette Guérin et *Corynebacterium parvum*—comme adjuvants de la chirurgie dans le traitement à visée curative des cancers colorectaux. Les résultats sont généralement peu significatifs et souvent contradictoires, mais ils indiquent une tendance qu'il y a lieu de confirmer.

Suite à leur expérience personnelle dans la chirurgie des cancers du tube digestif les auteurs se sont engagés dans des études cliniques sous l'égide d'organismes reconnus. Ils incitent les chirurgiens à participer à de telles études et ils soulignent le rôle que doit jouer l'Association canadienne des chirurgiens généraux afin de promouvoir les essais thérapeutiques canadiens.

Surgical treatment of colon and rectal carcinoma, in spite of technical improvements, seems to have reached its limit; the 5-year survival rate is still approximately 50%. There is some hope of curing a patient by surgery if the cancer is localized. If the condition is generalized, one must resort to adjunctive therapy with a view to improving the effectiveness of conventional therapy by destroying residual tumour cells and micrometastases.

The authors reviewed the literature pertaining to the prophylactic use of chemotherapy—thiotepa, 5-fluorouracil and methylcyclohexyl-chloroethyl-nitrosurea—and immunosuppressive therapy—bacille Calmette Guérin and *Corynebacterium parvum*—as surgical adjuvants in the curative treatment of colonic or rectal cancers. The results generally are not very significant and often are contradictory, but they indicate a trend that requires confirmation.

Based on their own experience in the surgical treatment of gastrointestinal cancers, the authors are at present engaged in conducting therapeutic studies under the aegis of recognized research groups. They urge surgeons to participate in such studies and emphasize that the Canadian Association of General Surgeons must play a role in promoting Canadian therapeutic trials.

Les traitements chirurgicaux classiques, tels que pratiqués depuis des années dans le cancer du côlon et du rectum, semblent avoir atteint leurs limites. Les divers types de résection décrits depuis quelques décennies pour radicaliser la résection colique, n'ont guère amélioré le pronostic. Il en est ainsi des raffinements de techniques pour prévenir la dissémination des cellules cancéreuses lors des manipulations opératoires.[1-6]

C'est ainsi que Morson et Bussey[7] ont remarqué, à juste titre, que la chirurgie ne pouvait apporter plus que ce qu'elle avait donné. Le raisonnement qui amène ces auteurs à cette conclusion s'appuie sur une revue de plus de 1500 cas de cancers du rectum, traités chirurgicalement au St. Mark's Hospital de Londres.

Une analyse plus approfondie des causes de décès après traitement chirurgical à visée curative, permet de poser le problème et d'illustrer le fondement des thérapies d'appoint qui ont été, depuis quelques 10 ans, mises de l'avant pour contrer l'évolution locale et générale de la maladie cancéreuse.

En effet, pour 100 cancers du rectum traités dans un but curatif, le taux de survie à 5 ans est d'environ 50%. Cinquante patients décèderont de leur cancer, dont 10% de dissémination par voie lymphatique, 20% de récidive périnéale et 70% de métastases viscérales à distance, principalement hépatiques.[8]

L'apparition de métastases à distance présuppose la circulation de cellules néoplasiques depuis la lésion primaire jusqu'au foyer de nidation. L'invasion veineuse par les cellules tumorales, souvent visible sur les prélèvements, est un facteur favorisant la présence de cellules cancéreuses dans la circulation et implique habituellement un mauvais pronostic. La présence de cellules tumorales dans la circulation veineuse de drainage et dans la circulation périphérique varie selon le temps opératoire et la technique employée.[9]

C'est pour prévenir cette dissémination peropératoire des cellules cancéreuses que Cole, Roberts et Strehl[10] ont recommandé certains gestes préventifs et que Turnbull[11] a décrit la "no touch isolation technique". Ackerman[12] a recommandé la ligature précoce de l'artère principale et des artères marginales. Bien que le but de ces détails de technique soit mis en doute par certains,[13] il est de bonne pratique de les observer en cours d'opération.

Si la maladie est locale au moment du traitement à visée curative, la chirurgie seule a d'excellentes chances de guérir le patient. Par contre, si la maladie est générale au moment du traitement primaire, la chirurgie seule est vouée à l'échec; elle devrait être complétée d'un traitement à portée générale, pour prévenir la nidation des cellules en circulation et leur développement sous forme de micrométastases.

Schabel[14] a précisé cette notion de

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micrométastases et a démontré l'importance des cellules résiduelles en post-traitement. Pour guérir un cancer, il faut théoriquement détruire toutes les cellules cancéreuses, puisque une seule cellule résiduelle peut se développer et donner naissance à des métastases. Un nodule de 1 mm de diamètre peut contenir de 10^5 à 10^6 cellules.

Dans les cancers à risque élevé, il est logique de croire que de multiples îlots de cellules tumorales existent un peu partout dans l'organisme, sous forme de micrométastases tel que l'a décrit Schabel chez l'animal.

Par ailleurs, l'évolution fatale de la maladie cancéreuse est souvent prévisible au moment du traitement à visée curative. En effet, le pronostic et l'évolution peuvent être déterminés par l'examen anatomopathologique et le degré d'extension de la lésion primaire. Quand la tumeur pénètre les couches de la paroi, jusqu'à la séreuse et la graisse péricolique (Astler–Coller stage B_2),[15] la survie est d'environ 40%. Quand il existe une invasion des ganglions (Dukes' C), la survie à 5 ans est de l'ordre de 25%.

Le taux élevé de récidive des cancers B_2-C suggère la présence de micrométastases déjà existantes au moment de la chirurgie. C'est dans cette situation, c'est à dire, lorsque la masse cellulaire résiduelle est minime, que la thérapie d'appoint a de bonnes chances d'être efficace.[16] En effet, dans le schéma de Schabel, plus la tumeur est petite, plus la loge A est importante, et plus les cellules sont actives et attaquables par les inhibiteurs chimiques spécifiques du cycle cellulaire.

La thérapie adjuvante s'appuie sur l'hypothèse que l'efficacité d'un traitement conventionnel peut être augmentée par l'usage complémentaire de substances chimiques, visant à détruire les cellules tumorales résiduelles et les micrométastases. Adjuvant se dit d'une méthode qui renforce l'action d'une autre.

Et comme exemple, il est classique de mentionner l'expérience des tumeurs de Wilms, traitées conventionnellement par chirurgie et radiothérapie et dont le pronostic a été amélioré par l'usage de l'actinomycine D en traitement d'appoint.[17]

Nous allons essayer de situer la place de ces méthodes, soit la chimiothérapie et l'immunothérapie, en revoyant quelques études publiées. Nous voulons également en dégager les indications et finalement nous voulons préciser le rôle que doit jouer l'Association canadienne des chirurgiens généraux dans le domaine des essais thérapeutiques.

Chimiothérapie Prophylactique

Pour illustrer le travail fait dans le domaine de la chimiothérapie prophylactique, l'Union internationale contre le cancer[18] a publié une liste des essais thérapeutiques en voie de réalisation.

La plupart ne datent que de 5 ans et ne sont pas terminés; les résultats publiés ne sont que préliminaires et partiels et ne permettent pas de tirer de conclusion ferme. Ils illustrent cependant une tendance qui remet en "question" la place des traitements conventionnels et celle des traitements d'appoint. La chimiothérapie est utilisée en phases opératoire et postopératoire, sous forme de monochimiothérapie ou de polychimiothérapie.

Le VA Surgical Cancer Chemotherapy Group[19] présente une première étude de chimiothérapie per- et postopératoire. La drogue utilisée, le thiotepa, a été administrée aux patients par diverses voies et la posologie a varié selon les phases de l'étude. Cette étude randomisée ne permet pas de conclusion positive et il en ressort que le thiotepa, à la dose employée (dose totale 0.6 à 0.8 mg/kg) n'a apporté aucune amélioration du taux de survie à 5 ans.

L'étude de Holden, Dixon et Kuzma[20] regroupant 14 hôpitaux américains, porte sur l'usage du thiotepa comme adjuvant postchirurgical. Sur 693 patients, 337 ont reçu la médication. Les résultats sont complexes mais non concluant: ni le temps de latence ni la survie ne sont améliorés.

Rousselot,[21,22] de St. Vincent's Hospital de New York a, depuis 1960, utilisé la chimiothérapie peropératoire comme adjuvant à la chirurgie colorectale.

Dans le but de détruire les cellules disséminées dans la lumière colique au cours de l'intervention, les cellules circulant dans le système porte et les cellules en circulation dans les veines périphériques, le 5-fluorouracil (5-FU) a été utilisé en injection intraluminale (10 mg/kg) au moment de l'intervention et par voie intraveineuse durant les 2 premiers jours postopératoires (30 mg/kg).

Il ne s'agit pas d'une étude randomisée; le contrôle est historique, par comparaison avec les résultats du traitement chirurgical des cancers du côlon et du rectum traités au St. Vincent's Hospital pendant la même période et ceux des statistiques nationales américaines.

Compte tenu de la faible morbidité, cette étude paraît valable et traduit une tendance vers laquelle la thérapeutique doit s'orienter. Dans les stades III (Dukes' C), le 5-FU semble avoir été plus efficace, la survie à 5 ans étant le double de celle de la série témoin; après 8 ans d'observation la différence se maintient.[23]

Du Medical College of Virginia une étude randomisée faite par Lawrence et collègues[24] de 1968 à 1973, portant sur une série de 156 patients dont 80 reçurent du 5-FU comme adjuvant postchirurgie, apporte des conclusions contraires et négatives. Lawrence utilise la chimiothérapie peropératoire en vue de prévenir la dissémination chirurgicale des cellules cancéreuses et complète par une chimiothérapie à long terme par voie buccale, pour prévenir le développement des micrométastases viscérales.

En conclusion, ni l'intervalle libre, c'est à dire, le temps avant récidive, ni la survie, n'ont été améliorés par le traitement prophylactique. Il n'y a pas de différence significative dans le taux de survie à 4 ans, entre le groupe traité par chirurgie seule et le groupe traité par chirurgie et 5-FU.

Grage[25] du Central Oncology Group présente les résultats d'une étude randomisée prospective au cours de laquelle 204 patients sur 372 ont reçu un traitement postopératoire d'appoint au 5-FU par voie intraveineuse. Le protocole est le suivant: 12 mg/kg par jour, pendant 4 jours, suivi de 6 mg/kg à tous les 2 jours pendant 5 jours, et finalement 12 mg/kg par semaine pendant 1 année. La toxicité est rarement sévère et une leucopénie survient chez 50% des patients traités. La majorité des patients a été suivie de 6 mois à 3 ans, et la survie à ce jour est à peu près identique pour les deux groupes, soit 68% des patients vivants et sans signe de maladie après un traitement d'appoint par comparaison à 63% de ceux traités par chirurgie seule.

Li et Ross[26] de Californie ont traité un groupe de 213 patients porteurs de cancer colorectal, dont 183 étaient aux stades II et III. La chimiothérapie (5-FU) fut administrée de la façon suivante: 1 g de 5-FU par voie intraveineuse le 1er jour, 500 mg les 4 jours suivants, suivi 4 semaines plus tard d'un second cycle identique de chimiothérapie. L'amélioration du taux de survie à 5 ans dans les groupes de tumeurs classe C est de l'ordre de 33.2%, tandis que pour le groupe de tumeurs classe B, l'amélioration du taux de survie est de 23.1%. L'augmentation globale de la survie à 5 ans est de l'ordre de 28.1%. Cette étude n'est pas randomisée, le groupe témoin est constitué de patients traités par chirurgie seule par l'auteur durant les 5 années qui ont précédé l'essai. Une chimiothérapie de courte durée, à doses non-toxiques, semble avoir donné des résultats très intéressants.

Après avoir essayé, sans résultats, le thiotepa et le 5-FU en per- et postopératoire, le Veterans Administration Surgical Adjuvant Group[27] a entrepris deux autres études prospectives, randomisées, comparant la chirurgie seule et la chirurgie plus 5-FU.

Les 1118 patients furent divisés en trois groupes (A, B et C) selon l'examen anatomopathologique du spécimen chirurgical.

Dans une première série, l'injection de 5-FU (12 mg/kg•j, iv, pendant 5 jours) se donne aux 2e et 6e semaines après l'opération; dans la seconde série, le 5-FU se donne en cycles répétés, durant 18 mois.

Dans tous les groupes, la survie est meilleure pour les patients qui reçurent du 5-FU, bien que les résultats ne soient pas statistiquement significatifs.

L'Eastern Cooperative Oncology Group, du Docteur Paul Carbone, a proposé deux protocoles (2276 et 4276, non-publiés) pour établir un traitement d'appoint à la suite d'une résection à visée curative d'un cancer du côlon et du rectum de type B_2 et C. Le traitement vise à comparer l'effet du 5-FU seul (450 mg/m² iv, id pendant 5 jours à toutes les 5 semaines) ou du 5-FU (325 mg/m² iv, les 1ers et 5e jours et 375 mg/m² iv, les 36 et 40 jours) plus methylcyclohexyl-chloroethyl-nitrosurea (MeCCNU) (130 mg/m² per os, le 1er jour seulement à toutes les 10 semaines) pour les cancers situés au-dessus du repli péritonéal (non-publié); pour les cancers du rectum la radiothérapie (de 4500 à 5100 rads) s'ajoute à la chimiothérapie (non-publié). Les traitements chimiothérapeutiques doivent se poursuivre pour un total de 15 cycles avec un intervalle de 5 semaines entre chaque cycle, pour ceux qui reçoivent du 5-FU seul, et pour un total de 8 cycles avec intervalle de 10 semaines, pour ceux qui reçoivent du 5-FU et du MeCCNU.

Le but de ces études vise principalement l'amélioration du taux de la survie et de la période de latence; elles permettront également de comparer les résultats de la monochimiothérapie à ceux de la bichimiothérapie. Aucun résultat n'est disponible à date, puisque ces protocoles n'ont pas assez de recul.

Immunothérapie Prophylactique

Le principe de l'immunothérapie s'appuie sur la capacité immunitaire antitumorale d'un individu qui, pour une raison inconnue, serait inefficace ou faible et qui pourrait être effectivement stimulée par des vaccins.[28]

La maladie cancéreuse serait due à la présence permanente de cellules néoplasiques dans l'organisme. En effet, il semble qu'il y aurait constamment dans l'organisme des cellules tumorales en croissance qui seraient régulièrement éliminées soit par un processus de défense immunologique de l'hôte, soit par d'autres mécanismes. Le cancer se développe lorsque cette défense vient à faire défaut; ce fait peut se vérifier chez les patients cancéreux en phase avancée, dont la plupart montrent une immunocompétence générale diminuée.

Morton et collègues[29] ont fait la preuve de l'action bénéfique de l'immunothérapie dans les mélanomes stade II, après excision locale large et lymphadénectomie. Après deux ans, 70% des patients ayant eu une immunothérapie adjuvantielle sont libres de toute maladie, tandis que 40% seulement du groupe contrôle n'ont pas de signe de maladie.

L'expérience de l'immunothérapie dans le traitement des macrométastases, c'est à dire, chez les patients ayant un cancer avancé, n'a donné pratiquement aucun résultat.[16] Cependant, Israel[30] prétend que l'immunothérapie ne devrait pas être réservée seulement aux patients qui n'ont qu'un minimum de cellules résiduelles.

Dans le tableau suivant, on peut constater que les essais thérapeutiques en immunothérapie[31] sont de date récente, que la quantité de patients traités est faible, que la surveillance est de courte durée, rendant les résultats difficiles d'interprétation. La majorité utilise l'immunothérapie active nonspécifique ou l'association chimioimmunothérapie. Certaines études ne sont pas randomisées et utilisent, comme témoins, des contrôles historiques.

Dix-neuf institutions américaines, regroupées dans le Southwest Oncology Group,[32] ont participé depuis mars 1975 à une étude randomisée comparant la chimiothérapie et la chimioimmunothérapie dans les cancers localement avancés du gros intestin (Dukes' B_2 et C), recevant un traitement à visée curative. Tous les patients ont reçu du MeCCNU par la voie orale, et du 5-FU en injection, à toutes les 3 semaines. La moitié de ce groupe recevait, en plus, du BCG par voie orale (Connaught bacille Calmette Guérin [BCG] 6 x 10^8 organismes) à toutes les 2 semaines. L'étude, trop récente, quoique comptant 130 patients, ne nous offre aucune conclusion. Elle vise cependant à juger de l'efficacité de la polychimiothérapie et de la chimioimmunothérapie.

Mavligit,[33,34] du M.D. Anderson Hospital, présente l'expérience d'une étude prospective nonrandomisée dans les cancers colique classe Dukes' C. Cent vingt-et-un patients ont été admis à l'étude; 52 reçurent du BCG en scarification et 69 une combinaison chimio-immunothérapie de 5-FU et BCG. Le 5-FU (150 mg/m², *qid*) est administré pendant 5 jours à tous les 28 jours pendant 2 ans. Le BCG se donne en scarification une fois par semaine pendant 3 mois, puis aux 2 semaines par la suite.

Utilisant comme témoins des patients traités par chirurgie seule, au M.D. Anderson Hospital pendant une période de 10 ans, l'auteur rapporte une différence statistiquement significative touchant l'intervalle libre et la survie. En effet, le temps de récidive et le pourcentage de survie des cancers Dukes' C, traités par chimioimmunothérapie, semblent rejoindre ceux des cancers Dukes' B, traités par chirurgie seule. D'après Mavligit, il semble donc que l'immunothérapie, avec ou sans chimiothérapie, puisse améliorer la survie des cancers du côlon.

Ce groupe du M.D. Anderson Hospital vient de commencer un nouvel essai thérapeutique combinant l'immunothérapie et la chimiothérapie (5-FU, *Corynebacterium parvum* et BCG).

Le BCG seul a été utilisé avec succès en instillation intrapleurale dans les cancers opérables du poumon, par McKneally et Maver[35] Falk et collègues[36] de Toronto ont utilisé le BCG en instillation intrapéritonéale (2 mg) et par voie buccale (120 mg) combiné avec chimiothérapie (5-FU et cyclophosphamide) pour les cancers du tube digestif en métastase. Les résultats paraissent valables et permettraient de faire un essai identique pour les cancers du côlon traités dans un but curatif.

Notre Expérience

Bien que nous ayons une expérience chirurgicale de longue date dans le domaine des cancers du tube digestif, notre intérêt aux thérapies d'appoint est récente, partielle et sans influence statistique sur nos résultats à date.

Personnellement, c'est depuis 1970 que nous appliquons, pour les patients subissant une opération dans un but curatif, une technique adjuvante selon le protocole de Rousselot, c'est à dire, le 5-FU en injection intraluminale peropératoire suivi d'injection intraveineuse les 2 premiers jours postopératoires.

Les techniques chirurgicales que nous avons toujours utilisées ont été classiques et radicales. Pour les adénocarcinomes situés sous le repli péritonéal (< 10 cm de la marge de l'anus) nous pratiquons la résection de type périnéoabdominale décrite par Lloyd-Davies[37] à deux équipes chirurgicales qui travaillent simultanément. La phase périnéale de l'opération est plus radicale et plus extensive que celui de la résection abdominopérinéale de Miles.[38] C'est ainsi que l'excision des muscles releveurs de l'anus se fait très latéralement et que, chez la femme le septum rectovaginal est excisé.

Les résultats de notre expérience avec les cancers du rectum traités chirurgicalement sont comparables aux statistiques connues, la survie globale est à 51%, la mortalité opératoire est de 2.8%, et le taux de récidive locale est de 10%. Dans les cancers localement avancés, les résultats sont pau-

vres, ce qui met en évidence de façon irréfutable l'importance de faire une thérapie adjuvante des cancers de classe C1 et C2.

Voilà pourquoi le groupe que nous dirigeons à l'Hôtel-Dieu de Québec s'est intéressé aux essais thérapeutiques depuis 5 ans. Une centralisation administrative a permis d'élargir cette sphère d'activité à plusieurs types de cancers, à plusieurs hôpitaux et à plusieurs participants, sous l'égide d'organismes nationaux. C'est ainsi que nous participons aux essais thérapeutiques du National Surgical Adjuvant Breast Project et du Institut National du Cancer du Canada.

Depuis 6 mois, nous avons rejoint le groupe du Carbone et sommes devenus membres de l'Eastern Cooperative Oncology Group.

Conclusion

Cette revue de la littérature nous a permis de faire le point sur les traitements d'appoint dans les cancers coliques et de voir se confirmer ce que nous avons préconisé il y a 10 ans pour les cancers dont l'examen pathologique laisse supposer un mauvais pronostic.[8]

Malgré des résultats peu significatifs, souvent contradictoires, nous croyons qu'il se dégage une tendance qu'il faut suivre et qui permet de rationaliser notre thérapeutique.

En effet, pour améliorer le taux de guérison des patients qui vont éventuellement développer une récidive ou des métastases, et chez qui, nous pouvons, au moment du traitement chirurgical primaire, prévoir cette évolution par l'examen anatomopathologique, il nous semble que "l'abstention" soit un constat d'échec. Personnellement, nous ne pouvons l'accepter.

Quelle devrait être l'attitude des chirurgiens généraux? Maintenir le statu quo, c'est à dire, continuer à n'utiliser que l'excision chirurgicale radicale et n'accepter aucune amélioration du pourcentage de guérison? Connaissant les causes d'échec, ne serait-il pas plus logique d'essayer de prévenir par des méthodes connues, peu morbides, la nidation des cellules tumorales en circulation et le développement des micrométastases?

Le stade pathologique de la maladie, tel que déterminé par l'examen microscopique du prélèvement chirurgical, fournit les critères qui permettent de sélectionner les patients pour qui un traitement d'appoint nous paraît s'imposer. En effet, le pronostic des adénocarcinomes du côlon et du rectum dépend du degré d'extension pariétale et extracolique, du grade histologique, de l'invasion lymphatique et ganglionnaire et de l'invasion veineuse.

L'utilisation des marqueurs[39] biochimiques (hydroxyproline urinaire, ferritine) et immunologiques (antigène carcino-embryonnaire, α-foetoprotéine, et antigènes associés à la tumeur) permettraient de bien diviser les cancers selon leur stade et offriraient une plus stricte sélection. En attendant, il faut se fier à l'examen anatomopathologique.

Chez ces patients à risque élevé, il faudrait donc compléter l'excision chirurgicale classique radicale par l'une ou l'autre des méthodes d'appoint.

Pour être pratique cependant, et pour que toutes ces techniques expérimentales d'appoint soient utilisables pour la majorité des patients à risque élevé, elles doivent être simples d'application, être faibles en morbidité, sans mortalité et être à la portée de tout centre régional.

Pour ce faire, il faut cependant que les chirurgiens acceptent de participer à des essais thérapeutiques stricts, dont les indications sont bien spécifiques, la sélection des patients honnête et sous la direction immédiate d'un responsable régional ou d'un organisme provincial ou national.

C'est uniquement dans un tel cadre qu'un chirurgien peut s'aventurer dans ces types de traitements qui sont avant-gardistes et encore expérimentaux. Ainsi, pourra-t-on accumuler dans un temps relativement court, des données valables statistiquement et fournir des réponses à toutes ces questions depuis si longtemps débattues.

En 1974, l'Institut National du Cancer a tenté en vain de mettre en branle un essai thérapeutique pour le cancer du côlon. Tout récemment, un groupe de travail du Cancer Research Coordinating Committee présentait aux membres participants de l'Institut du Cancer du Canada, un projet d'essai thérapeutique pour les cancers de classe B_2, C_1 et C_2, traités chirurgicalement.

L'Association canadienne des chirurgiens généraux se doit de faire oeuvre de pionnier au Canada dans le domaine des cancers du tube digestif et principalement du côlon et du rectum. L'association doit promouvoir les essais thérapeutiques canadiens de concert avec le Conseil médical de la recherche du Canada et l'Institut du cancer du Canada.

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1. Candidates shall be currently engaged in a recognized surgical residency program leading to eligibility for the Fellowship of the Royal College of Physicians and Surgeons of Canada in one of the surgical specialties (cardiovascular and thoracic surgery, general surgery, neurosurgery, obstetrics and gynecology, ophthalmology, otolaryngology, orthopedic surgery, plastic surgery and urology).
2. The material to be submitted shall be in the form of a manuscript relating to work in which a surgical resident is or has been the prime or major investigator. Prior oral presentation at a Royal College meeting or a surgical forum meeting will not be a disqualification, but prior publication as a formal paper in a journal will. The paper should relate to any field of surgical interest. The manuscript must conform to the style requirements of the Journal and must not exceed 3000 words of text and six tables and/or six figures. Coauthors are permitted on the understanding that the candidate shall be the first author and that only the first author shall be eligible for the award.
3. Entries must be received in the office of the Journal no later than June 30, 1978. Each entry must be submitted to the editorial office of the *Canadian Journal of Surgery*, PO Box 8650, Ottawa, Ont. K1G 0G8, with a letter stating that the paper is being submitted as an entry for the Davis & Geck Surgical Essay Award.
4. All papers submitted shall be the property of the *Canadian Journal of Surgery* unless returned to the author without publication.

All papers submitted will be judged by an independent committee comprising at least one member of the editorial board of the Journal, one fellow of the Royal College of Physicians and Surgeons of Canada, and one representative of The Canadian Medical Association, together with other fellows invited to serve at the discretion of the three permanent members of the committee. For the purpose of judging, the candidates will be anonymous. The judges' decision shall be final.

The name of the successful candidate and the title of the paper will be announced in the November 1978 issue of the Journal.

5. Panel Discussion on Carcinoma of the Colon and Rectum

Chairman: E.B. TOVEE, MD, FRCS(EDIN), FRCS[C], FACS†
Panelists: B.J. CUMMINGS, L.J. DIONNE, A.B. PÉLOQUIN AND I.P. TODD

Dr. Tovee: How do the members of our panel stage carcinoma of the rectum?

Mr. Todd: I think we all recognize that it is possible to stage only a proportion of rectal malignant growths. As many as 50% are not palpable. In addition there are those that are obviously very advanced. We are left with quite a small percentage to which we can assign a stage. One must take into account all the physical findings, and these include any protuberance as well as ulceration and mobility. Very rarely can one feel retrorectal glands. If there is a palpable retrorectal gland, I know the case is an advanced one and that more than local treatment is necessary.

Dr. Tovee: Dr. Cummings, you are at a disadvantage because you're not like the surgeon who can use the knife to find what the specimen looks like, and send it to the pathologist for examination. You must have some special method of staging tumours.

Dr. Cummings: I recognize that it's important to know the extent of a tumour, but I wonder if in some tumours we don't attach too much importance to staging. Certainly in regard to rectal tumours, there is no question that Dukes' staging system has been of tremendous help in estimating prognosis. It does not, of course, determine treatment. It may affect treatment when we consider the field of adjuvant therapy, which today means the field of postoperative adjuvant therapy. Has the time not come when we must decide on some form of clinical staging? The UICC tried to do this some years ago and, as you are aware, TNM staging was abandoned in 1967. The difficulty with clinical staging is that the only unequivocal finding is the size of the primary growth, which is quite unrelated to any other features of the case.

The techniques that we have been investigating in a preliminary way at the Princess Margaret Hospital include perirectal node scanning, which has been developed along the same lines as internal mammary node scanning used in breast carcinoma. We are also trying to devise a system similar to that advocated by Feinstein who defined certain clinical markers that enabled him to venture a vague prognosis for the patient. As a radiotherapist, I can tell you how I arrive at a clinical staging. I can tell whether the tumour is mobile or not; if it is not, I cannot be sure whether its fixity is due to an inflammatory or a malignant process. With the patient under anesthesia I can determine whether it infiltrates the bladder. I can do a liver scan and incur all the problems that it may involve. I can do lymphangiography, which will tell me nothing about the lymph nodes below the bifurcation of the aorta in this disease. I can do a bone scan, which may or may not be useful, although it has been advocated in this disease. I can do a carcinoembryonic antigen determination which tells me nothing whatever about the stage of the disease. I can record a lot of information, but really we are left with a clinical decision — "Is this tumour confined within the pelvis or not?" And at this stage I don't think we have advanced beyond that. I wish we did have a reliable clinical staging system because then I could claim that our 79 cases are as good as, or are better, or are worse than any other surgical series, but at the moment I cannot do that. Neither can I tell you what happens after high-dose preoperative irradiation, because any preoperative treatment must alter the stage. It is wrong to talk about operative staging without specifying whether the patient has had preliminary treatment.

Dr. Tovee: Dr. Dionne, what do you do when confronted with carcinoma of the rectum in a patient on the operating table when that patient has gross hepatic metastases? Would you do a palliative anterior resection, an abdominoperineal resection or a proximal colostomy, or would you do nothing and treat the patient with chemotherapy?

Dr. Dionne: I recall reading about a series of 12 patients who survived 10 years after an abdominoperineal resection, at which time the surgeon noticed that there were liver secondaries. Mind you, these were very good surgeons because they were from St. Mark's Hospital. This report gives me help in answering your question. If you are absolutely sure that there is a metastasis in the liver, then the steps you take depend on how large it is, what the expectation of life is and the effect your operation will have on the quality of life for that individual. If you are not sure, you think there is a metastasis but you're not completely sure, I think you should excise the lesion.

Dr. Tovee: Any other comments? Dr. Péloquin?

Dr. Péloquin: I agree entirely that all the tumours that can be resected must be excised even in the presence of hepatic metastases. When the primary tumour either in the rectum or in the colon was resected, the survival rate at 2 years was as high as five times the rate when a resection was not done. The reason for this is not understood but it is believed by many surgeons. Even at the beginning of this century some surgeons realized that when you resect the primary tumour you may arrest or retard the growth of hepatic metastases.

Dr. Tovee: Mr. Todd, this next question is directed to you. Are there any technical problems in performing resection and anastomosis if the patient has had preoperative irradiation, especially if this has been administered in several doses?

Mr. Todd: With the regimen that has been used in the trials in England, no problems have arisen from this form of management. I'm still slightly worried, I must admit, about anterior resections, and one of my colleagues at St. Mark's won't allow preoperative irradiation because he claims he can't always decide whether he's going to excise the rectum or do an anterior resection until he has opened the abdomen and he is worried about breakdown of the anastomosis after the administration of 2000 rads. I personally

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don't think that we've had any serious problems as a consequence.

Dr. Cummings: May I make a comment? In the recorded series where the dose range has been that used in the United Kingdom, namely 2000 rads given over 2 weeks or a single dose of 500 rads, there has been no increase in the complication rate. One such randomized series is the Veterans Administration study in which most patients, it is true, were treated by abdominoperineal resection; however, in approximately 200 cases other types of resection were used and the complication rate was not increased. If as high a dose as 6000 rads is given over 6 weeks, as reported by Stevens from Oregon, anterior resection was deliberately avoided at first because of fear about the anastomosis. By now they have experience of 4 out of 50 cases in which they have safely done an anterior resection. In Kligeman's report from the southern United States, 4500 rads is given and the type of operation is left to the discretion of the surgeon; no problems are recorded with anterior resection in a relatively small number of patients. I myself would think that the dose could safely reach about 4500 to 5000 rads. I would be worried about levels higher than that.

Dr. Tovee: Mr. Todd, what's the best operation for rectal villous adenoma?

Mr. Todd: It depends on where the tumour is situated. It's an almost impossible question to answer because one needs to know more details. Is it a proliferative lesion, is it a carpet type of lesion, does it extend over a major part of the circumference of the rectum? One has seen some tumours that cover many square inches, just as a carpet. I think this is one situation where a transsphincteric operation has a place. The proliferative tumours sometimes may be dealt with by local excision. On occasions they can even be snared. Of course if the villous type of tumour becomes malignant it tends to be highly malignant and therefore these patients need to be watched extremely carfeully. My colleague, Mr. Parks, does sleeve resections for some of these, which he thinks is a safer procedure.

Dr. Tovee: Dr. Dionne, do you do local perfusion of the liver for metastases from carcinoma of the colon and rectum and what are the indications for so doing?

Dr. Dionne: I treated some cases of liver metastases or perineal recurrences in this way with very poor results. Following the trend throughout the world, I abandoned the procedure completely.

Dr. Tovee: Dr. Cummings, what happens to anal function after curative irradiation?

Dr. Cummings: After curative irradiation for carcinoma of the rectum anal function will remain normal unless the tumour has already infiltrated the anal sphincter. If that has already happened you proceed to destroy the tumour with radiation. Healing will be by fibrosis, as after any procedure, and if the patient initially was incontinent owing to this cause, then he is likely to remain so. There is no specific effect of the radiation as we deliver it that will destroy a normally functioning anal sphincter.

Dr. Tovee: Would you tell us a little more about the complication rate from radiation used in the treatment of carcinoma of the rectum?

Dr. Cummings: With moderate-dose preoperative irradiation, as commonly used, complications are probably not significant. For postoperative irradiation, the data are not yet available. From analogy with the treatment of other tumours and from reported studies, it is quite apparent that you should not give high-dose wide-field irradiation to most of the pelvic and abdominal contents. A total of about 70 to 80 cases have been recorded in the literature where high doses, and by that I mean doses in excess of 5000 rads in 4 to 5 weeks, have been given to the whole of the pelvis and lower abdomen. Follow-up ranges from 12 months to 7 or 8 years. Complications have developed and there have been radiation-induced deaths. What I call acceptable irradiation is a dose of 4500 rads given over 4 weeks, and that can be given safely to the whole of the pelvis. In addition, one can give probably 2000 to 2500 rads to the whole of the upper abdomen including the liver, and that is quite tolerable. We have very wide experience with that sort of radiation in treating patients with carcinoma of the ovary and I think that, provided you control the dose, it is safe. Higher doses, I think, are dangerous. After radical irradiation such as we are using at Princess Margaret Hospital for certain patients with carcinoma of the rectum, there has been moderate morbidity. I think every patient had troublesome diarrhea. If the tumour can be reached by the examining finger, we now deliberately irradiate the entire perineum to almost full dose because we found that otherwise these tumours recurred around the anal canal. Patients will have a moist reaction at the perineum and most will require bed rest for perhaps a week, although some of them in fact continue working. Healing takes place normally. A small proportion, about 3%, will have significant small-bowel morbidity. This figure is of the same order as after irradiation for carcinoma of the cervix. I can't be more precise because a number of these patients die from uncontrolled tumour and it's often impossible to distinguish side effects of irradiation from the effects of uncontrolled tumour. Provided the dose is controlled and the patient is watched carefully, the morbidity is acceptable.

Dr. Tovee: Dr. Péloquin, would you tell us what you do with the perineum that won't heal after an abdominoperineal resection?

Dr. Péloquin: Usually it does heal, although sometimes not very fast. You must be patient and wait. After a certain length of time one sometimes has to go back and try to do a second stage procedure.

Dr. Tovee: Mr. Todd, tell us, then, what you do for the perineum that fails to heal.

Mr. Todd: I think the most important thing is to have very good hemostasis or what you think is very good hemostasis of the perineum before you close it, or whatever you do with it. Recently we have closed the perineum in the male entirely and we have put in Shirley sump sucker drainage. I usually use only a single suction apparatus, but I have been very surprised that in the first 24 hours about 500 mL of what looks like pure blood collects in the sucker. Hence, no matter how dry you think you leave it, the perineum is actually not very dry. This is the first thing that matters. If you can't obtain complete hemostasis, I certainly would not suture it completely, but would insert a small piece of corrugated drain and leave it in situ for 48 hours. I don't believe in irrigating the wound unless a lot of blood collects; then I sometimes do irrigate it. Usually I do not use skin grafts for malignant cases. However, in cases of inflammatory bowel disease, which I find are probably more difficult to heal, I try to make the wound into an acceptable shape and then apply a xenograft and later a homograft.

Dr. Tovee: Have any of the panelists any thoughts about the value of the procedure of enclosing the suture line of an anterior resection with omentum? Is it worth while trying?

Mr. Todd: I bring down the omentum if it can be done easily, but I don't make any special effort to mobilize it. One of the most important things in an anastomosis is a good blood supply. We acknowledge this, but a number of surgeons, I think, tie their sutures far too tightly and cut off the blood supply. A piece of omentum whose blood vessels you have tied in mobilizing it is not in the least helpful. If you can lay it easily in the neighbourhood of the suture line, do so, otherwise forget it!

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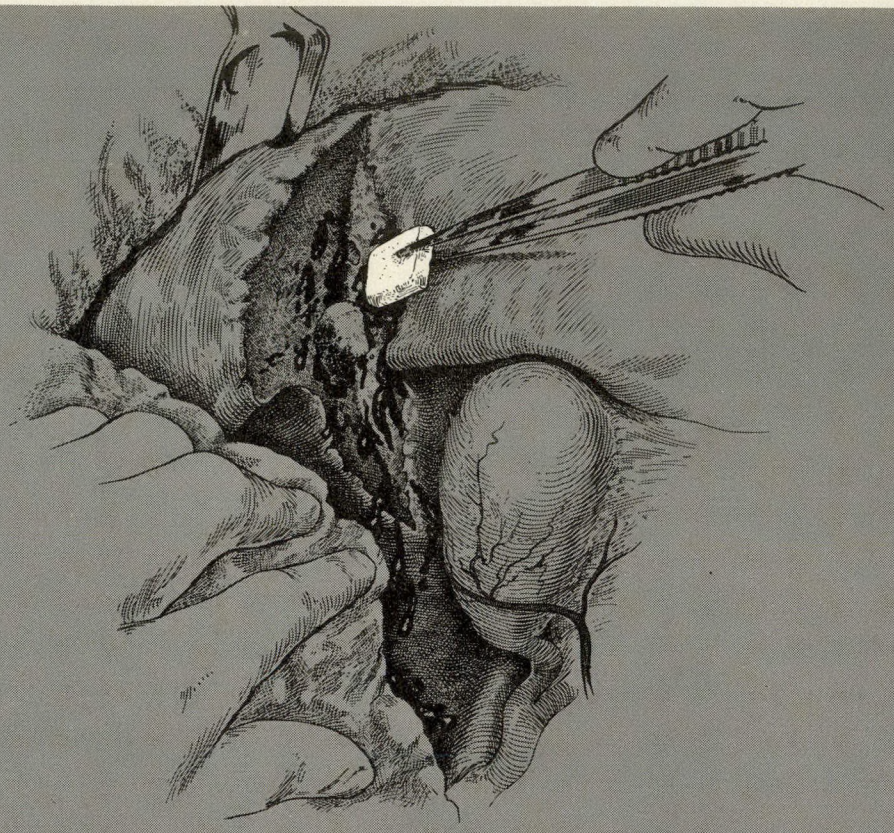

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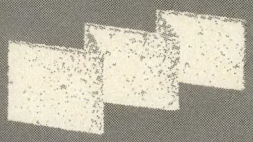

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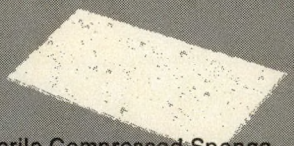

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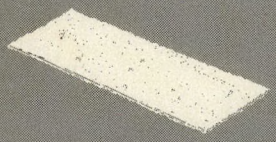

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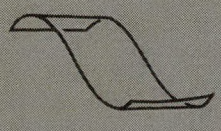

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Symposium on Pancreatitis

1. Conservative Management of Acute Pancreatitis*

ROGER G. KEITH, MD, FRCS[C], FRCS, FACS

Acute pancreatitis may present as the mild edematous type or the more rare and dangerous hemorrhagic form. The effects of the latter are believed to be due to the activation of pancreatic enzymes, notably trypsin. Therefore attempts are being directed towards suppression of pancreatic enzyme activation in the management of the condition. Aprotinin and glucagon are the agents for this purpose that have received most attention.

Patients with acute hemorrhagic pancreatitis are subject to respiratory failure, which is not detectable early by clinical evidence, so that early monitoring of pulmonary function by the determination of arterial blood–gas pressures is desirable. This is borne out by the findings in six fatal cases.

La pancréatite aiguë peut être du type oedémateux bénin, ou prendre la forme hémorragique, dangereuse et plus rare. Dans ce dernier cas, les effets sont possiblement dus à l'activation des enzymes pancréatiques et, notamment, de la trypsine. Dans le traitement de cette affection, on essaie donc de supprimer l'activation des enzymes pancréatiques. L'aprotinin et le glucagon sont les produits utilisés à cette fin ayant reçu le plus d'attention.

Les patients souffrant de pancréatite hémorragique sont sujets à une insuffisance respiratoire qui ne peut décelée tôt à partir du tableau clinique. Une surveillance précoce de la fonction pulmonaire par la mesure des pressions gazeuses du sang artériel est donc souhaitable. Ceci est confirmé par les observations faites dans six cas mortels.

The Marseilles classification of pancreatitis correlates the clinical and pathological aspects of acute and chronic forms of the condition.[1] Beyond that classification two forms of acute pancreatitis are recognized. Acute edematous pancreatitis, so called to indicate the pathologic state, is the mild form of the disease, which comprises about 80% of all cases of acute pancreatitis.[2,3] Acute hemorrhagic pancreatitis, characterized by parenchymal necrosis and hemorrhage, presents the risk of major complications and death.[4-6] Clinical differentiation between the two states at initial presentation is usually impossible; the distinction is evident only in retrospect.

Acute hemorrhagic pancreatitis is a dynamic condition that may progress to a state of irreversible shock and organ failure through three major mechanisms. Hemorrhage occurs early and is usually restricted to the local peripancreatic tissues. Elastase plays a major role in the small vessel disruption implicated in this process. Retroperitonitis with peritonitis and paralytic ileus also characterize the early phase of the disease. Subsequent third-space losses account for the extracellular fluid deficits, which range up to 10 L in the initial 24 to 36 hours. Pancreatic enzyme activation, absorption and dissemination account for additional microcirculatory insufficiency and specific organ failure occurring from 48 hours onward. Current observations support the theories that trypsin activation precedes activation of other proteases and initiates activation of the kinin system, other vasoactive peptides, the coagulation sequence and the platelet release phenomena.[6-8] Using pH electrophoretic gel diffusion techniques, White has isolated 22 pancreatic enzymes. In addition to lipase and phospholipase, there are 3 to 6 amylases and 15 proteases.[9] Trypsin is capable of activating the majority of the proteases as well as phospholipase and converts kallikreinogen present in pancreatic tissue to kallikrein, thereby activating the kinin system.[10] Thus, indirectly and directly, through activation of the Hageman factor the coagulation cascade is initiated, as are platelet aggregation and release. It has been suggested that trypsin acting through phospholipase is capable of disrupting surfactant.[11] The duration of free trypsin stability in the plasma is less than 30 seconds and measurement of circulating levels of this unbound enzyme in patients with pancreatitis is difficult. As well, two trypsin inhibitors have been identified. These are particularly potent in the intraductal inactivation of trypsin.[12,13]

Recently Allan, Tournut and White[13] were able to obtain evidence of the conversion of trypsinogen to trypsin in the intraductal secretions of the human pancreas during the spontaneous development of pancreatitis. This is the first direct observation to support theories of the basic mechanism leading to the development of the proteolytic holocaust that results in the enzyme shock associated with acute hemorrhagic pancreatitis.

Current advances in conservative management of acute pancreatitis have been directed towards suppression of pancreatic secretory activity or inactivation of pancreatic proteases. In 1950 in Germany, Frey, Kraut and Werle[14] isolated a trypsin and kallikrein inhibitor from beef salivary glands. Subsequent experimental and clinical trials using this trypsin inhibitor suggested improved morbidity and mortality. However, controlled experimental trials with Trasylol (aprotinin) showed significant improvement from the use of this agent only when it was given prophylactically before the induction of pancreatitis in an experimental model. Many controlled clinical trials failed to show that Trasylol brought about substantial improvement when given in a dosage of 200 000 units/24 h.[15-19] In 1974 Trapnell and colleagues[20] reported a controlled trial in which the patients treated with Trasylol received a dosage of 800 000 units/24 h; the mortality rate was substantially lower in the treated group. This report was criticized

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on the basis of the exclusion from the series of cases of alcoholic and postoperative pancreatitis, and the control group may have been unduly weighted with cases of severe pancreatitis. The multicentre study conducted by the Medical Research Council in the United Kingdom prospectively compared the effects of Trasylol and glucagon in a controlled double-blind protocol; the mortality rate in patients treated with either agent was approximately the same as in the controls. Imrie (personal communication, 1977) prospectively compared the outcome in patients treated with Trasylol in high dosage with that in controls in one institution over 2 years. In this series of 150 patients no significant difference in the mortality rate was noted between the two groups.

Glucagon, the hormone produced by the α cells of the pancreatic islets, has primary glycogenolytic and gluconeogenic activity in the liver. Because of its positive inotropic and chronotropic action, glucagon has been used in the shock syndrome of myocardial disease.[21] Pharmacologic doses of exogenous glucagon suppress pancreatic secretion.[22,23] Hyperglucagonemia has been reported in bacterial infection,[24] shock[25] and pancreatitis.[26] Knight, Condon and Day[26] observed a rapid fall of elevated plasma glucagon values, correlating with onset of shock in a fatal experimental model of pancreatitis. Extrapolating from this observation, they suggested that infusion of exogenous glucagon might further suppress pancreatic activity and reduce mortality. The animals treated with glucagon had a prolonged survival. Uncontrolled clinical experience has suggested that morbidity and mortality are reduced in patients with acute pancreatitis treated with glucagon.[27]

However, controlled studies using a number of pancreatitis models have failed to demonstrate prolonged survival in glucagon-treated animals.[28] At the cellular level glucagon is believed to act at the cell membrane, activating adenyl cyclase at a specific receptor site with resultant subsequent cyclic AMP activity. Using histochemical techniques, Fodor and colleagues[29] were unable to identify glucagon receptor sites in pancreatic acinar tissue. Controlled clinical trials have failed to document improved survival in glucagon-treated patients (Imrie CW: Personal communication, 1977).[30]

Recent reports that describe the mode of death in patients with acute hemorrhagic pancreatitis indicate a high incidence of respiratory failure.[31] This develops in the early phase of the disease, is usually unrecognized and may progress rapidly to sudden death. Since 1974 we have assessed the respiratory function of 50 patients suffering from acute pancreatitis. Arterial blood–gas measurements made 48 hours after establishment of the diagnosis illustrated hypoxia in six cases that subsequently proved fatal. At this stage of disease the patients had limited clinical evidence of respiratory insufficiency. The chest roentgenograms were usually normal. None of the patients had persistent hypotension or shock. Coagulation studies showed thrombocytopenia but no evidence of disseminated intravascular coagulation (Table I). Minimal hypoxia is observed in some nonfatal cases of pancreatitis. Sustained hypoxia in the first 48 hours despite oxygen administration during spontaneous respiration should be considered to indicate a grave prognosis and should provoke consideration of early aggressive ventilatory support.

The respiratory failure of acute pancreatitis probably represents organ failure specifically related to an enzyme-mediated effect on pulmonary arterioles and the alveolar capillary membrane. Halmagyi and colleagues[32] demonstrated normal cardiac output and normal pulmonary wedge pressures, thus negating the theory of acute left heart failure. They also demonstrated increased pulmonary arteriolar pressure. Warshaw and associates[33] were unable to confirm pulmonary hypertension and proposed as the site of injury the alveolar capillary membrane. Imrie has shown a right-to-left cardiac shunt of up to 15%, a restricted ventilatory defect and evidence of disseminated intravascular coagulation.[8,34] Such changes in the lung are similar to those seen in the adult respiratory distress syndrome or shock lung; the term "pancreatitis lung" has been coined for this situation.

If we consider the principles for current management, it is possibly sufficient in the majority of cases of acute edematous pancreatitis to replace fluid deficit, relieve pain with appropriate analgesics and treat the ileus as well as suppress pancreatic stimulation by means of nasogastric decompression. However, evidence of progressive clinical deterioration with associated tissue hypoperfusion may indicate acute hemorrhagic pancreatitis. In such cases fluid losses will be more extensive and requirements may include albumin, plasma, or blood in addition to balanced electrolyte solution. The role of glucagon and Trasylol is still in doubt. In early conservative management of acute pancreatitis attention must be directed to the respiratory system. Early assessment of pulmonary function by determination of arterial blood–gas pressures is mandatory. Hypoxia, with failure of prompt response to oxygen administered by mask, should indicate the need for endotracheal intubation and positive-pressure ventilation. Improved mortality rates in prospective trials support this therapeutic approach.[20,33,35]

Many problems exist in the overall management of acute pancreatitis. Awaiting definition through research are such tools as the biochemical characteristics that will quickly distinguish edematous from hemorrhagic pancreatitis and the development of an effective protease inhibitor or blocker of vasoactive peptides. In spite of the excellence of conservative management, occasional patients fail to respond. In this situation, highly selective and well-defined surgical treatment will continue to have a place in the management of acute pancreatitis.

Table I—Arterial Blood-Gas Pressures at 48 Hours in Six Subsequently Fatal Cases of Acute Pancreatitis

Case no.	pH	P_{O_2}, mm Hg	P_{CO_2}, mm Hg	Platelets, $\times 10^9$/L
1	7.6	67	28	160
2	7.3	87	48	80
3	7.3	67	37	125
4	7.3	83	39	185
5	7.43	53	34	395
6	7.3	64	36	63

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2. Surgical Management of Acute Pancreatitis*

PAUL PONCELET, MD, FRCS[C]

While there is general agreement on the indications for surgery in acute pancreatitis, the preferred operation is controversial and the approach ranges from one that is very conservative to one that is extremely aggressive. The author believes that in all cases the gallbladder should be opened to permit exploration and that cholangiography should be performed. If gallstones are discovered they should be removed and the organ drained; cholecystectomy is advised if the procedure is at all feasible. In a personal series of 50 cases of acute pancreatitis, 10 patients had early operation and 19 surgical procedures were performed.

Alors qu'il y a généralement accord sur les indications de la chirurgie dans la pancréatite aiguë, l'unanimité n'est pas faite sur l'opération de choix, l'abord étant ou bien très conservateur ou extrêmement agressif. L'auteur croit pour sa part que la vésicule biliaire doit être ouverte dans tous les cas pour en permettre l'exploration, et qu'on doit effectuer une cholangiographie. Les calculs découverts doivent être enlevés et l'organe drainé; lorsqu'elle est possible, la cholécystectomie est recommandée. Dans une série de 50 cas de pancréatite aiguë, 10 patients ont été soumis à une opération précoce et 19 interventions chirurgicales ont été réalisés.

Most cases of acute pancreatitis are best treated conservatively and only 5% to 10% should be operated upon during the acute stage of the disease.[1,2] There is no consensus on the best timing for surgical exploration in these patients, but most surgeons[3-5] agree that the indications for operation are:

1. When diagnosis is uncertain.

2. When persistent jaundice develops.

3. When the general condition of the patient deteriorates despite adequate medical treatment.

4. When a complication such as an abscess, pseudocyst, or hemorrhage supervenes.

What should be done at the time of operation is much more controversial.

Some surgeons close the abdomen without doing anything. In such cases the mortality remains the same; you do the patient no harm but you do not help him very much.

The most widely accepted practice today in North America is to drain widely the pancreatic area and to perform a cholecystostomy, gastrostomy and feeding jejunostomy.[2,4,6] Some surgeons also establish a peritoneal dialysis around the pancreatic area[1] or drain the thoracic duct.[7] Cholecystos-

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tomy is probably unnecessary when the biliary tract is normal and some surgeons do not drain the gallbladder in such cases.[6] The problem here is that, although the biliary tract may look normal, there can be small stones in the gallbladder or common bile duct. We strongly believe that in all cases the gallbladder should not only be palpated but opened. Routine cholangiography should be performed and then the surgeon can decide whether or not to drain the biliary tree.

Other surgeons advocate a more aggressive attitude.[8-11] Hollender of Strasbourg performs pancreatectomy as early as 12 hours after the onset of the illness and sometimes removes as much as 95% of the pancreas.[10,12] It is obvious that such an approach is too aggressive since at this stage necrosis is not always well defined and large parts of viable pancreas will be removed, even if frozen sections are used to determine which portion should be left and which resected.

Still other surgeons, such as Edelmann in Paris, are more conservative and wait 8 to 10 days. By this time necrosis is well defined and a subcapsular sequestrectomy can be performed with surprisingly good results and few complications.[6,13-15]

What should be done with the gallbladder and common bile duct when pancreatitis is due to biliary tract disease? If there are gallstones, the least that should be done is to remove them and drain the gallbladder through a cholecystostomy after performing cholangiography to make sure there are no stones in the common bile duct. If technically feasible, a cholecystectomy should be done at this stage since no further operation would be needed.

If stones are demonstrated in the common bile duct, most authors agree they should be removed.[5,16] Some surgeons perform a transduodenal sphincterotomy if there is no other way to dislodge the stones, and their results are good;[12,17] others claim that the sphincter should always be left alone at this stage and that drainage of the common bile duct is sufficient.[5,16]

We are able to report briefly our personal experience with such cases. Of 50 patients with acute pancreatitis, 10 were operated upon early (12 hours to 10 days after onset). Nineteen operative procedures were performed at this stage: total pancreatectomy (1 case), left pancreatectomy (4 cases), sequestrectomy (2 cases), cholecystectomy (7 cases), sphincteroplasty (3 cases), and cystoduodenostomy with vagotomy and subtotal gastrectomy (1 case).

One patient died from acute myocardial infarction with septic shock 12 hours after the operation. Four patients had a minor pancreatic fistula that closed spontaneously. One patient bled from an acute gastric erosion and was treated conservatively. Five patients became infected and two of these had septic shock, but all recovered after treatment with antibiotics. One episode of minor pulmonary embolism was observed.

In conclusion, we believe that two principles should govern our attitude to the surgical management of acute pancreatitis:

1. Necrotic tissue should be removed if possible or at least widely drained if resection is not technically feasible.

2. The primary cause of the disease should be treated at the same time whenever possible.

Bearing these principles in mind, early surgery is recommended in cases of gallstone pancreatitis—as soon as possible if diagnosis is established and the treatment should be definitive if possible.[1,12,17,18] Early operation is advised also in severe cases of alcoholic pancreatitis when there has been improvement after 24 to 48 hours of intensive medical treatment.

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3. Diagnostic Tools in the Management of Chronic Pancreatitis*

J.E. MULLENS, MD, FRCS[C] AND S. SALEM, MD

The chief diagnostic tools used in planning the management of chronic pancreatitis require close collaboration of the surgeon and radiologist. Barium meal, endoscopic retrograde cholangiopancreatography (ERCP), ultrasonography and angiography are the most useful procedures. The barium meal is the initial screening procedure. Ultrasonography should follow if there is suspicion of a pseudocyst or pancreatic abscess. It also may be of value in demonstrating localized chronic pancreatitis. The most useful of all the tests is ERCP. This shows the pancreatic duct, the common bile duct, or both ducts, so that the surgeon may avoid operation where there is no defect to correct, or it may guide him in selecting an operation that is designed to correct the anatomical abnormalities of either duct. Angiography is occasionally of use when the foregoing procedures have not provided enough information. In over 80% of patients it is possible for the surgeon to undertake an operation with foreknowledge of the pancreas that will help him select the correct procedure to alleviate the patient's symptoms.

Les principaux moyens de diagnostic servant à planifier le traitement de la pancréatite chronique exigent la collaboration étroite du chirurgien et du radiologiste. La radiographie après repas baryté, la cholangio-pancréatographie endoscopique rétrograde (CPER), l'ultrasonographie et l'angiographie sont les techniques les plus utiles. Le repas baryté est la technique initiale de dépistage. L'ultrasonographie vient en second lorsqu'il y a suspicion de pseudo-kyste ou d'absès pancréatiques. Elle peut également être utile pour démontrer une pancréatite chronique localisée. L'épreuve la plus utile est la CPER. Elle met en évidence le canal pancréatique, le canal biliaire, ou les deux canaux, de sorte que le chirurgien peut éviter l'opération lorsqu'il n'y a pas de défaut à corriger, ou elle peut le guider dans le choix d'une opération destinée à corriger les anomalies anatomiques de l'un ou l'autre des deux canaux. A l'occasion, l'angiographie est utilisée quand les renseignements fournis par les méthodes précédentes sont insuffisants. Chez plus de 80% des patients, le chirurgien peut entreprendre un opération avec une bonne connaissance du pancréas ce qui l'aidera à choisir le mode opératoire approprié pour soulager les symptômes du patient.

Until recently, dependable evaluation of the chronically inflamed pancreas was virtually impossible without resorting to laparotomy. Now technologic advances in radiology have made it possible to assess the condition of the pancreas without operation in a large proportion of patients. In those patients with chronic pancreatitis one can distinguish abnormalities that can be corrected by operation from those that cannot.

There are four procedures that are particularly helpful and complementary, and since more than one will be required to establish a diagnosis, the radiologist should be involved in the selection of the techniques. He will be able to choose the technique that is appropriate and he can give a reliable interpretation of the films if he is informed of the patient's history and of the presence or absence of pain, alcoholism, diabetes mellitus, biochemical abnormalities such as an abnormal glucose tolerance curve, pancreatic steatorrhea and significant changes in urinary and serum amylase concentrations.

The four most useful procedures are:

1. Barium meal.
2. Endoscopic retrograde cholangiopancreatography (ERCP).
3. Grey-scale ultrasonography.
4. Angiography.

Barium Meal

A well-performed barium meal will often disclose swelling of the inflamed pancreas. Swelling is most easily detected if the head of the pancreas is affected; in this case hypotonic duodenography may better demonstrate the swelling. Fig. 1 shows displacement of the stomach due to pancreatic swelling and Fig. 2 shows a swelling of

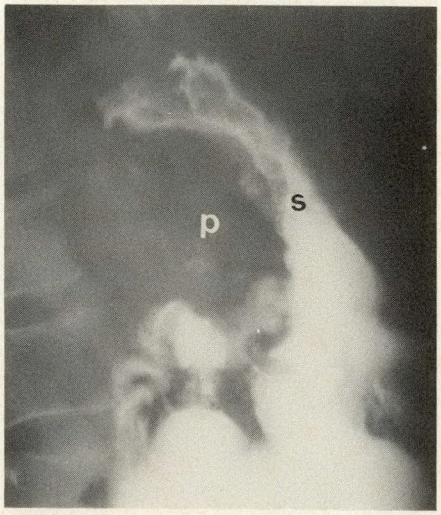

FIG. 1—Pancreatic pseudocyst (p) displacing stomach (s).

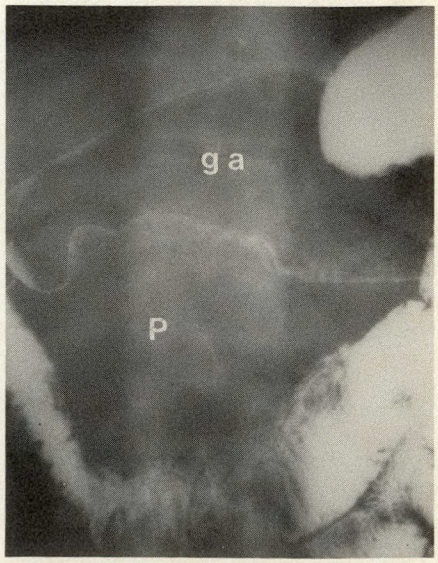

FIG. 2—Pancreatic pseudocyst (P) encroaching upon gastric antrum (ga).

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the head of the pancreas indenting the greater curve of the stomach. In both instances the lesions proved to be pancreatic pseudocysts. However, one cannot expect displacement of the stomach or duodenum in all cases of enlargement of the pancreas, and this is especially true if the swelling lies in the tail of the pancreas.

ERCP

This is the most informative of the procedures available to assess the pancreas.[1-9] The findings of critical importance in planning the management of patients with pancreatitis are listed and illustrated as follows:

1. The Normal Pancreas

Fig. 3 shows a normal pancreatic duct and common bile duct in a patient in whom the diagnosis was chronic pancreatitis. Clearly, it is important to the surgeon to know that the patient's symptoms cannot be relieved by an operation on these normal ducts.

2. Papillary Stenosis

Fig. 4 shows a dilated common bile duct and dilated pancreatic duct. There is an organic or functional obstruction at the papilla, and a sphincteroplasty may relieve the patient's symptoms.

3. Strictures of the Pancreatic Duct

Fig. 5 is the roentgenogram of a patient with chronic alcoholism and recurrent attacks of pancreatitis; there are multiple strictures of the pancreatic duct and irregular duct ectasia. The operative procedure selected to overcome this problem must be one that drains the pancreas distal to the strictures. This is the ideal type of case for retrograde drainage of the pancreatic duct into a Roux-en-Y loop anastomosed to the opened pancreatic duct.

4. Obstruction of the Pancreatic Duct

ERCP may show a complete obstruction of the pancreatic duct. This finding can be caused by carcinoma of the pancreas, but when there is a long history of attacks of pancreatitis one can usually be confident of relieving the condition by surgery. This type of abnormality usually can be managed by distal pancreatectomy.

5. Tortuous or Irregular Ducts

If there is a tortuous or irregular duct that extends from the head of the pancreas out to the tail it is difficult to provide adequate retrograde drainage. A subtotal pancreatectomy may be the best operation in this situation.

6. Small, Attenuated or Sclerotic Ducts

If the pancreatic duct is thin and sclerotic there is no operation short of subtotal pancreatectomy or total pancreatectomy that is likely to alleviate the patient's symptoms.[10]

7. Stones in the Pancreatic Duct or the Common Bile Duct

Fig. 6 shows stones in a dilated pancreatic duct. The operation selected for such a patient must be designed to remove the stones and provide drainage. Retrograde drainage with a Roux-en-Y loop to the opened pancreatic duct may suffice, but if the stones extend into the head of the pancreas it may be necessary to perform sphincteroplasty in addition.

One may find stones in the common bile duct in the absence of any abnormality in the pancreatic duct. Their removal may be sufficient to prevent further attacks of pancreatitis, but a sphincteroplasty may be required as well. An intravenous cholangiogram also may show stones in the common bile duct, but it does not give information on the pancreatic duct, and it is a great advantage to possess this information, if at all possible, before undertaking operation.

8. Stricture of the Lower End of the Common Bile Duct

Chronic pancreatitis may cause a stricture of the retropancreatic portion of the common bile duct. The stricture may be of such a degree as to cause obstruction of the duct, and this problem should be anticipated before undertaking operation to relieve chronic pancreatitis.[11] Fig. 7 shows a stricture at the lower end of the common bile duct in a patient with pancreatitis. The supraduodenal portion of the duct should be anastomosed to the intestine in such cases, either by a choledochoduodenostomy or a choledochojejunostomy Roux-en-Y.

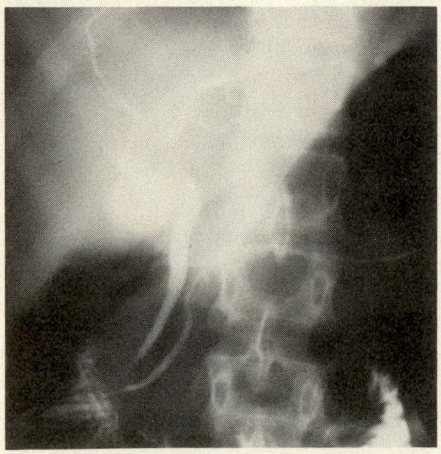

FIG. 3—Normal pancreatic duct and bile ducts.

FIG. 4—Papillary stenosis.

FIG. 5—Pancreatic duct ectasia with multiple strictures.

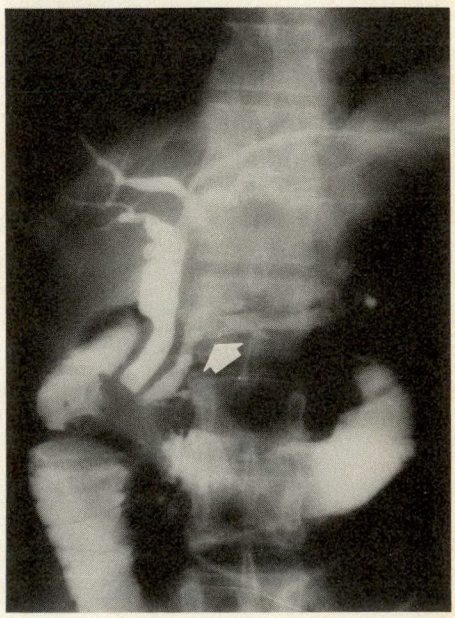

FIG. 6—Stones in pancreatic duct.

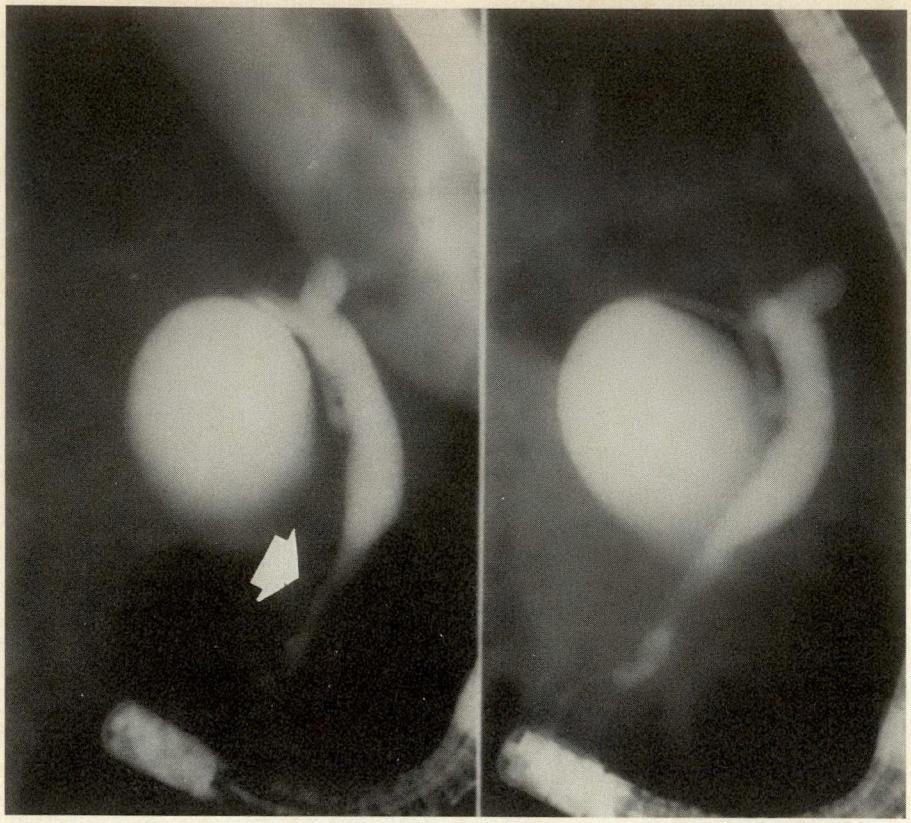

FIG. 7—Stricture of pancreatic portion of common bile duct.

9. Pseudocysts

In the opinion of some endoscopists it is unsafe to perform ERCP on patients with a pancreatic pseudocyst, but the hazards are not formidable if the pseudocyst is not overfilled with contrast medium. The pancreatic duct communicates with the pseudocyst in 60% of cases. Sometimes ERCP shows pseudocysts where none were suspected (Fig. 8). Ultrasonography is excellent for demonstrating pseudocysts, but it is not infallible. In particular, it has shown only one pseudocyst where more than one has actually been present.[12]

10. Carcinoma of the Pancreas

It is not always easy to distinguish carcinoma of the pancreas from chronic pancreatitis, especially if the history is atypical. If carcinoma is present ERCP will often demonstrate it, but the appearance is seldom pathognomonic and the diagnosis may have to be established by operation or by external needle biopsy. If these examinations are not conclusive ERCP will provide the surgeon with additional evidence that may help him decide the management of the lesion.

Ultrasonography

Grey-scale ultrasonography demonstrates the pancreas in 70% to 80% of patients and is particularly helpful in diagnosing pancreatic pseudocysts and abscesses (Fig. 9).[13-15] It also may be of help in diagnosing carcinoma of the pancreas, but it cannot distinguish localized chronic pancreatitis from carcinoma because both lesions may produce a circumscribed solid-appearing mass on the ultrasonogram. Chronic pancreatitis may cause a uniform enlargement of the pancreas, which is unusual in carcinoma. Ultrasonography cannot demonstrate atrophy of the pancreas.

Angiography

Fig. 10 is the arteriogram from a patient with two pseudocysts of the pancreas. Only one of these lesions had been disclosed by the other forms of radiologic examination. Angiography may also show obstruction of the splenic artery or the portal vein by pancreatic inflammation or neoplasm, but this may be of little help in planning management. Angiography cannot readily distinguish pancreatic inflammation from neoplasia except in the presence of an endocrine neoplasm of the pancreas.

FIG. 8—Pseudocyst of pancreas.

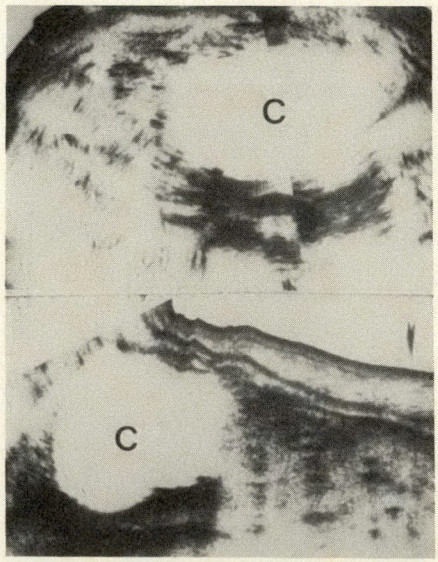

FIG. 9—Ultrasonogram showing pseudocyst (c) of pancreas: upper portion, transverse section; lower portion, sagittal section.

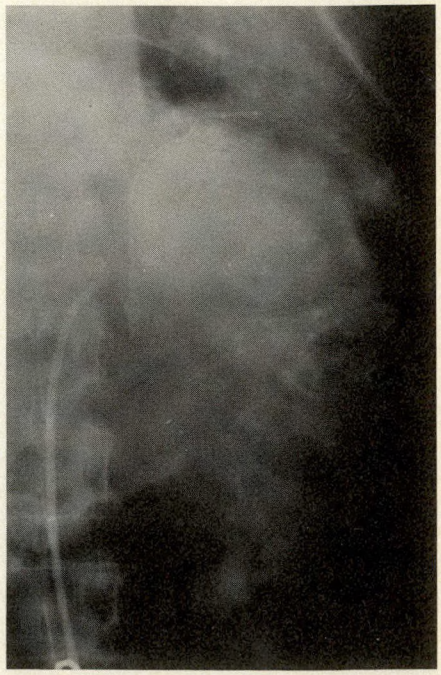

FIG. 10—Arteriogram outlining pancreatic pseudocyst.

The procedure should be used selectively on those patients in whom there is appreciable doubt about the pathologic process. In such patients it may provide additional information for planning the operation.

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4. Surgery in Chronic Pancreatitis*

FRANK W. TURNER, MB, CH B, M SC, FRCS[C], FACS

When the pain associated with chronic pancreatitis is due to ductal obstruction, it is logical that surgical management should be designed to relieve that obstruction while preserving as much of the functioning gland as possible. A number of cases are described to illustrate the various procedures available and to indicate the features that govern the selection of the one most appropriate for a particular patient. The operations include partial pancreatectomy, Roux-en-Y pancreaticojejunostomy and longitudinal pancreaticojejunostomy; these can be modified to suit the peculiar circumstances of a given case.

Quand la douleur associée à une pancréatite chronique est causée par une obstruction du canal pancréatique, il est logique de choisir un traitement chirurgical destiné à soulager l'obstruction tout en conservant le plus possible de la glande. Un certain nombre de cas sont décrits afin d'illustrer les diverses interventions disponibles et pour indiquer les caractéristiques qui déterminent le choix de l'opération la plus appropriée à un patient. Les opérations comprennent la pancréatectomie partielle, la pancréatojéjunostomie de Roux-en-Y et la pancréatojéjunostomie longitudinale; celles-ci peuvent être modifiées pour convenir aux circonstances particulières d'un cas donné.

Despite the many studies of chronic pancreatitis, there has never been a controlled clinical trial to compare the results of one form of surgery with those of another or, indeed, to compare the results of surgery with those of nonoperative treatment. Therefore, the surgical management of this condition continues to be based on the opinions of individual surgeons, often supported at best by retrospective analyses of disparate series of patients. Having done nothing to improve this sad state of affairs, I can only present yet another prejudiced opinion in the hope of stimulating debate.

By definition, this discussion will be concerned with the relief of symptoms resulting from permanent and progressive alteration in both structure and function of the pancreas.[1] In fact, we are really discussing the management of pain, because to restore lost endocrine and exocrine function is at present beyond our surgical capability. The exact cause of pain in chronic pancreatitis is unclear, but there can be little doubt that in most patients with ductal obstruction, relief of that obstruction brings about relief of pain. Unfortunately not all patients have major ductal obstruction, and in these it is postulated that a more diffuse obstruction in the smallest duct radicals is responsible.

Some advantage derives from the altered nature of the chronically inflamed gland, in that it permits surgical assault in ways that would never be tolerated by the healthy gland with its propensity to acute inflammatory change on the least provocation. It is truly amazing how much battering the hard, fibrotic gland of chronic pancreatitis will withstand.

*From the department of surgery, University of Alberta, Edmonton, Alta.

Presented at the inaugural meeting of the Canadian Association of General Surgeons, Toronto, Ont., May 11 and 12, 1977

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University of Alberta Hospital Experience, 1970 to 1976

A review of local experience served to indicate the scope of the subject and the relative uselessness of such reviews. Endoscopic retrograde cholangiopancreatography (ERCP) was introduced midway through the survey in mid-1973 and produced a notable improvement in the recognition and management of chronic pancreatitis, particularly in patients in whom radiologic calcification of the gland was absent. Moreover, preoperative delineation of altered ductal morphology allowed better selection of patients for surgery.

The causes of clinically recognized chronic pancreatitis in 53 patients are listed in Table I; not included in the analysis are the many cases of upper abdominal pain attributed to chronic pancreatitis but lacking documentation of pancreatic disease other than by exclusion. Radiologic evidence of calcification was present in 28 (53%).

Of the total group, 28 eventually underwent surgery for relief of pain. Table II lists the 34 procedures performed on these patients, the diversity illustrating a nice lack of rigidity among the operating surgeons. The term "ductoplasty" is used to describe plastic procedures on the pancreatic ducts themselves (either of Wirsung or Santorini) as differentiated from a sphincteroplasty, which only promotes drainage of the common bile duct. The one Whipple procedure was done in the belief that an occult malignant growth was responsible for the changes of chronic pancreatitis.

Table I—Causes of Chronic Pancreatitis in 53 Patients Treated at University of Alberta Hospital, 1970 to 1976

Cause	No. of patients
Alcohol	37
Gallstones	3
Familial factors	2
Hyperlipidemia	1
Trauma	1
Unknown	9

Table II—Operations Performed on 28 Patients with Symptomatic Chronic Pancreatitis

Procedure	Number
"Ductoplasty"	3
Distal pancreatectomy without drainage	3
Distal pancreatectomy with drainage (Duval)	2
Side-to-side pancreaticojejunostomy	3
Longitudinal pancreaticojejunostomy (Puestow)	8
Near-total pancreatectomy	2
Pancreaticoduodenectomy (Whipple)	1
Drainage of retention cyst	4
Biopsy alone	1
Procedures on common bile duct*	7
Total	34

*Includes sphincterotomy, sphincteroplasty and choledochoduodenostomy.

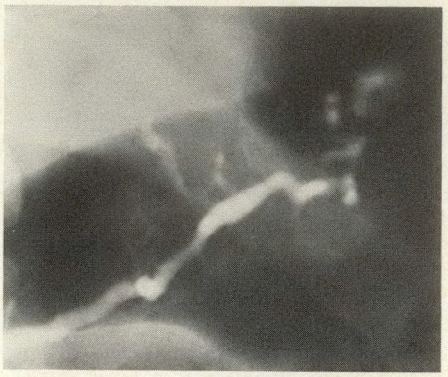

FIG. 1—Case 1. Distal pancreatic duct with cystic dilatation in tail.

The Logical Surgical Approach

In patients with demonstrable ductal abnormalities, the procedure selected must surely be that which will most easily overcome the problem while preserving whatever pancreatic function remains. Assuming that ductal distension distal to a zone of obstruction is the major cause of pain in chronic pancreatitis,[2] then relief of that obstruction by ductal decompression is all that is required. The logic of performing 95% resection of the gland as the initial procedure in such patients is hard to understand; not only is it technically more difficult, but it guarantees that those fortunate enough to survive the operation will suffer from both diarrhea and diabetes.

In patients in whom macroscopic ductal changes are absent and who, presumably, have diffuse disease, there may be no recourse other than performance of a major resection, but, as illustrated below (case 8), ductal

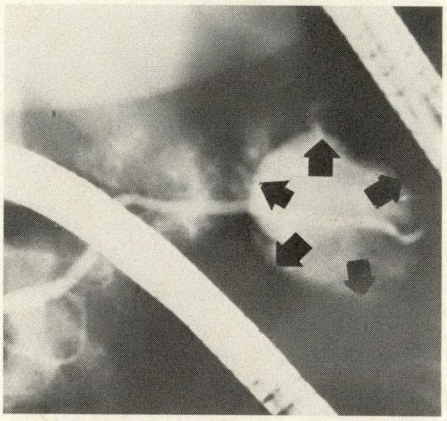

FIG. 2—Case 2. Large cyst in communication with distal pancreatic duct.

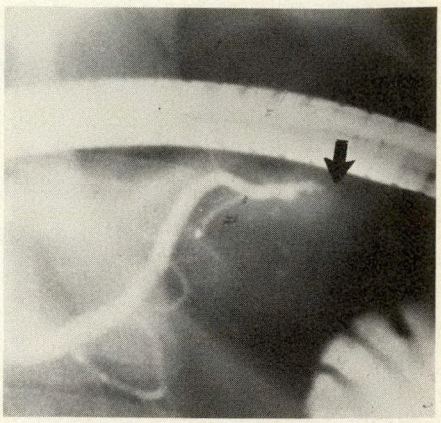

FIG. 3—Case 2. Normal pancreatic duct 1 year after resection of tail.

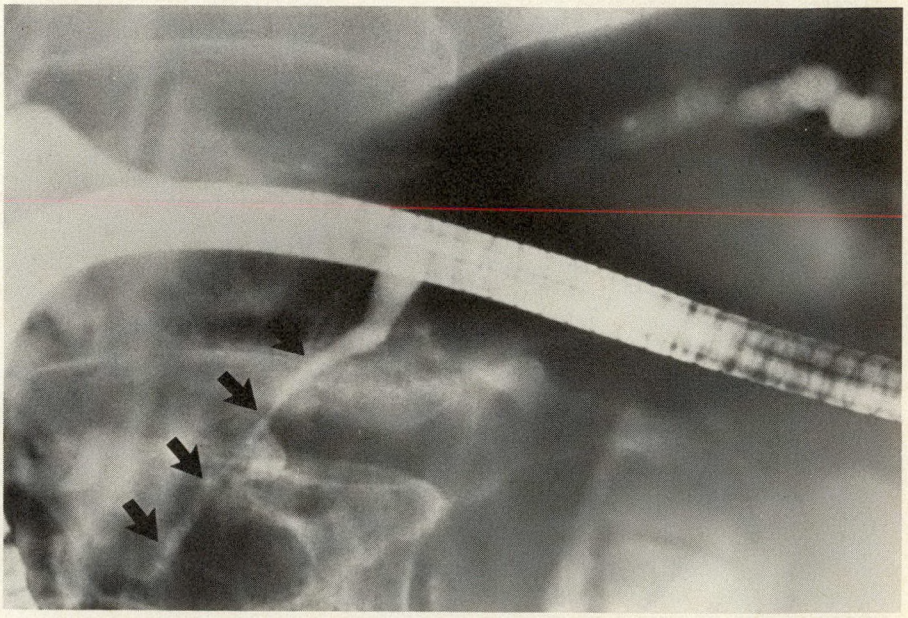

FIG. 4—Case 3. Narrowed supra-ampullary segment (arrows) with dilatation above.

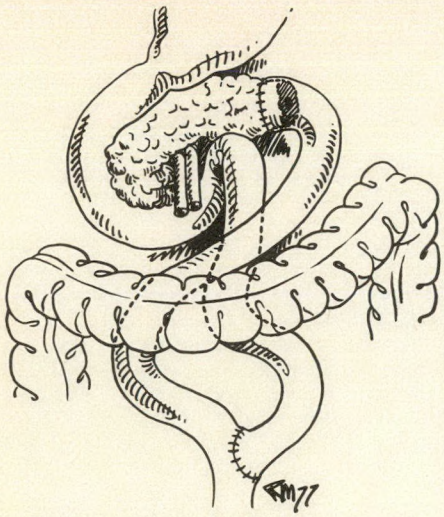

FIG. 5—Distal Roux-en-Y pancreaticojejunostomy (Duval).

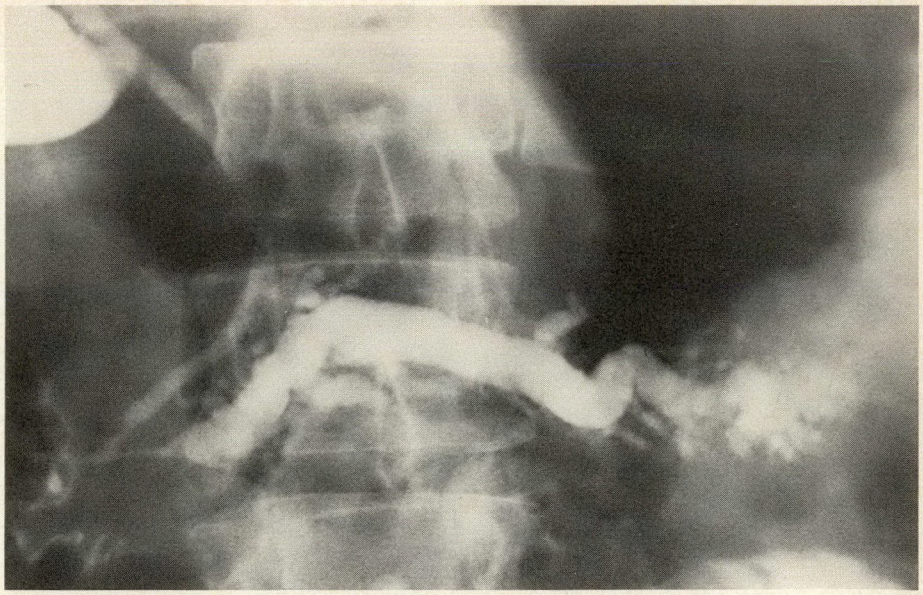

FIG. 6—Case 4. Narrowed supra-ampullary segment with tortuous widely dilated duct above.

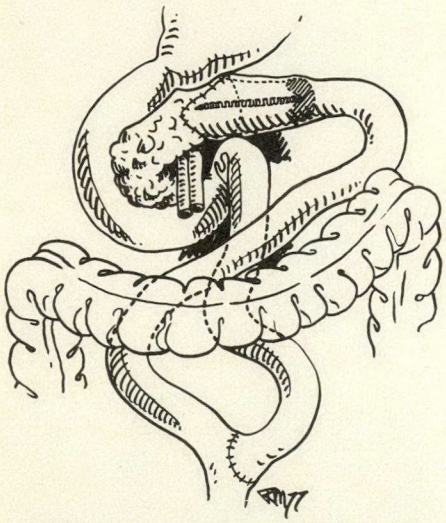

FIG. 7—Longitudinal pancreaticojejunostomy of Puestow. Incision into duct is usually carried further into head than illustrated here.

changes permitting a lesser procedure may eventually develop even in these patients.

The presence of retention cysts is readily recognized with ERCP. These vary in size from relatively small fusiform dilatations of the duct to large cysts frequently misinterpreted as postnecrotic pseudocysts because, like pseudocysts, they may lack a recognizable lining epithelium. Retention cysts are always intrapancreatic and communicate with a major duct. They represent cystic dilatation of the duct distal to a point of obstruction and usually develop slowly without any precipitating episode of pancreatic necrosis. Their management depends upon their size and position, as illustrated below.

Finally, the surgeon must be convinced that the patient's symptoms are indeed attributable to pancreatitis; drug addiction is not uncommon in this disease and even the most skilful surgery may fail to quench the demand for drugs.

Illustrative Cases

Case 1.—A 27-year-old alcoholic man had a 5-year history of recurrent chronic pancreatitis. ERCP demonstrated a normal proximal duct but a 2 × 1 cm cystic dilatation in the tail (Fig. 1). Quite illogically the procedure selected was sphincteroplasty, from which no benefit was derived. A distal pancreatectomy would have been a better choice.

Case 2.—This 32-year-old woman had documented chronic pancreatitis of unknown etiology. ERCP, 2 years after the diagnosis had been established, demonstrated a 3 × 4 cm cavity in the tail of the pancreas associated with a normal proximal duct (Fig. 2). A distal pancreatectomy completely relieved her symptoms and follow-up ERCP 1 year later (Fig. 3) confirmed the unchanged status of the remaining pancreas. It is of interest that

FIG. 8—Case 5. Multiple strictures with intervening areas of dilatation ("chain-of-lakes").

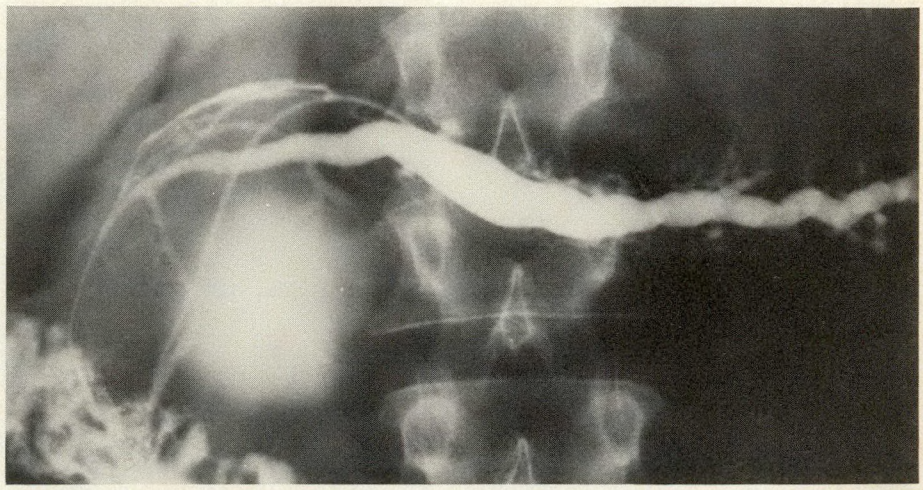

FIG. 9—Case 6. Operative pancreatogram demonstrating large cyst in head of pancreas associated with narrowing and elongation of proximal duct with distal dilatation.

there was an unusual foreign-body giant cell reaction around eosinophilic foreign material in the wall of the cyst; the nature of this material was never determined.

Case 3.—In a 59-year-old alcoholic man with long-standing disease ERCP demonstrated a narrowed, supra-ampullary segment (length, 6 cm) with dilatation beyond (Fig. 4). Multiple biopsies ruled out a malignant condition and a Roux-en-Y pancreaticojejunostomy (Fig. 5) provided complete relief of his symptoms.

Case 4.—This 23-year-old alcoholic man was becoming dependent on narcotics. ERCP demonstrated a hugely dilated and tortuous duct with a narrowed supra-ampullary segment (Fig. 6). A longitudinal pancreaticojejunostomy (Fig. 7) provided dramatic relief of pain. At discharge 10 days later he was not using any analgesics.

Case 5.—This 36-year-old male alcoholic was addicted to narcotics. Increasing severity of pain and a 20-kg weight loss over 3 months precipitated reinvestigation. ERCP revealed a characteristic "chain-of-lakes" deformity as well as narrowing of the distal common bile duct (Fig. 8); the pancreatic duct was packed full of calculi. A Puestow longitudinal pancreaticojejunostomy was performed together with a choledochoduodenostomy to relieve the common-duct obstruction. Postoperatively, although readily admitting that his back pain had gone, his addiction to narcotics continued.

Case 6.—A 41-year-old male alcoholic with increasing pain and a recent weight loss of 10 kg had a mass in the right upper abdominal quadrant. ERCP was unsuccessful. At exploration a large cystic mass was found in the posterior part of the head of the pancreas. A widely dilated duct was easily palpable in the body of the gland; after its injection with contrast medium a pancreatogram was obtained (Fig. 9). A Roux-en-Y loop was used to drain the cyst and was anastomosed side-to-side to the main pancreatic duct (Fig. 10). The patient was completely relieved of his symptoms.

Case 7.—In a 46-year-old male alcoholic with type IV hyperlipidemia sequential ERCPs 6 months apart demonstrated an increasingly narrow stricture of the duct (Fig. 11) with multiple calculi. A near-total pancreatectomy was followed by a difficult postoperative course during which the coexisting problems of diabetes, diarrhea, subnutrition, wound infection and pancreatic fistula were successfully managed.

Case 8.—This 32-year-old man, probably alcoholic, presented with a 3-year history of chronic pancreatitis. Initial ERCP demonstrated a normal duct (Fig. 12). Near-total pancreatectomy was offered at that time, but was refused. ERCP repeated 1 year later revealed a stricture of the main duct with cystic dilatation in the tail (Fig. 13). A Puestow procedure provided a good early result.

Longitudinal Pancreaticojejunostomy

This procedure was introduced by

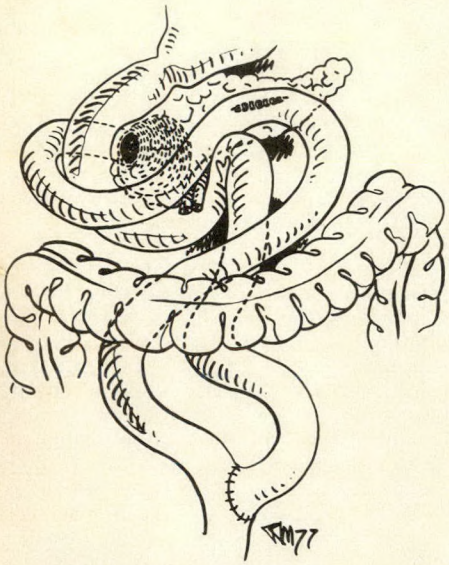

FIG. 10—Case 6. End-on jejunostomy and side-to-side pancreaticojejunostomy.

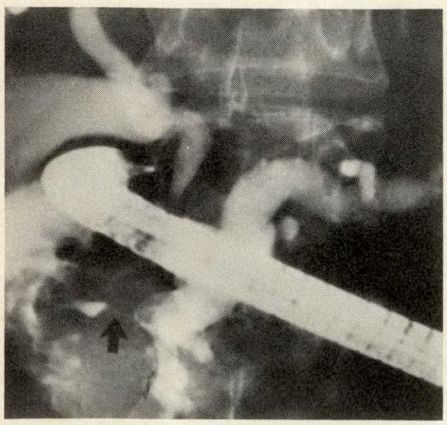

FIG. 11—Case 7. Proximal stricture (arrow) with wide dilatation above.

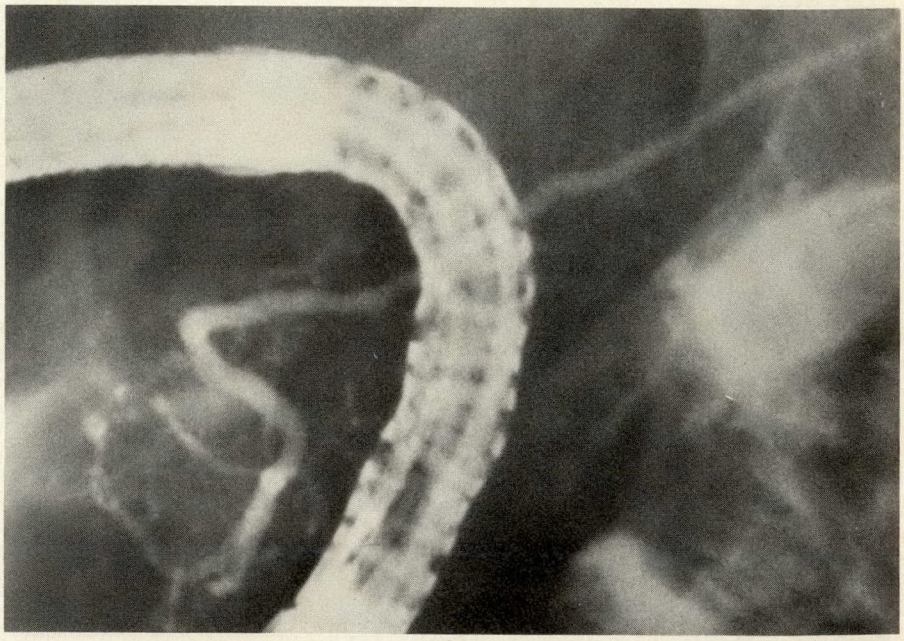

FIG. 12—Case 8. Initial ERCP demonstrating normal duct.

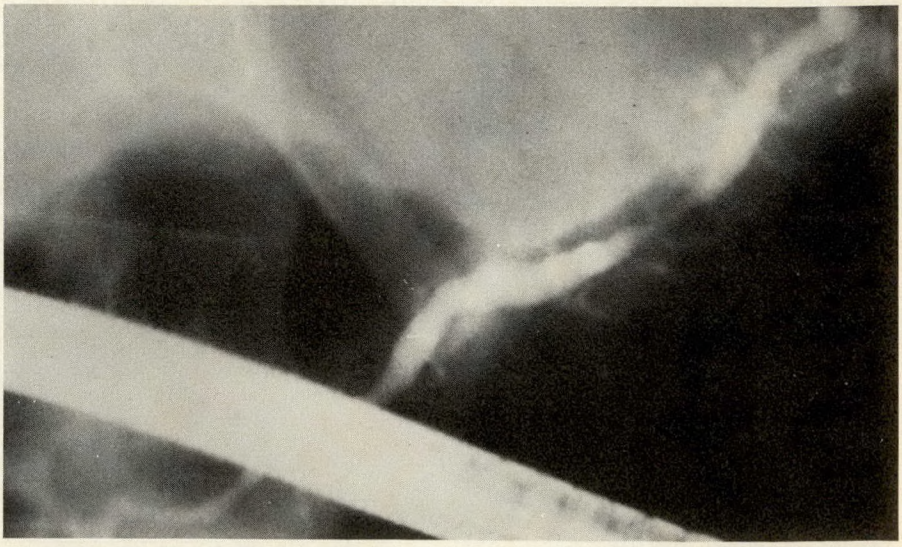

FIG. 13—Case 8. Repeat ERCP, 1 year later. Stricture and dilatation are now evident.

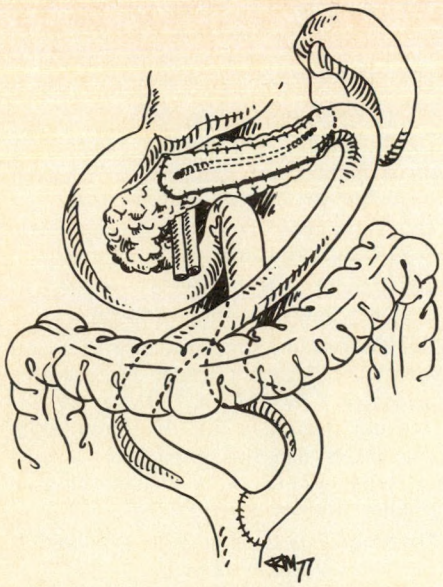

FIG. 14—Longitudinal pancreaticojejunostomy as modified by Thal.

Puestow and Gillesby in 1958[3] as a means of dividing all strictures and removing calculi from the pancreatic duct. Because it can occasionally be difficult, modifications to avoid mobilizing the spleen and tail of the pancreas such as that suggested by Thal (Fig. 14) have been widely adopted. However, it has been my experience that, in all but the thinnest patients, it is necessary to mobilize the pancreas to be able to work comfortably upon the duct. Inserting the entire body and tail into the Roux-en-Y loop is also attractive, being much less likely to be followed by fistula formation or loop separation. The latter has been described as a late complication of the Thal operation (Trapnell JE: Personal communication, 1976).

Results and Conclusions

There is general agreement that appropriate drainage procedures will provide good long-term relief of pain in 75% of patients with ductal abnormalities,[4] an experience that is confirmed in our own series. In such patients immediate near-total pancreatectomy, which has a higher operative mortality rate and postoperative morbidity,[5] is not justified. In patients with severe symptoms and normal major ducts, there may be no alternative to resection.

Occasionally a simple plastic procedure carried out on the termination of the pancreatic duct ("ductoplasty") will suffice if that is the only level of obstruction; the classic sphincteroplasty is of use only for stenosis of the sphincter of Oddi, which rarely is the obstructing lesion responsible for alcohol-related chronic pancreatitis. It is generally accepted that attempts to relieve pain by splanchnicectomy or destruction of the celiac ganglia are of little or no value.[6]

Finally, the best results are obtained in patients who will abstain from alcohol. Resumption of drinking usually reactivates the disease, perhaps modified to consist of recurrent bouts of acute pancreatitis rather than the previous chronic form.

The help of Dr. Lambros Costopoulos in reviewing the roentgenograms and of Mr. Ralph McNabb in preparing the illustrations is gratefully acknowledged.

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5. Panel Discussion on Pancreatitis*

Chairman: A.G. THOMPSON, MD, FRCS[C], FACS†
Panelists: R.G. KEITH, J.E. MULLENS, P. PONCELET AND, F.W. TURNER

Dr. Thompson: I would like to suggest that the questioning of the panel members be on a practical basis. We have listened to a number of presentations that have been both interesting and informative, but most of us would like to hear more about the actual details of treatment of patients with acute or chronic pancreatitis.

Most patients with acute pancreatitis suffer from the mild form of the disease and will recover on routine "suck and drip therapy" (i.e., nasogastric suction and intravenous fluids), together with suitable analgesia. However, approximately 20% of patients with severe pancreatitis require intensive care and management, which call for the participation of various groups of specialists. It is in relation to this group of seriously ill patients that I would like to ask the panel for direction. Dr. Poncelet, in his presentation, briefly mentioned intravenous hyperalimentation (IVH) as an important part of the treatment of the patient with acute pancreatitis. Dr. Keith, do you think this is true? Do you use IVH?

Conducted at the inaugural meeting of the Canadian Association of General Surgeons, Toronto, Ont., May 11 and 12, 1977

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Dr. Keith: I agree and I disagree. I don't think that in the first 48 to 72 hours of the acute fulminant process IVH will do anything to reverse or reduce the severity of the disease. Later, when one is faced with complications of the acute process, I certainly think it is of great value. I agree that both IVH and oral alimentation with elemental diets have little stimulating effect on the pancreas, which is in their favour for the management of this disease.

Dr. Thompson: Do any of you have strong beliefs on the use or the nonuse of antibiotics in the severe form of acute pancreatitis?

Dr. Poncelet: I use antibiotics in gallstone pancreatitis because most samples of bile from these cases show enteric bacteria. But antibiotics are only a part of the treatment. If there is pus in the gallbladder it is obvious that the organ should be removed as soon as possible; antibiotics alone are not going to cure this patient.

Dr. Mullens: I think that antibiotics should be reserved for the complications of pancreatitis. We don't use them routinely.

Dr. Keith: I would like to remark that recently a report of a controlled clinical trial was published demonstrating that antibiotics (I think that ampicillin and cephalothin were used) had no effect whatever on the outcome of the acute form, so I do not use them.

Dr. Thompson: We would probably all agree, however, that in the complicated case, when the patient has infection or is suspected to have infection, antibiotics are indicated. Dr. Mullens, how do you diagnose a pancreatic abscess or an acute pseudocyst in these patients?

Dr. Mullens: I think that first of all radiology is a great help. The two initial procedures in the investigation of a pancreatic mass are ultrasonography and roentgenographic barium studies, followed when necessary by ERCP (endoscopic retrograde cholangiopancreatography).

Dr. Thompson: The patient in the intensive care unit suffering from severe pancreatitis is extremely ill and probably can be subjected to no more than an ultrasonic B scan. This examination during the course of acute pancreatitis can be very helpful indeed.

Dr. Mullens: It is also very easy to do.

Dr. Thompson: Agreed. It is noninvasive and can help you diagnose the early abscess or acute pseudocyst. If repeated on a daily basis it can indicate whether the abscess or cyst is changing in size.

Is there any place for steroids in the treatment of acute pancreatitis? Dr. Keith?

Dr. Keith: No.

Dr. Thompson: Anybody else? Everyone agrees that there is no place for steroids! How about the prevention and treatment of the respiratory complications that probably occur in most patients with severe pancreatitis, at least in most of the ones I see? Very many of them go into respiratory failure. Dr. Turner, have you any views on this subject?

Dr. Turner: The only comment I would make is that operating on patients with acute pancreatitis tends to increase the likelihood of respiratory complications. I would like to know what Dr. Keith thinks.

Dr. Thompson: Dr. Keith, are many of the respiratory complications iatrogenic?

Dr. Keith: That's an important question. Are we overloading these patients? Are we projecting them into pulmonary edema or is the pancreatitis the sole cause? Some reports suggest the former, since patients improve with massive doses of diuretics and albumin given in an attempt to draw fluid back into the intravascular compartment. The data available would indicate that there is a primary end-organ effect in this disease and that we must replace fluid losses. We have to use colloid for the purpose and must be careful not to overload the patient. But there is also an acute pulmonary problem for which the specific therapy is mechanically assisted ventilation. By this I mean high-volume ventilation with positive end-expiratory pressure. Frequently respiratory failure is not recognized early enough and when it is, the reversible stage of the disease has passed. The onus is on us to look for it earlier and to treat it aggressively. We will find, as Imrie in Scotland is finding, that the survival rate will be increased even in patients otherwise left untreated.

Dr. Mullens: I also firmly believe that the management of the pulmonary problem, as Dr. Keith has just said, should begin early in the course of the disease. I think it is very important to recognize the case of high-risk acute pancreatitis. This patient should also be treated with peritoneal dialysis; it is well established now that, when a patient has a low serum calcium value, a high leukocyte count, low Po_2, high BUN concentration, reduced urinary output and is delirious, the institution of peritoneal dialysis can work miracles.

Dr. Thompson: What fluid do you use for lavage?

Dr. Mullens: We use Ringer's lactate solution, the same that the nephrologists use for peritoneal lavage except that we add a little potassium chloride to make it more efficient.

Dr. Thompson: One more word on respiratory failure. Do any of the panelists depend on pulmonary wedge pressures in monitoring fluid therapy? Dr. Poncelet, do you feel these are superior to central venous pressures?

Dr. Poncelet: Yes. In most patients we use a Swan-Ganz catheter in the postoperative period for 3 to 4 days.

Dr. Thompson: Is this a difficult procedure to carry out?

Dr. Poncelet: No, not for us because the anesthetist introduces them.

Dr. Thompson: I mean, can a measurement of pulmonary wedge pressures by means of a Swan-Ganz catheter be carried out only in a high-level university hospital or can this procedure be used by those of us who are working in smaller hospitals?

Dr. Poncelet: It should be available in any intensive care unit.

Dr. Thompson: We found pulmonary wedge pressures very useful to indicate whether the patient is being overloaded. The procedure is simple and it gives more reliable information than the central venous pressure.

Would the panelists comment on the treatment of pancreatitis after biliary tract surgery or gastric surgery? Do any of you ever meet this postoperative complication?

Dr. Mullens: Postoperative pancreatitis is a serious condition associated with a high mortality rate. One must be aware of the possibility of its development and institute early treatment. Not only can it follow biliary tract or pancreatic surgery but also operations on the bowel. These patients should have peritoneal lavage.

Dr. Thompson: Dr. Keith, should Trasylol (aprotinin) be used prophylactically when there is a possibility of damage to the pancreas during, say, duodenal dissection or common-bile-duct exploration?

Dr. Keith: We haven't used Trasylol but we have used glucagon. If glucagon has any place at all it is its prophylactic use when there has been dissection around the pancreas or biliary tract. Unfortunately, we have done no controlled study so I cannot be specific about its value.

Dr. Thompson: Is glucagon available to the average surgeon?

Dr. Mullens: I am told its production is now limited. There has been such a demand for glucagon that I have had to stop using it in ERCP; the radiologists have a limited supply and they require it for hypotonic duodenography.

Dr. Thompson: If it were readily available, is there any place for glucagon in the treatment of acute pancreatitis?

Dr. Keith: Again, I can only refer back to what's been reported. I think that once the disease is established this agent

has little effect and that it probably has more value when given prophylactically.

Dr. Thompson: Could we consider the management of the patient with acute gallstone pancreatitis? By some means or other we have found out that a patient who is suffering from acute pancreatitis has gallstones. When should one operate to remove the gallstones? Dr. Poncelet, I believe it is your opinion that this should be done as soon as possible after the onset of the episode and as soon as the diagnosis has been made. If the patient has gallstone pancreatitis, should he be operated upon?

Dr. Turner: I don't really have any strong views, but it would seem reasonable if the patient is improving not to do anything about the gallstones at that time. I would allow the patient to recover and bring him back in approximately 6 weeks for an elective cholecystectomy.

Dr. Keith: I think, Dr. Turner, you may find that in the 6 weeks the patient may have more attacks of pancreatitis? Have you not had this experience? I agree with Dr. Poncelet that early operation is indicated, but I would like him to tell us how he knows which patient has gallstones unless there has been a previous workup indicating their presence?

Dr. Poncelet: In most cases of gallstone pancreatitis my knowledge of the primary cause is based on a previous workup. Sometimes my diagnosis is on a clinical basis, for example, the patient does not drink alcohol or is a 40-year-old fat lady; in such instances one can be almost certain that the patient has gallstones.

Dr. Mullens: I would like to make a plea for ultrasonography — it will show gallstones in many cases.

Dr. Thompson: Sometimes the ultrasonographer is a little overenthusiastic but usually he is pretty reliable.

In the case of a patient with acute pancreatitis as a result of gallstones, probably most of us would prefer to operate during the same admission. Personally I like to let the patient recover, but before he or she goes home 3 to 4 weeks later to perform an elective cholecystectomy with operative cholangiography to make sure that there are no stones in the common duct.

Dr. Turner: I would ask the other panelists whether they believe that stones within the gallbladder or a stone passing into the common duct and through the sphincter causes the pancreatitis? It seems to me that if the stone that has caused the trouble has already passed, then there is not much urgency to take out the gallbladder.

Dr. Poncelet: How can you be sure that the stone has already passed?

Dr. Turner: I am not sure and that's why I'm asking about it. There are reports that if the stools of such patients are filtered, a stone will be found in a very high percentage of them. Presumably it is the actual passage of the stone through the sphincter that causes the trouble rather than the mere presence of a stone in the common bile duct.

Dr. Poncelet: But sometimes there is just one big stone in the gallbladder and the patient has pancreatitis.

Dr. Turner: That just means that you have missed the one that has gone through.

Dr. Thompson: This is certainly a moot point. Perhaps we can move on to another area and I would like to pose the question, What should be done if one happens to operate on a patient with acute pancreatitis? Not all of us are as enthusiastic as Dr. Poncelet, but would somebody like to outline their indications for operation in the course of acute pancreatitis. Dr. Keith, you tend to treat these patients more conservatively than Dr. Poncelet. Do you believe there are indications for surgery during the course of acute pancreatitis?

Dr. Keith: I think it will be simpler to discuss alcoholic pancreatitis and then we can set aside the question of what is to be done about gallstones. If a patient is not responding to conservative measures, are we going to consider surgery? I believe the answer is yes. There are about 5% of patients whose condition, in spite of the most aggressive nonoperative management, excluding peritoneal lavage, will continue to deteriorate, and this is the patient who needs an operation. I have no personal experience with acute pancreatic debridement or sequestrectomy for a totally necrotic gland other than as an observer in France. I was impressed at that time by the ease of removal of the dead black pancreas, but I was also impressed by the comments of the men who worked under Hollender that these patients had 100% mortality; about 5 days later they either bled to death or were overcome with sepsis.

Dr. Turner: I have tried this procedure in the acute stage and had great difficulty in recognizing whether the pancreas was actually necrotic or not.

Dr. Thompson: What might one do at the time of operation short of pancreatectomy or sequestrectomy, if we accept the fact that most of us are a little hesitant about resecting the acutely inflamed pancreas? What else can be done at the time of operation? Dr. Poncelet, you mentioned cholecystostomy or drainage of the biliary tract. Do you feel that this is important?

Dr. Poncelet: If there are gallstones present, then I strongly believe that the biliary tract should be drained and, if possible, through the common bile duct. I think this is a better drainage procedure than a cholecystostomy. With respect to pancreatectomy, I disagree with Hollender, who proposes early operation within 12 hours, and I agree with Edelman that after 8 to 10 days is the optimal time to consider operation in these patients. Necrosis is then well defined and it is much easier to determine what part of the pancreas has to be resected and what can be left in place.

Dr. Thompson: Do you use drains in these patients?

Dr. Poncelet: Yes, the pancreatic area is widely drained and peritoneal lavage is carried out postoperatively.

Dr. Thompson: I think that many of these patients come to operation because of a misdiagnosis. We think we're probably operating on a patient with acute cholecystitis and at operation, to our horror, we find the patient has active acute pancreatitis. What should one do then? Usually it is an acute, edematous type of pancreatitis and I believe that in such instances the less one does the better. These patients are going to recover as long as we don't interfere with them too much, and I agree with Dr. Poncelet that if there is any evidence of biliary tract disease one should drain the biliary tract but not do much more than that.

Let us move on to a consideration of chronic pancreatic disease. Dr. Poncelet, would you like to comment on the easiest and best method of draining the average pseudocyst?

Dr. Poncelet: If possible, I drain them through the stomach after waiting 5 to 6 weeks to be sure that there are good adhesions present. If one is forced to operate early during the acute phase of the cyst development, then external drainage is advisable. A pancreatic fistula may follow but this can be dealt with at a later date. Sometimes a small cyst lying adjacent to the duodenum can be drained into this structure.

Dr. Turner: I would agree completely with Dr. Poncelet, although I am not sure what the average pseudocyst is.

Dr. Thompson: The average pseudocyst is one that is well formed, easily identifiable, has a thick fibrous wall and is not friable; in other words it can easily be sutured to stomach or bowel. Do complications ever follow drainage into the stomach?

Dr. Mullens: Not all pseudocysts require treatment; some of them subside spontaneously and we should not be too hasty in operating on these patients.

Dr. Thompson: This is where ultrasonic B scanning has helped in allowing us to follow the course of the so-called

acute pseudocyst, many of which do subside, as we now realize. In answer to the enquiry about complications from draining a pseudocyst into the stomach, I have encountered a few myself.

Dr. Mullens: What were they?

Dr. Thompson: Hemorrhage. If there is a highly alkaline fluid in the pseudocyst and you drain it into the stomach, multiple bleeding ulcers can develop in the gastric mucosa and these can create quite a situation. I agree that this is a rare occurrence and that drainage into the stomach is the easiest and safest way of draining most cysts when they lie in the lesser sac. I, myself, prefer to drain them into the jejunum but most surgeons consider cyst-gastrostomy as the treatment of choice. How about the small pseudocyst in the tail of the pancreas?

Dr. Mullens: I was going to remark that there is sometimes more than one pseudocyst, and that these can be easily overlooked, especially one that is in the tail region of the pancreas.

Dr. Thompson: What would you do with such a one, Dr. Mullens?

Dr. Mullens: Excise the tail of the pancreas along with the spleen. With regard to the stump of the pancreas, I would remind you of the little trick about the pancreatic duct that Sir Rodney Smith taught. Sir Rodney advised that if you can see the duct in the stump of the pancreas, you should put a tube into the duct, attach the stump to the back of the stomach and bring the tube out through both walls of the stomach and the abdominal wall. This works very well.

Dr. Thompson: Dr. Turner, you have used the Puestow procedure in a number of patients with chronic pancreatitis. Were your results always good if ductal obstruction was present?

Dr. Turner: So far, yes, and this is in agreement with the reported results of other surgeons. Several long-term studies have been recorded now. Jordan has 30 patients he has observed over 15 years and White has patients who are doing well in the long term. Both of these investigators report good long-term results, meaning freedom from pain, in 70% to 75% of patients.

Dr. Thompson: In performing a Puestow or similar procedure, is a mucosa-to-mucosa apposition necessary?

Dr. Turner: I do not think so. Jordan doesn't carry out such mucosa-to-mucosa apposition because he believes this may obstruct small radicles draining into the main duct. I don't know how he avoids this because when you split the pancreas open it bleeds so much from the edges that, in my experience, the edges must be oversewn anyway. I have never carried out a formal mucosa-to-mucosa apposition in performing various pancreatic ductal drainage procedures.

Dr. Thompson: What suture material do you use when you are working on the pancreas?

Dr. Turner: I use silk routinely.

Dr. Thompson: Does anyone use absorbable sutures? No. How about the technique for closing the proximal stump after distal pancreatectomy?

Dr. Turner: I don't think there is anything special about this. I try to identify the duct and close it separately and then I simply use mattress sutures of silk for the end. Sometimes one can wedge the stump a little to get a better closure.

Dr. Mullens: You don't need to do this if you use the Rodney Smith procedure I mentioned previously.

Dr. Keith: My only other comment is that if the stump is to be oversewn without draining it you must be sure that the sphincteric duodenal end is patent. This can easily be determined by sliding a small no. 5 esophageal feeding catheter along the pancreatic duct; it should fall in the duodenum quite easily.

Dr. Thompson: Dr. Turner, you have mentioned a patient with chronic pancreatitis and a very normal-looking small duct; you stated there is no place for ductal drainage in this type of case. Then what would you do?

Dr. Turner: I am not altogether certain whether a patient with chronic pancreatitis but having a normal duct should actually have a pancreatectomy as the primary procedure. Perhaps it would be advisable to wait a few years and then operate on the duct after it has become dilated for then it will be more adaptable to a drainage procedure.

Dr. Thompson: Dr. Mullens, should we all be doing ERCP? Are there any complications from putting a little tube into the pancreatic and biliary duct systems?

Dr. Mullens: It takes quite a time to develop the necessary skill and I think the performance of this procedure should be reserved for a few individuals so that they can get the practice necessary to obtain dependable results consistently. Our results are successful in approximately 90% of instances at the present time, but only after a great deal of practice on my part.

The complication I would like to mention first is the transmission of infection when a patient with infectious hepatitis is being investigated. Obviously the instrument should be carefully sterilized before it is used in another patient. The practical rule is that if no cause for the patient's jaundice is found at the time of ERCP, the scope should be sterilized in a gas autoclave. There is also the complication of sepsis, either cholangitis or pancreatic abscess, but as long as one is aware of the possibility, treatment with antibiotics can be instituted if these seem indicated. Thirdly, pancreatitis can develop if one injects the pancreatic duct at too high a pressure. Many patients do have a transient elevation of serum amylase. I have had two such cases but in both instances the disease process was short-lived and of no great consequence.

Dr. Thompson: Do you find the so-called common channel in all patients whom you intubate?

Dr. Mullens: Oh no. In only about 60%; in the other 40% the common bile duct and main pancreatic duct have to be cannulated separately. This means they have separate openings, but usually both are located in the same area.

Dr. Thompson: I would like to thank the members of the panel for their participation and also the members of the audience who submitted many of the questions. It has been a most interesting discussion.

Critique of Item 600 (SESAP II)

Pseudomonas aeruginosa grows very well under conditions of moisture and alkalinity. Urethral catheter drainage, when improperly managed, is an ideal situation for such infections since both conditions exist. The water trap used in mechanical ventilators to increase the water content of inspired gases provides the best environment for the growth of Pseudomonas. Although infection of the central venous catheters used either for recording of pressure or for hyperalimentation is an important complication, Candida albicans is the most frequent microorganism to appear in this situation; Pseudomonas aeruginosa is cultured infrequently.

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Symposium on Intensive Care

1. Monitoring of the Critically Ill Surgical Patient*

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The skill and experience of the medical and nursing staff are the factors that have the greatest impact on the quality of monitoring and treatment of the critically ill surgical patient. Basic determinations at the bedside together with periodic evaluation of the whole patient by the medical staff may, in selected cases, be supplemented usefully by more invasive monitoring techniques. The specific complications and technical pitfalls of these techniques should be known, and caution should always be exercised that the values provided are not misinterpreted. A critical care area serving a major tertiary referral hospital should be able to measure pulmonary capillary wedge pressure and cardiac output. Mixed venous oxygen content and arterial lactate concentration, as indices of oxygen delivery, are also useful measures.

L'habilité et l'expérience du personnel médical et infirmier sont les facteurs qui influencent le plus la qualité de la surveillance et du traitement du patient de chirurgie dont l'état est critique. Les principales déterminations relevées au lit du malade associées à une évaluation périodique complète du patient par le personnel médical peut, dans des cas choisis, être complétées par des techniques de surveillance plus envahissantes. Les complications spécifiques de ces techniques et leurs écueils techniques doivent être connus, et l'interprétation des valeurs obtenues doit toujours être faite avec circonspection. Un poste de soins pour malades critiques attaché à un grand hôpital de consultation devrait pouvoir mesurer la pression capillaire pulmonaire et le débit cardiaque. La concentration veineuse mixte en oxygène et la concentration artérielle en lactate utilisées comme indices du transport d'oxygène sont aussi utiles.

Monitoring in its broadest sense refers to the surveillance, by whatever means, of either a static situation or an ongoing series of events, so as to detect change. When a patient is "monitored" this term is frequently interpreted as referring to various forms of electrical surveillance, but in this discussion the broader definition of the concept of monitoring will be used.

Many surgical patients require "intensive" care, but are not critically ill. Individuals who have suffered major trauma or who have undergone a major surgical procedure require intensive monitoring, but this need not normally be carried out in a critical care unit. These patients can be cared for on a surgical ward where there is provision for continuous surveillance by experienced nursing personnel. This need may usually be satisfied by a six- to eight-bed unit that is part of the surgical ward. As long as the individual sustains vital organ function, without need for major or continuous intervention, while he remains a "major" surgical case, he is not critically ill and does not require admission to a critical care unit.

Critical Care Units

Whether this is a medical, surgical, or combined unit, such an area should always be constructed in a manner that provides easy continuous observation by the nurses and physicians available.

The collection and recording of basic physiologic variables (such as temperature, pulse and blood pressure) by the nursing personnel, although important, serve the additional and perhaps more important function of bringing the nurse or physician to the patient's bedside at regular and frequent intervals. A current and somewhat alarming trend is to provide a unit that is designed to remove the nurse from the bedside and to carry out multiple-patient, remote monitoring by television or digital display.[1] Only the human mind has the capacity to recognize patterns in illness; there are many developments in the course of critical illness that are infrequent or unpredictable, and no transducer or electronic device has been yet devised that will warn of such events. The colour of the patient's skin, an increase in his respiratory effort, a change in his pain pattern, impairment of cerebration, development of abdominal distension, or discharge from a wound can only be observed, and their significance assessed, by an experienced nurse or physician.

Experienced nurses are a vital link in the monitoring of the critically ill patient. A critical care unit must have such a nursing staff, and must provide for their continuous instruction and updating of their knowledge and skills.

Nursing staff should be alert to, and recognize the significance of, trends in vital functions. They must recognize changes in respiratory parameters in ventilated patients and be able to identify important changes in cardiac rhythm. They must understand the supportive or monitoring equipment and be capable of carrying out cardiopulmonary resuscitation.

In order that the critical care unit may function well, there should be a full-time director who has responsibility for the performance and training of his nursing and medical staff, who also administers the unit and is responsible for the maintenance of instrumentation and other supportive equipment.

If the medical staff is composed partially of residents, they should be of sufficient seniority (3rd or 4th year) to assure good management during the times when they are the only responsible physicians present. Because residents "rotate", staggering of rotations is desirable, and the director of the

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unit must be sure that new staff are fully oriented to procedures and equipment.

Although the construction of the unit and the skill and experience of the staff may seem rather basic considerations, they are the factors in critical care that will have the greatest impact upon the quality of monitoring and treatment.

For the majority of patients, even in a critical care unit, sufficient monitoring can be provided by an experienced nurse, who determines at frequent intervals and records on an appropriate chart the blood pressure (taken with a cuff sphygmomanometer), pulse rate and urine volumes, together with a medical staff to carry out periodic evaluation of the patient, and supplemented by the necessary biochemical, hematologic and radiologic examinations.

Failure of adequate oxygen delivery to the body cell mass must be detected and corrected as early as possible in order to prevent secondary deterioration of hepatic, renal and cerebral function; therefore, the adequacy of cardiac and respiratory function is the major priority in monitoring. Oxygen delivery may also be impaired at the microcirculatory or cellular level, but these problems are less common and their impact on oxygen delivery probably less significant than a serious deterioration of blood flow or arterial oxygen tension.

Monitoring Oxygen Transport

Pulse Rate and Electrical Activity of the Heart

In a patient who has had a sufficiently severe dislocation of his vital functions to justify admission to a critical care unit, such a simple and useful device as a three-lead cardiac monitor should obviously be employed. In the management of myocardial infarction this form of inexpensive, noninvasive monitoring is extremely valuable, in that ventricular arrythmias are quickly detected and more serious problems thus averted. It should be recognized, however, that surgical patients, in whom myocardial disease is not the primary disorder, may have suffered cellular hypoxia for some time before cardiac arrythmias appear.

Radial Arterial Cannula

Insertion of a radial arterial cannula with continuous monitoring of blood pressure should be available in a critical care area but should seldom be required. This procedure is of low priority in initial management but is essential when drugs and anesthetic techniques intended to lower peripheral vascular resistance are used. It should be kept in mind that gangrene of the hand after such cannulation continues to be reported sporadically. Cannulation of the radial or ulnar artery for the purpose of collecting arterial blood for blood–gas determinations is unnecessary, as multiple needle punctures are well tolerated.

Urine Volume

Insertion of a Foley catheter and recording of urine volume are a basic monitoring requirement not to be omitted in any critically ill patient. A falling hourly urine volume, showing a clear trend over a period of a few hours, warns of unfavourable changes in blood flow, usually on the basis of a contraction of blood volume, or a redistribution of flow in response to increasing metabolic demands (e.g., sepsis).

Central Venous Pressure

An adequate evaluation of the central venous pressure (CVP) can sometimes be obtained by examination of the external jugular veins. In the critically ill patient it is seldom possible to base important therapeutic decisions on such an estimate of central venous pressures. For dependable CVP determinations a catheter must be placed with its tip located in the superior vena cava. Respiratory fluctuation of the column must be evident, and the position of the catheter must be verified by roentgenography. The measurement of CVP with a simple water manometer brings the technique within the scope of any small hospital. A CVP catheter also provides central venous access for the administration of drugs and fluids.

Central venous pressure does not measure blood volume but is an indicator of the competence of the right ventricle in expelling the blood being returned to it. Venous tone and, particularly, intrathoracic pressures also affect CVP levels. The CPV may be useful in the diagnosis of a low-flow state, or, more importantly, a series of measurements exhibiting a trend will act as a guide of blood volume expansion in the management of a low-flow state.

In most patients the CVP, as a measure of right heart filling pressures, may be titrated against hourly urine volumes, and blood volume expansion be continued on the assumption that filling pressures in the right heart reflect those in the left heart.

Expansion of blood volume is the cornerstone of therapy in low-flow states, and can be most effectively and quickly accomplished by the infusion of a colloid; CVP will then be a reliable indicator of cardiac filling pressures on both sides of the heart, and ineffective and poorly sustained expansion of blood volume with accumulation of salt and water in the interstitium will be avoided.[2]

Therapeutic decisions based on a low CVP in an oliguric or hypotensive patient are usually correct, and the CVP is useful in diagnosis of hypovolemia and in guiding colloid infusion. Increased intrathoracic pressures, loss of right ventricular compliance, or outflow tract obstruction and increased pulmonary vascular resistance can cause elevation of the initial CVP and may lead to erroneous conclusions and misdirected therapy.

Pulmonary Capillary Wedge Pressures

Pulmonary hypertension, right ventricular hypertrophy, or significant discrepancies in function between the left and right ventricles are uncommon coexistent problems in patients whose primary disease or injury is in another system. If they are present, however, it is not possible on the basis of CVP to make reliable estimates of, or to predict changes in, left atrial pressures.

These deficiencies have led to the development of flotation catheters and the measurement of pulmonary artery and pulmonary capillary wedge pressures in selected patients. The indications for insertion of Swan-Ganz catheters appear to be broadening as experience and confidence with the technique and instrumentation are gained. In our institution, at present, if the measured CVP is low and the clinical picture is compatible with hypovolemia, blood volume expansion can be carried out with the guidance of a CVP catheter, and pulmonary capillary wedge pressures are not required.

In the event that the CVP is elevated or rises quickly with a volume challenge, without satisfactory evidence of improved cardiac output, subsequent therapy will have to be guided by knowledge of the left atrial pressures as indicated by pulmonary capillary wedge pressure.[3] In these instances knowledge of the full clinical picture will usually suggest the factors that are making CVP an unreliable guide to volume expansion. In addition, some patients will be encountered where CVP is low, yet there are clinical or radiologic indications of cardiac failure. It is not possible to proceed with expansion of blood volume in these individuals without knowledge of left atrial pressures. It must be recalled, however, that monitoring of pulmonary capillary wedge pressure does not assure that pulmonary edema will not develop or progress, because there are two other critical variables, plasma oncotic pressure and pulmonary capillary permeability. There is no means

of direct evaluation of pulmonary permeability.

Cardiac Output

The development of the triple-lumen balloon flotation catheter, incorporating a thermistor probe 4 cm from the catheter tip, has greatly facilitated measurement of cardiac output by the thermodilution technique. Electronic computation devices are required to allow the on-line determination of cardiac output. Thermodilution now appears to be the method of choice for determining cardiac output. The indicator (5% glucose) is inexpensive, no withdrawal of blood samples is required, and measurements can be obtained at short intervals.

A unit that selectively employs pulmonary capillary wedge pressure for diagnosis and monitoring should also be capable of determining cardiac output. It is a major advantage in some cases to be able to construct a Starling curve for a patient on the basis of direct measurement of left atrial pressures and cardiac output by thermodilution.

The determination of cardiac output and derived values of ventricular function have found application in the diagnosis and management of patients with severe sepsis and septic shock, where physical examination may be misleading in so far as establishing a hemodynamic diagnosis is concerned. Individuals in respiratory failure and requiring positive end-expiratory ventilation may require cardiac output determinations to assure that increases in positive end-expiratory pressure (PEEP) are not actually reducing oxygen delivery. Serial determinations of cardiac output may guide the use of vasoactive or cardiotonic drugs when these are indicated.[4]

Mixed Venous Oxygen Content

A flow-directed catheter in the pulmonary artery allows sampling of true mixed venous blood and the determination of mixed venous oxygen content. The gradient of arteriovenous oxygen content can be calculated. This value will normally approximate 4.1 vol%. Narrow differences will correlate reasonably with high cardiac output, and wider differences with low-flow states. In a unit where flow-directed catheters are used but the instrumentation for cardiac output is not available, this value may indicate those individuals with high cardiac output and poor oxygen extraction, a common development in sepsis, which may not be appreciated on the basis of bedside evaluation.

Arterial Lactate

Arterial lactate concentrations are still valuable as prognostic indicators, and also serve as an additional detector of inadequate oxygen delivery or utilization. Microcirculatory or cellular disturbances associated with severe sepsis may be indicated by lactic acidosis, where cardiac output is normal or elevated and arterial oxygen tensions are in a satisfactory range. Bicarbonate concentrations are derived from direct measurements of pH and carbon dioxide pressure (P_{CO_2}), and may be depressed by the accumulation of fixed acids other than lactate. Arterial lactate values therefore are a more direct measure of oxygen utilization at the cellular level than bicarbonate.

Severe lactic acidosis is not a consistent finding in septic or hypovolemic shock, and bicarbonate should not be administered without the guidance of blood–gas determinations. Therapy should be directed towards correction of the primary disorder of oxygen delivery. One should be aware that transient increases in lactate concentration occur during resuscitation as a result of the "flush" phenomenon in hypoxic peripheral vascular beds.

Monitoring of Oxygenation and Ventilation

In the unassisted patient, measurement of P_{CO_2} and arterial oxygen tension (P_{aO_2}), respiratory rate and vital capacity should assure that adequate arterial oxygenation and ventilation are possible, without undue elevation of respiratory rate and effort. Arterial oxygenation can be supported by increasing the inspired oxygen concentration up to 60%. Respiratory rates greater than 35/min suggest that the effort of ventilation is excessive, and a vital capacity less than 15 mL/kg body weight suggests that the individual's ventilatory reserves are limited. Where the full clinical picture indicates that the disorder impairing oxygenation or ventilation will be progressive and not quickly reversible, endotracheal intubation and assisted ventilation will be required. No arbitrary figure can be the sole indication for ventilatory assistance; all the contingencies of the case must be considered.

Once mechanical ventilation has been established, tidal volume, rate and minute ventilation will be controlled, and can be adjusted and monitored with the volume-cycled respirator. Monitoring of the inspired oxygen tension, P_{aO_2} and P_{CO_2} should continue at intervals as frequent as other clinical factors indicate. In our experience, needle puncture of the radial artery may be repeated as often as necessary and insertion of a cannula is not indicated solely for the purpose of sampling arterial blood.

Failure to maintain a P_{aO_2} over 60 mm Hg with an inspired oxygen concentration of 60% is usually an indication for PEEP. The response to PEEP is not always predictable, and estimations of arterial blood gases must be repeated as end-expiratory pressures are increased in small increments. With a PEEP, a fall in cardiac output should be anticipated.

A measure of compliance can be derived from peak inspiratory pressures and tidal volume. This value may assist in quantitating the course of the disease and predicting the response to increments of PEEP. During weaning from assisted ventilation, inspiratory force measurement may assist in predicting or monitoring progress.

Body Temperature

Monitoring of body temperature is of particular importance in the period immediately following major trauma or extended surgical intervention. The system utilized should be capable of detecting temperatures at the lowest range. Hypothermia is very common under these circumstances and may have a considerable effect on visceral function as well as on the interpretation of results (e.g., arterial blood gases).

Conclusions

Every critical care area servicing a major tertiary referral hospital should have the capacity to perform the invasive monitoring techniques described above. Each of these techniques has specific complications and technical pitfalls. The worst complication of invasive monitoring is misinterpretation of the results. Because such techniques provide figures, there is often an unfortunate tendency to attach undue importance to a number, and to disregard or overlook important clinical observations.

Caution must be exercised at all times to be certain that the placement of invasive monitoring devices and the determination of baseline values do not delay urgent resuscitative measures. Frequently, simple bedside observations will indicate the appropriate therapy. It is wrong in these instances to delay such measures pending introduction of various monitoring devices and catheters.

Once a monitoring catheter has been introduced and data are being obtained there is sometimes a reluctance to disturb the collection of data by moving or examining the patient. Necessary examinations or treatment may thus be omitted in the interest of the monitoring device.

An array of transducers and electronic devices may produce a mass of

data, which is returned in a form that makes meaningful interpretation difficult. It is now possible to process the data and present the information as a "physiologic profile" on a preprinted format; the data are available within 1 hour and are presented in a way that facilitates interpretation and assists in therapeutic decision-making.[5] All techniques and devices used in critical care monitoring should be under continuous review to ensure that the risks and expense are justified by the collection of data that can be interpreted in time to be of value in making therapeutic decisions.

In the presence of good indications and an awareness of the hazards and pitfalls of interpretation, however, the advances in monitoring techniques will usefully supplement physical examination, laboratory and roentgenographic data and other components of the standard clinical record.

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2. Infection Control in the Surgical intensive Care Unit*

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Control of infection in the surgical intensive care unit demands unfailing attention to three distinct areas: a) The *bacteria* responsible may be endogenous or exogenous. The effects of the former can be limited by careful surgical techniques and judicious use of antibiotics, of the latter by the practice of asepsis and antisepsis, essentially of scrupulous cleanliness. b) The *environment of infection* concerns the support of natural barriers to infection (notably the integrity of the skin and the adequate drainage of the pulmonary system), and the sterility and appropriate care and use of the many invasive devices currently available. c) The patient's *natural defence mechanisms* show considerable variation, and those at increased risk can be detected by skin-testing with a number of antigens as well as by recognized clinical features. It is in these patients with anergy and abnormal natural defences that total parenteral nutrition can be of the greatest value.

Le contrôle des infections dans l'unité chirurgicale de soins intensifs exige une attention constante sur trois points précis: a) la *bactérie* responsable peut être d'origine endogène ou exogène. Dans le premier cas, les effets peuvent être circonscrits par des techniques chirurgicales soigneuses et une utilisation judicieuse des antibiotiques; dans le second cas, on recourra à la pratique de l'asepsie, de l'antisepsie et, essentiellement, d'une propreté absolue. b) L'*environnement, ou le milieu responsable de l'infection*, suppose le maintien des barrières naturelles (particulièrement, l'intégrité de la peau et un drainage adéquat du système pulmonaire) et la stérilité ainsi que la manipulation et l'usage appropriés des divers dispositifs d'utilisation courante destinés à pénétrer l'organisme. c) Les *mécanismes naturels de défense* des patients montrent des variations considérables. Ceux qui présentent un risque augmenté peuvent être identifiés par cutiréaction avec un certain nombres d'antigènes ainsi que par des caractéristiques cliniques. La nutrition parentérale totale s'avère très bénéfique chez les patients anergiques.

Infection control in a surgical intensive care unit (SICU) is an ongoing and difficult job. In this population sepsis continues to be either the major cause of death or a major contributing factor to organ failure and subsequent mortality. Control of infection is directed practically and philosophically against the three determinants that are intimately involved with the development and evolution of each septic process. These are: *bacteria*, which cause the infection; the *environment* or local area, where the infection develops; and *host defence mechanisms*, which are systemic reactions to the developing infectious process, that are to contain and ultimately resolve the infection.

The SICU patient is at particular risk in all of these areas. There is exposure to bacterial flora, which has usually demonstrated pathogenicity and increased resistance to antibiotics. These are patients in whom the environment

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of potential infection is altered by their disease or by their treatment; specifically, invasive devices, inability to clear secretions, the presence of wounds and fistulas, and previous surgery all contribute to potential infection. Lastly, host defence mechanisms can be demonstrated to be altered in the majority of these patients.[1]

Bacteria

The infecting organisms to which the SICU patient is exposed are endogenous or exogenous. Endogenous organisms are the patient's normal flora, that is, commensal flora of the skin, mouth and nasopharynx and gastrointestinal tract. These organisms are usually susceptible to antibiotics and have modest pathogenicity, and their identity may to some extent be predicted by site. The normal flora does change in hospital so that autochthonous organisms are replaced by hospital flora, making infections caused by endogenous bacteria more difficult to treat. In time, endogenous flora becomes exogenous. Exogenous flora comprises those organisms that flourish in the area where the patient is being treated. In an intensive care unit these organisms tend to have considerable pathogenicity and resistance to antibiotics.

Control of endogenous and exogenous bacteria is different. The removal of endogenous flora is clearly impossible. There have been attempts, particularly in burn centres and centres administering the chemotherapy of advanced neoplasia with associated complications of bone marrow aplasia, to use life islands and intensive antibiotic treatment to alter or obliterate the patient's normal flora and isolate the patient from contact with the outside world. These attempts have been successful on occasion but are, however, extraordinarily expensive and not justified in the SICU. The exposure of the patient to his or her own endogenous flora is usually greatest at the time of surgery, and control of infection relates particularly to surgical technique, to the judicious use of preoperative antibiotics, and to subsequent careful wound and dressing management with optimal technique. Critical selection of antibiotics in the SICU, that is, prescription only for demonstrable infection, as distinct from colonization, can prevent overgrowth of normal flora with resistant bacteria and fungi.

Control of exogenous bacteria presents different issues. The development of resistant flora in any area, but particularly in an ICU, is frequently the product of antibiotic pressures, and therefore judicious use of antibiotics is critical. The second feature, perhaps the most important and certainly the simplest factor in the control of infection in an ICU area, is a zeal for cleanliness and good technique on the part of personnel in their approach to the patient. The approach to control of exogenous bacteria is in many ways similar to control of the environment of infection and reflects attitudes and techniques that date back to Semmelweiss, Lister and Halsted and were designed to keep bacteria from the locale of potential infection: lungs, wounds, venepuncture sites, etc. Asepsis and antisepsis are the keystone of control.

Environment of Infection (Local Factors)

The environment relates to the area of the patient that is to become infected, or that is indeed infected. Features of control are maximization of the local factors to prevent lodgement of bacteria in a potentially infected focus. In the SICU the support of these natural barriers is largely attitudinal and technical. Specifically there are mechanical, chemical and bacteriologic barriers to colonization, lodgement and subsequent development of bacteria.[2]

Maintenance of the integrity of the skin is perhaps a simple example but nevertheless makes the point. The skin is an obvious mechanical barrier to the invasion of bacteria and in addition its fatty acids have major chemical bactericidal properties. With normal cutaneous integrity, bacteria that are potentially invasive are in these settings kept on the outside. The problems in infection control in thermal injuries bear this out. More pertinent is the development of a decubitus ulcer (a problem for which SICU patients are at risk), presenting an environment for the growth of bacteria that is most appealing and therefore representing a very real risk of systemic sepsis to the patient. Prevention is the key to control. The pulmonary system, another area in which infection is common in the surgical intensive care patient, requires constant attention. In unconscious patients control of bronchopulmonary secretions is difficult and nasotracheal or oral-tracheal suction and promotion of drainage are critical. In those patients who are able to cough, the clearing of their own secretions is equally important and the patients must continually be urged to do so.

While these two examples may appear somewhat simple they make the point that constant vigilance and attention to the minutiae of care are critical in order that infection may be prevented and thereby controlled. In both, it is the control of the environment of potential infection that reduces infection.

Invasive devices, some of which are listed in Table I, present the other large area of environmental control. Intravenous catheters both central and peripheral, bladder catheters, endotracheal tubes and arterial lines have all been a major source of local infection as well as systemic sepsis in this patient population. In addition, the equipment associated with these devices, such as transducers, respirators and nebulizers, is a documented source of potential infection. Care must be taken to ensure that these items do not become contaminated and a source of sepsis. The control of infection from these devices is largely a function of attention to detail and the belief on the part of personnel responsible for their use that these devices upon which we have come to depend so greatly for their monitoring and therapeutic benefits must also be controlled to cause a minimal amount of harm. It is my belief that we have too many invasive lines, which not only detract from our willingness to examine the patient but which also remain in place overlong and are prone to infection. The technology for the management of intravascular, intravesical and endotracheal intubation is well known. The problem in reality is the difficulty of maintaining constant vigilance. It is never adequate to have solved the problem once. These devices remain an issue that is a constant thorn in the side of managing physicians in intensive care and if they are not attended to in a meticulous manner, major infectious complications inevitably follow.

The most obvious example is the sepsis that is associated with hyperalimentation or total parenteral nutrition and central lines. Depending on the studies reported it is clear that the infection rate can range from 5% to 33%. The major difference in the incidence of sepsis in these patient populations and the type of organisms that

Table I—Invasive Devices

Vascular	Peripheral venous catheter
	Central venous catheter
	monitoring
	nutrition
	Arterial lines
	Swan-Ganz catheter
Respiratory	Endotracheal tube
	nasal
	oral
	Chest tube
Urinary	Bladder catheter
	urethral
	suprapubic
	Nephrostomy

are responsible stems from the attitude of the personnel looking after these lines and the technical attention paid to their management. In control of both the bacteria and the patient's environment or local areas of infection, attitudes, techniques and attention to detail are more important than any other factors.[3]

Host Defence Mechanisms (Systemic Factors)

Surgeons have long believed that in spite of good surgical technique and excellent pre- and postoperative care, some patients have major septic complications that can only be ascribed to some intrinsic host defect. The demonstration of such defects in general surgical patients has been very difficult. However, in the case of burn injury, consistently the most severe form of trauma, it has been shown that major abnormalities of neutrophil function, cell-mediated immunity, and complement and humoral responses develop, and that these abnormalities are associated with septic episodes.[4,5] Other forms of trauma have been shown periodically to be accompanied by defects in some aspects of host defence, but none that could be related to clinical course or outcome. In other branches of surgery, investigations have been less informative. Identification of the patient at risk for sepsis because of abnormal host defence mechanisms has been an elusive goal.

There are now data to show that the results of a procedure as simple as skin testing with five antigens — mumps, varidase, candida, purified protein derivative and trichophyton — can identify those patients at increased risk for sepsis and mortality.[1,6,7] In 320 patients skin-tested prior to surgery, 42 had abnormal responses with 21.4% demonstrating sepsis and a 33.3% postoperative mortality rate compared with 4.6% and 4.3%, respectively, in those who reacted normally. In the context of the intensive care unit, 115 have been studied and results are shown in Table II. There was no difference between those who were anergic and those who were relatively anergic. As expected, in the SICU there was an increased number of patients with altered skin tests. The sepsis rate in all groups was increased, consistent with the severity of the disease processes for which patients were admitted to the SICU, but it was significantly greater in those with altered responses. It is of interest that the mortality rates in ICU patients with altered or normal responses were identical to those in patients with similar responses studied preoperatively.

Skin-test responses are related to the process of delayed hypersensitivity and as such are thought to be a reflection of cell-mediated immunity, that branch of the immune response associated with reaction to tumours, organ transplants and infections from a variety of viruses, fungi and other intracellular parasites such as *Salmonella, Listeria monocytogenes* and *Mycobacterium tuberculosis*. None of these organisms are common pathogens in the SICU. In a study we conducted of this subject, all the infections were caused by common gram-positive cocci or gram-negative rods.[7] This indicates that if there were defects in host defence, they were not cell-mediated. Extensive in vitro studies of lymphocytes in mixed leukocyte culture from anergic patients, cell-mediated lympholysis, ability to generate blastogenic factor and response to various mitogens were all normal. There were some lymphocyte abnormalities; rosetting of lymphocytes with sheep erythrocytes was abnormal and was associated with a serum factor that inhibited rosetting of normal lymphocytes, indicating a change in cell surface characteristics. The rosetting abnormality and normal lymphocyte function were not associated with the demonstrated increase in sepsis in the anergic patients.

Neutrophil function was also assessed. We found that neutrophil phagocytic and bactericidal function was often abnormal[6] but did not correlate with sepsis in the SICU patient as has been shown for the burn injury.[4] Neutrophil chemotaxis was examined and found to be abnormal in patients with altered skin-test responses. This abnormality was no longer evident when cutaneous responses were restored, an indication that host defences could improve. Similarly anergic serum contained a factor that inhibited chemotaxis in normal neutrophils as well as in anergic neutrophils. This factor disappeared if the anergic state returned to normal cutaneous reactivity.

This improvement correlates clinically with skin testing as a measure of host defence (Table III). The mortality rate in those patients whose skin-test responses improved was much lower than in those whose responses and presumably host defence remained abnormal.

Skin testing identifies those patients who are at increased risk for sepsis and mortality, whether they are studied preoperatively or seen in the SICU. We have identified a number of clinical features commonly associated with anergy. These are age over 80 years, major trauma, sepsis, shock related to hemorrhage and malnutrition. Surgical principles, well founded in practice, address themselves to resolution of trauma, drainage of infected sites and restoration of blood volume. None of these measures can be considered as immunotherapy, nevertheless they appear to be so. Shizgal and his group, using body composition studies, have clearly demonstrated that in anergic patients there is an erosion of body cell mass and that restoration of the body cell mass is associated with return to normal of cutaneous responses.[8]

However, in many patients total parenteral nutrition given over periods of between 2 and 3 weeks does not correct the contraction of body cell mass or the abnormal ratio of total exchangeable sodium to total exchangeable potassium. In these particular cases skin reactivity also remains abnormal and the prognosis is poor. Correction of protein–calorie malnutrition by total parenteral nutrition is likely to fail if this treatment is delayed until after a septic complication has developed. Anergy is often a reversible state, but the aggressive *early* use of total parenteral nutrition is essential in the treatment of these patients.

Table II—Outcome in 115 Patients in an Intensive Care Unit after Operation or Trauma, According to Response to Skin Testing

Response to skin testing	Outcome, %*	
	Sepsis	Death
Anergy or relative anergy, n = 96	61.5	31.3
Normal, n = 19	26.3	5.3

*Differences in outcome according to response to skin testing are significant at $P < 0.001$.

Table III—Outcome in 178 Patients According to Results of Serial Skin Testing

Result of skin testing	Outcome, %	
	Sepsis	Death
Normal, n = 76	6.6	0
Improved, n = 59	42.4	5.1
Failure to improve, n = 43	65.0	74.4

In practical terms the presence of anergy alerts the surgeon to the acquired defects in host defence in a patient who requires alert anticipatory care, possibly drainage of an infection and certainly total parenteral nutrition. The restoration of cutaneous responses allows some relaxation of vigilance as the patient is then usually on his way to recovery.

Conclusion

Control of infection is a reasonable goal in the SICU and should be directed at the three determinants of infection: bacteria, environment and host defence. The first two are approached through attitudes and techniques of asepsis and antisepsis. Host defence may be bolstered by resolution of those factors that are responsible for its diminution, particularly by the early use of total parenteral or enteric nutrition.

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3. Upper Gastrointestinal Bleeding in the Intensive Care Unit*

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Bleeding from hemorrhagic erosions in the stomach or duodenum of seriously ill patients is associated with a high mortality. While the pathogenesis of such lesions is by no means certain, it is known that they are universal after shock, sepsis or severe burns. Fiberoptic endoscopy has become the most valuable means of diagnosis. This should be preceded by gastric irrigation, which usually suffices to control bleeding caused by acetylsalicylic acid or alcohol, or both. Neutralization of gastric acidity is essential. The histamine H_2-receptor antagonist, cimetidine, was used in 27 patients with erosive gastritis, and bleeding ceased in 24. There is a prospect that such agents will obviate the necessity of total gastrectomy in the occasional resistant cases in favour of conservative surgery.

Chez les patients gravement malades, le saignement provoqué par l'érosion hémorragique de l'estomac et du duodénum est associé à un taux de mortalité élevé. Bien que la pathogénie de ces lésions demeure inconnue, on les retrouve de façon constante après un choc, une septicémie ou des brûlures graves. La fibroscopie est devenue une méthode diagnostique des plus précieuses. Elle devrait être précédée d'une irrigation gastrique qui suffit habituellement à contrôler le saignement causé par l'acide acétylsalicylique ou l'alcool. La neutralisation de l'acidité gastrique est essentielle. La cimétidine, un antagoniste des récepteurs histaminiques H_2, a été utilisée chez 27 patients souffrant de gastrite érosive et le saignement a cessé chez 24. On peut entrevoir que de tels agents thérapeutiques puissent obvier à la nécessité d'une gastrectomie totale dans les cas résistants occasionnels, laissant la place à une chirurgie conservatrice.

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It is unfortunate but true that in those seriously ill patients who can withstand them least, hemorrhagic erosions are most likely to develop in the stomach or duodenum. It is therefore not surprising that the mortality rate from this condition is distressingly high, from 20% to 60% in reported series.[1-6] At the Victoria General Hospital, Halifax, in only 15% of cases of hemorrhagic gastritis induced by alcohol or acetylsalicylic acid in otherwise fit individuals does the bleeding fail to stop spontaneously and in those few requiring operation the mortality rate is less than 3%. But in patients who require admission into an intensive care unit (ICU), bleeding erosions are often the final straw that determines a fatal outcome.

Pathogenesis

There has not been a single report of bleeding erosions of the stomach or

duodenum in an achlorhydric patient. Therefore it appears that acid is essential for the production of such ulcers. In experimental animals acid is required, indeed the erosions are difficult to produce if the gastric luminal pH is much above 3. On the other hand, it is also true that there is no increase in acid production in response to serious illness; in fact, it often falls.[7,8] Although disputed,[9] many believe that an increase in back diffusion of acid across the gastric mucosa produces the observed mucosal damage. This implies a breakdown in mucosal resistance to acid and an alteration in mucosal permeability. Agents such as acetylsalicylic acid,[10] bile acids[7] and alcohol[11] have been shown to have this effect. The mechanism by which this occurs in seriously ill patients is not understood. Hypovolemic shock is accompanied by gastrointestinal ischemia and it is not difficult to visualize how this might cause focal ischemic necrosis of the mucosa.[12] However, in our experience most patients in whom these erosions develop in the intensive care unit have not experienced hypotensive shock. In fact, in some groups (e.g., patients in renal failure) hypervolemia is often present. The majority of patients who bleed have sepsis, frequently caused by gram-negative organisms, but often they are not in shock. Clinical observations of alterations in gastric blood flow are not very convincing. Yet it has been demonstrated that the appearance of mucosal ulcerations is almost universal after shock, sepsis, or severe burns[13,14] and the incidence is probably much higher than suspected in other stressful conditions. While the ulcerations may occur universally, bleeding does not. This is probably due to the tremendous regenerative capacity of the gastrointestinal mucosa. Mucosal ulcerations often disappear within 24 hours or less despite massive involvement of gastric fundus and duodenum initially. It is our belief that what distinguishes the bleeders from the nonbleeders or transient bleeders is continuation of the stressful situation that led to the erosions.

It is tempting to think that all the common situations that lead to stress ulcers have a common pathogenesis. Yet there are factors that are obviously more important in one disease than in another. The common clinical conditions we have found to precede erosive gastritis in our ICU are shock, sepsis, organ failure (kidney, liver and lung), drug ingestion (acetylsalicylic acid, alcohol and corticosteroids) and elevated intracranial pressure. In the majority of patients more than one factor has been implicated. The mechanism by which sepsis, in the absence of overt shock, causes erosions in stomach and duodenum is still a matter of speculation. In some patients alterations in liver function are apparent, whereas in others the lung is affected and hypoxia is present. Usually there is a high cardiac output. In some patients prolonged clotting times or depressed platelet counts are present. In uremic individuals there is often interference with normal coagulation as well, as an effect of uremia on the mucosal barrier. The incidence of bleeding is exceptionally high in patients in whom uremia develops as a complication of some other surgical problem and in our hands the mortality in those who bleed has been 50%.[15] In liver failure bleeding is also frequent, probably because of the associated coagulation defects and the accompanying hyperacidity; an incidence higher than 50% has been reported and the mortality is forbidding.[6] The role of acetylsalicylic acid or alcohol, or both, in precipitating erosions is well recognized. In our experience, in almost all these patients the bleeding will stop with very little treatment, unless it has precipitated other problems such as liver failure, heart failure etc. The effect of steroids is much less clear cut and the previously accepted connection has been challenged.[16] The doses of corticosteroids now used in the treatment of shock, adult respiratory distress syndrome and renal transplant rejection are much higher than those used for chronic conditions. However, the very conditions for which the steroids are given are those in which bleeding gastric erosions are common. The role of steroids is therefore unproven.

Raised intracranial pressure is associated with increased vagal tone and hyperacidity. Frequently in such patients deep penetrating ulcers develop rather than superficial erosions, although the latter do occur.

There are a variety of other conditions seen frequently in the intensive care unit that are associated with bleeding erosions. Pancreatic disorders, particularly postoperative resections, are not rare causes of massive bleeding from acute erosive gastritis. Here the concomitants of liver pathology, hypovolemia and sepsis are presumed to be responsible. Not infrequently patients are seen with rebleeding from erosive gastritis after operations for control of bleeding duodenal or gastric ulcer, or even for erosions themselves.

Diagnosis

The hallmark of erosive gastritis is bleeding, and the mainstay of diagnosis is fiberoptic endoscopy. Barium contrast roentgenographic examination is not helpful because, although it may show varices or an ulcer, neither one may cause the bleeding. The superficial erosions are not deep enough to be seen by roentgenography and the barium may interfere with subsequent endoscopy or angiography. Endoscopy should be done first and the roentgenographic examination reserved for those patients who stabilize or those who are being considered for surgery.

Prior to endoscopy, gastric irrigation is required, first to confirm that the origin of the bleeding is indeed proximal to the ligament of Treitz, second to indicate the rate of blood loss, and third, therapeutically to reduce or stop the bleeding by the use of iced glucose or saline solution. This procedure may be sufficient to stop the bleeding, or at least to slow it to the point where endoscopy is feasible. Even if the bleeding is torrential, endoscopy should be performed at least to rule out esophageal varices as the source.

At endoscopy, early in the course of illness, one finds numerous punctate areas of hemorrhage, typically most intense along the lesser curvature and over the posterior wall of the fundus. The antrum is often spared. The duodenum may show only erythema although often it too has multiple small bleeding areas. Occasionally only the duodenum is involved. As the duration of the illness lengthens, the erosions tend to enlarge and coalesce, often forming a long serpiginous shallow ulcer several centimetres long, which can be mistaken for a Mallory-Weiss tear. If the process is allowed to continue, the ulcers begin to deepen, but reactive granulations are still absent. This sequence is most likely in those patients who have irreversible organ failure with an inevitably fatal outcome. In patients in whom the primary stress that has produced disease is relieved, for example, by surgical drainage of an intra-abdominal abscess, the erosions can disappear incredibly rapidly.

Treatment

Acute hemorrhagic erosive gastritis as a single disease entity, usually precipitated by acetylsalicylic acid or alcohol, or both, almost always resolves with simple lavage of the stomach with ice water followed by oral antacids. The same condition occurring in an otherwise severely ill patient is another matter. Results have improved with the demonstration by Skillman and Silen[17,18] and others[19,20] of the beneficial effect of neutralizing gastric acidity by the use of antacids. A whole variety of other techniques have been tried with occasional success, including intragastric instillation of viper venom or epinephrine, or both,[21] endoscopic electrocoagulation,[22] laser-induced coagulation,[23] selective embolization of the gastric arteries,[24] and percutaneous

transarterial celiac artery catheterization and infusion of vasopressin.[25] In our hands the mainstays of therapy have been ice water lavage, neutralization of gastric acidity and infusion of vasopressin by way of the celiac artery. Where we have differed from others is in our use of histamine H_2-receptor antagonists instead of, or in addition to, intragastric instillation of antacids.[26] These new agents are potent inhibitors of gastric acid secretion,[27,28] and have the advantage of inhibiting histamine release from mast cells[29] and its damaging effect on gastric mucosa. In our first series of patients we used metiamide to treat 17 episodes of bleeding from erosive gastritis in severely ill patients. Because of occasional agranulocytosis metiamide was withdrawn, but cimetidine, an equally effective agent, is now available. We have used it in 27 patients with erosive gastritis (Table I); bleeding ceased in 24. These were uncontrolled trials and we do not know if the results represent any improvement over what could have been achieved by standard therapy alone. However, in the majority of instances we were asked to see the patients after conventional treatment had failed, when blood loss had been substantial and when continued bleeding was an immediate fatal threat in patients who were believed to have relative or absolute contraindications to surgery. Of the four in whom bleeding recurred, all were operated on and three died in the immediate postoperative period.

Similar good results have been reported with antacids only.[20] The only advantage of the H_2 blockers, in our opinion, is the ease and completeness with which they prevent hydrogen-ion release and thus elevate the pH to neutrality. That this will not be sufficient for all patients is illustrated by the report from Dudley, Fielding and Glazer[30] of four consecutive failures with cimetidine used to manage upper gastrointestinal bleeding; one of the cases was certainly, and one probably, due to stress erosions.

In all four failures in our practice endoscopic examination had confirmed the presence of diffuse punctate erosions in the gastric fundus. As the condition progressed some of these coalesced into larger erosions. When cimetidine was started the small erosions promptly disappeared, leaving one to three erosions that continued to bleed. To one of these patients cimetidine was given prophylactically following a Whipple pancreatectomy, yet the erosions caused bleeding that ultimately required total gastrectomy. It is not clear whether the erosions developed prior to the patient's Whipple operation, or while he was on cimetidine. In this patient, as in many others, we have been struck by the marked bile reflux that is apparent at endoscopy.

We have been most impressed by the results of controlled trials of histamine H_2-receptor antagonists for the prevention of upper gastrointestinal bleeding in patients in hepatic coma, as reported by MacDougall, Bailey and Williams.[31,32] Only 1 of 26 patients receiving H_2 blockers bled, while 54% of their controls did so. The drug appears to be almost completely free of side effects during short-term usage and it is our prediction that its routine prophylactic use in intensive care patients who are at risk will greatly reduce the problem of erosive gastritis.

There will, however, always be some patients who fail to stop bleeding despite all conservative measures and who will require operation. The selection of the procedure to be adopted is a vexing question. One is equally reluctant to remove the stomach in a patient who does not have a long-standing ulcer diathesis, or to do a lesser procedure and leave bleeding mucosa behind. A recent review of the literature by Moody and Cheung[33] shows that only total gastrectomy, as advocated by Menguy, Gadacz and Zajtchuk[34] is not associated with substantial rebleeding. The rebleeding rate for subtotal gastrectomy is 51%. Using vagotomy and drainage with suture ligation Menguy and colleagues had only a 9.5% rebleeding rate, although 24% of their patients died.

Based on our experiences with metiamide and cimetidine, we would advocate conservative surgery. In those who continue to bleed despite the administration of H_2 blockers, discrete ulcers are present which can be handled by suture ligation or excision, followed by vagotomy and drainage and continuous cimetidine therapy until the stressful situation has passed. Only time will tell if this is the correct recommendation.

Table I—Results of Treatment of Hemorrhagic Erosive Gastritis with Cimetidine

Diagnosis	No. of patients		
	Total	Stopped bleeding	Rebled
After gastric surgery	5	5	
After pancreatic surgery	4	3	1
Cirrhosis	1	1	1 (varices)
Renal failure	1	1	1
Cardiopulmonary failure	2	2	
Erosive gastritis only	12	10	1
Other	2	2	
Total	27	24	4

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4. Respiratory Failure*

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Patients requiring respiratory support may have normal lungs but inadequate ventilation, or they may suffer from defective pulmonary gas exchange despite adequate ventilation. In the first group some form of mechanical ventilatory support is called for, either pressure-cycled or volume-cycled, used first with an endotracheal tube and only later with a tracheostomy. Weaning the patient from the apparatus requires special care.

In cases of pulmonary insufficiency the use of positive end-expiratory pressure has been a major advance. Hemoglobin concentration, cardiac output and renal function must receive attention. Open lung biopsy is of the greatest value when the diagnosis is open to question. Resort to a membrane oxygenator to provide extracorporeal oxygenation of blood can sustain for a time the patient in whom hypoxia is critical in degree.

Les patients nécessitant une respiration assistée peuvent avoir des poumons normaux mais une ventilation inadéquate, ou ils peuvent souffrir d'une anomalie de l'échange gazeux pulmonaire en dépit d'une ventilation adéquate. Dans le premier groupe, on doit recourir à une forme quelconque d'assistance ventilatoire mécanique, à cycle de pression ou à cycle de volume, par intubation endotrachéale au début et, par la suite seulement, à l'aide d'une trachéotomie. Il faut des soins spéciaux pour débrancher le patient de l'appareil.

Dans les cas d'insuffisance pulmonaire, l'utilisation d'une pression positive en fin d'expiration a constitué une amélioration majeure. On doit porter attention à l'hémoglobinémie, au débit cardiaque et à la fonction rénale. Quand le diagnostic est incertain, la biopsie à poumon ouvert est de première importance. L'emploi d'un oxygénateur à membrane pour assurer une oxygénation extracorporelle du sang peut maintenir, pour un certain temps, le patient dont le degré d'hypoxie est devenu critique.

While acute respiratory failure may be variously defined, it can be considered the inability to maintain spontaneously normal arterial oxygen and carbon dioxide concentrations by an individual breathing room air and who has not previously had lung impairment.

Patients requiring respiratory support fall roughly into two categories: those with fairly normal lungs but with inadequate ventilation, and those in whom pulmonary gas exchange is defective even with adequate ventilation. The management of these two problems is quite different. Patients suffering from sedative overdose or from neurologic

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disease by and large require primarily mechanical ventilatory support and do not have gas-exchange difficulties. These patients fall into the first category. Patients with cardiac and renal failure, and those with primary pulmonary abnormalities that bring about defective pulmonary gas exchange belong to the second category. Patients with chest injuries and some postoperative patients may have features in common with both groups.

Respiratory units were first developed for the management of patients primarily requiring mechanical ventilatory support. The Copenhagen experience with poliomyelitis, in 1952, provided the opportunity for first widespread use of positive-pressure ventilation, and demonstrated its advantages over negative-pressure ventilation with an iron lung or a cuirass. Poliomyelitis patients and patients with other neuromuscular disorders such as myotonia, myasthenia, muscle wasting diseases and injuries to the central nervous system provided the stimulus for the development of specialized respiratory units.

Tracheostomy

Over the years important lessons have been learned regarding the logistics and mechanics of delivering safe positive-pressure ventilation. In the early days of such care, emergency tracheostomies were common and so were their related problems. These included local hemorrhage, displacement or obstruction of the tube, incorrect placement of the tracheostomy stoma and difficulties with the management of secretions. Today there is almost no place for emergency tracheostomy other than for acute upper airway obstruction. Respiratory support is begun with an endotracheal tube and tracheostomy is subsequently done on an elective basis, usually 4 to 7 days later.

Elective tracheostomy has not solved all problems relating to the use of cuffed tracheostomy tubes. We recently had experience with three tracheo-innominate fistulas, which were successfully managed by partial sternotomy and resection of the innominate artery. Control of the hemorrhage was by hyperinflation of the balloon cuff and forward leverage on the tracheostomy tube, or, failing this, by endotracheal intubation, removal of the tracheostomy tube and digital compression through the tracheostomy site, by pressing the innominate artery forward against the back of the sternum. In two of these cases the tracheostomy had obviously been placed much too low, causing the elbow of the tube to rest against the back of the innominate artery. In one case the tracheostomy was situated as low as the 7th tracheal ring. While it may be comforting to know that this complication can be successfully managed, it is far better to avoid the complication by placing the tracheostomy at the 2nd or 3rd tracheal ring. Even so, a high-riding innominate artery can still occasionally be eroded by the elbow of the tube.

We now know that old fashioned, high pressure endotracheal and tracheostomy cuffs can cause considerable tracheal damage in a short period of time, due to pressure necrosis at the cuff site. This causes necrosis and eventual dissolution of cartilaginous rings. Healing may be by scar formation with resultant tracheal stenosis. Pressure necrosis by the cuff can also lead to erosion through the posterior wall of the trachea into the esophagus, or through the anterior wall into the innominate artery. With the advent of tracheostomy tubes and endotracheal tubes fitted with high volume, compliant, low pressure cuffs, the problems of the cuff stenosis and cuff fistula have been virtually eliminated in those hospitals where such cuffs are routinely used.

Ventilators

Ventilators are available in various sizes, shapes and complexities. Their source of power may be electricity or compressed gas. A cycling mechanism determines the magnitude of the breath, a system is provided for determining the rate of inspiration and the inspired gas is properly humidified. Based upon the cycling system, ventilators can be roughly divided into two groups — the pressure-cycled ventilators such as the Bird, and the volume-cycled ventilators such as the Bennett, Ohio, or Emerson.

The Bird ventilator delivers gas at a preset flow rate until a predetermined peak airway pressure is reached, at which point the ventilator shuts off. Since the airway pressure depends on many factors including the patient's cooperation, chest wall and pulmonary compliance, the pressure-cycled ventilators do not deliver a given volume. The tidal volume must be measured periodically to ensure that the patient is receiving the desired ventilation. Also, the concentration of inspired oxygen is not accurately controlled by the Bird ventilator. A mixture of compressed air and oxygen may be required to give the desired concentration of inspired oxygen, and the oxygen concentration must be frequently checked with an oxygen analyzer.

Volume-cycled ventilators deliver a preset volume and an accurate concentration of inspired oxygen. With the use of such ventilators these parameters do not have to be monitored as frequently.

Whatever the type of ventilator, it must be monitored, including the volume and peak of the gas mixture delivered, the inspired oxygen concentration, and the effects on the patient's cardiovascular system and on arterial blood gases. One of the most important ventilator safeguards is an alarm system that sounds in case of a disconnection or mechanical failure. This may seem obvious today, but many of us who have been associated with respiratory care for a period of time can remember patients who have been lost in the past because ventilator disconnections were not discovered in time, in the absence of an alarm system.

Weaning

Just as there are problems associated with the use of a ventilator, there are others posed by weaning a patient from the ventilator. In this regard, the use of intermittent mandatory ventilation (IMV) has been an important recent advance. Traditionally the patient was weaned from the ventilator by intermittently removing him completely from a ventilator for progressively longer periods. With an IMV circuit the patient can breathe spontaneously at any rate he wishes and in addition he receives a fixed number of mechanical breaths from the ventilator. The gas inspired in the spontaneous breaths has the same oxygen concentration as the gas provided by the ventilator breaths. Over a period of hours or days the number of assisted breaths is gradually reduced, for example from 15/min, to 14/min, to 13/min, and so on, so that the patient is always receiving some assistance and increasingly does more of the work himself. This type of weaning is much smoother and easier for the patient and is useful in some of the more difficult problems. Early use of such a circuit, even before the patient is ready to be weaned, may be of value in preserving the strength and coordination of the patient's respiratory muscles.

An understanding and familiarity with the mechanics of ventilatory techniques help the surgeon to use rationally a form of ventilatory support for his patients. Certainly some patients undergoing major surgery appear to do much better when routinely ventilated overnight. Thereby some of the complications of marginal ventilation in the early postoperative period are avoided. As well, the patient may be provided with needed rest for the first night following operation. The surgeon familiar with ventilator support will consider its postoperative use, when indicated, as an important part of his therapy and not as an undesirable, and all too obvious, result of the operation.

Another example of ventilatory support as an adjunct to surgery is the case of the patient with an acute generalized empyema such as might result from a ruptured esophagus. Following thoracotomy to close the perforation and to drain the chest, the routine use of ventilatory support and positive end-expiratory pressure for several days will maintain a high lung volume, quickly obliterate the pleural space and avoid subsequent development of loculated pleural infection.

Ventilatory Support for Pulmonary Insufficiency

The second group of patients requiring respiratory support, those with basic pulmonary dysfunction, are far more difficult to manage. In patients with pneumonia, chronic lung disease, aspiration pneumonia, pulmonary edema or one of a host of inflammatory conditions of the lung, mechanical ventilatory support may not be enough and one must try to improve the impaired pulmonary gas exchange. It is now known that the *pattern* of ventilation in such patients may be as important as the *amount* of ventilation in improving gas exchange. These patients almost always require a volume ventilator. A ventilator that operates on a sine wave, such as the Engstrom, may give better gas exchange than one operating on square wave cycle. An inspiratory hold or plateau in the cycle may also improve gas exchange.

The use of positive end-expiratory pressure (PEEP) has been a major advance. Its use can be traced back at least to 1943 when Barach used such a system for spontaneous ventilation. With the use of end-expiratory pressure the lungs are maintained at a higher volume than otherwise, and in certain conditions this markedly improves oxygenation. Usually a pressure of 5 to 15 cm H_2O achieves maximum effect. In some patients, however, even higher levels, or "super PEEP" may produce further improvement. In one case, a patient receiving 100% oxygen had a partial pressure of oxygen (P_{O_2}) of 50 mm Hg when the PEEP was 15 cm H_2O. The P_{O_2} rose immediately to 150 mm Hg when the PEEP was increased to 25 cm H_2O. When the PEEP was raised to 30 cm H_2O no further rise in P_{O_2} was achieved and the cardiac output began to fall, so the PEEP was reduced to 25 cm H_2O, which was well tolerated.

When faced with severe hypoxia and acute respiratory failure, one manipulates the entire patient to improve the oxygen delivery to tissues. Careful monitoring is important during this period of active intervention. Pulmonary gas exchange is rendered optimal with the use of PEEP and an appropiate ventilatory pattern. The use of bronchodilators and sedation or bringing about paralysis of the patient, when required, may improve ventilation.

Oxygen delivery to the tissues is a product of the cardiac output and the oxygen content of the blood. Hence maintaining an adequate hemoglobin concentration and a satisfactory cardiac output is important. Digitalis, albumin, inotropic agents and calcium may be required to maintain adequate cardiac output in the case of hypoxia. Oxygen consumption can be reduced by cooling the patient to as low as 32°C and by sedating or paralysing the patient to reduce or eliminate muscle activity.

Increased pulmonary extravascular water is inevitably present in almost all patients with acute respiratory failure, regardless of its cause. Maximum dehydration by diuretics and correction of left ventricular failure, when present, are of the greatest importance. The use of peritoneal or hemodialysis should be considered if renal function is impaired, since reduction of excess body water is essential.

Emergency Open Lung Biopsy

In cases of acute respiratory failure if the cause is at all in doubt, a specific tissue diagnosis is required. Under these circumstances emergency open lung biopsy is most helpful. When we recently reviewed 28 cases in which emergency open lung biopsy had been performed we found that a correct diagnosis had been made possible in 27 (96%) cases. The clinical diagnosis prior to biopsy was confirmed in 12 cases but was in error or incomplete in 15 cases.

The procedure is usually done in the operating room but can be done at the bedside. Since a specific diagnosis in such cases is so important we consider there to be very few contraindications to emergency open lung biopsy. It can be done when the patient is on a ventilator and even when very high volumes of PEEP are being used. Thrombocytopenia is not a contraindication, as a platelet transfusion at the time of biopsy has, in our experience, prevented problems of bleeding.

One dramatic example of the importance of open lung biopsy was the case of a young woman presenting with rapidly developing pulmonary infiltrates and fulminant respiratory failure, several days after a normal delivery. The clinical diagnosis was amniotic fluid embolism. Emergency open lung biopsy revealed fulminant tuberculous pneumonitis. Treatment with antituberculous drugs in combination with steroids led to prompt resolution and complete recovery.

Controversies in Respiratory Care

Many controversies remain regarding the management of acute respiratory failure. For example, how long should an endotracheal tube be left before changing over to tracheostomy? The correct answer is probably 5 to 7 days, but there are great differences of opinion. There is a question as to the significance of pulmonary oxygen toxicity in humans. If it does exist as a primary entity, what is the safe concentration for inspired oxygen? I personally doubt whether oxygen toxicity is an important clinical problem if blood gases are monitored, and if one does not allow arterial oxygen concentrations to become excessive. Basically, hypoxia is bad, oxygen is good — but one should not use more oxygen than necessary. If there is an alternative to the use of high oxygen concentrations, such as the use of PEEP to improve oxygenation, this should be the first resort. However, one should not hesitate to use even 100% oxygen for days if required to prevent critical hypoxia. A number of patients so treated at high ventilatory pressures continuously for 4 and 5 days have made a complete recovery.

The debate as to whether colloid or crystalloid should be used for volume replacement is a continuing one, as is the use of massive doses of steroids for specific and nonspecific inflammatory conditions of the lung.

Use of Membrane Oxygenator

If all else fails, one can buy additional time with the use of a membrane oxygenator, a device for extracorporeal oxygenation of the blood. This device exchanges gas across a thin silicone rubber membrane separating the blood and gas phases. This avoids direct blood–gas contact and prevents most of the harmful effects on red cells, proteins and platelets, which occur after several hours on a bubble oxygenator. The membrane oxygenator can be used for days or even weeks. The longest documented successful perfusion was for 10 days and ended with the patient's complete recovery.

The membrane oxygenator can be used for acute respiratory failure when a patient with critical hypoxia has a disease process presumed reversible; by this means the physician can sustain the patient for a few extra days while waiting for recovery to occur. The perfusion catheters are inserted up the femoral vein and artery into the inferior vena cava and aortic arch, respectively. A ventilator is still required for part of the gas exchange requirements. We have used a membrane oxygenator on six

patients. One of the patients was removed successfully from it after 3 days of perfusion, but died several weeks later of bone marrow insufficiency due to underlying leukemia. Our one long-term success was a 19-year-old girl with a 3-week history of progressive dyspnea and cyanosis, and multiple small pulmonary emboli confirmed by lung scanning and pulmonary angiography. Increasing pulmonary edema and respiratory failure developed and the patient went into shock with a high pulmonary artery pressure, a low cardiac output and anuria. Pulmonary embolectomy was not believed to be indicated because no central major clots were identifiable on the pulmonary angiogram and the patient's history suggested that the small peripheral emboli were up to 3 weeks old. As a last desperate effort she was connected to a membrane oxygenator with a bypass flow of 3.5 L/min. This promptly reversed the shock, the anuria, the hypoxia and the pulmonary edema. After 35 hours of perfusion, however, the patient was still totally dependent on the oxygenator and continued to have elevated pulmonary artery pressures and a low cardiac output. Selective pulmonary angiography through a Swan-Ganz catheter revealed a clot obstructing the major branch to the right lower lobe. Peripheral embolectomy of this and several other smaller vessels was performed through a median sternotomy. There was no immediate improvement and she required another 35 hours of membrane oxygenator support before she could manage without it. She had an uneventful recovery thereafter.

5. Panel Discussion on Intensive Care*

Chairman: JOHN H. DUFF, MD, FRCS[C]†
Panelists: D.B. ALLARDYCE, J.D. COOPER, A.S. MACDONALD AND J.L. MEAKINS

Dr. Duff: A number of questions have been supplied by the audience and I will assign these to the member of the panel for whom they seem appropriate. How do you administer the H_2 blockers metiamide and cimetidine? Dr. MacDonald.

Dr. MacDonald: We routinely use intravenous cimetidine. Metiamide is no longer available, and at first we used to give 300 mg *q6h*. Now we tend to give it by continuous infusion at the rate of 300 mg over 6 hours. The objective is to eliminate production of acid and one can determine one's success by measuring intragastric pH. With cimetidine one can almost invariably bring the pH to 7.

Dr. Duff: Do you employ the exchangeable sodium to exchangeable potassium ratio to indicate anergy or do you routinely do the skin tests to confirm your diagnosis of anergy and its correction by parenteral nutrition? Dr. Meakins.

Dr. Meakins: We just use serial skin testing. Body composition studies do not rapidly supply the data necessary and so we use them in clinical practice only occasionally. As a general rule skin testing for anergy is done serially once a week on all patients in the intensive care unit.

Dr. Duff: Is this your present method of determining whether or not your parenteral nutrition is effective?

Dr. Meakins: Yes. And we have no better method of finding out how the patient is doing immunologically. Chemotaxis is accurate but skin testing is easier.

Dr. Duff: A question on which all the members of the panel might express an opinion. When do you decide on hyperalimentation for patients in the intensive care unit?

Dr. Allardyce: We believe that in the acute situation, for example during the period of resuscitation from shock, whether of the septic or hemorrhagic type, or when major surgery has just been carried out, total parenteral nutrition (TPN) probably complicates the issue and is not of much value. But as soon as the patient is stable from a cardiovascular standpoint, we institute intravenous feeding. We decide on the central or peripheral route on the basis of the expected duration of TPN. If it is to continue for 3 weeks or longer, we use the central route. If we think it will be for only 2 to 3 weeks we choose the peripheral route.

Dr. Duff: When do you start TPN and what solution do you give?

Dr. Cooper: When I go 12 hours without eating, I get rather hungry and by the time I have gone 24 hours without food I am feeling rather weak. It is definitely my opinion that it is unfair to put a patient on a ventilator in the intensive care unit and make him fight his way without giving him any nutritional support. To do so is to add starvation to his illness. I think nutrition is often neglected because we are so busy taking care of everything else. Often 5 or 6 days have passed when we suddenly remember even to do something so simple as putting in a nasogastric tube for feeding. By all means if you anticipate a long course for the disease you should start feeding the patient right away. My personal feeling is that feeding should be given during the first few days via a stomach tube if possible, otherwise by the parenteral route. It should be part of the early treatment plan to identify the patient who is likely to require either TPN or enteric nutritional supplementation. In 1977, this part of surgical treatment is to be considered, if not in the emergency room, certainly pretty soon afterwards.

Dr. Duff: Dr. MacDonald, have you anything to add?

Dr. MacDonald: Yes, two points. We

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March issue of the Journal

In addition to the papers from the inaugural meeting of the Canadian Association of General Surgeons, presented in this issue, the March 1978 issue of the Journal will contain three further papers from this meeting. The March issue will also contain a number of papers presented at the Annual Meeting of the Canadian Cardiovascular Society held in Toronto in October 1977 together with a review article on gastrointestinal fibreoptic endoscopy and the Davis & Geck award winning essay for 1977, entitled "Importance of Mixed Venous Oxygen Saturation in the Care of the Critically Ill".

discourage the use of peripheral veins for TPN. If the patient is going to be ill and in an intensive care situation for a long time, you want to have every peripheral vein available for as long as possible. The more you spare, the better. We use central veins early. The second point is that patients in an intensive care unit often have caloric requirements that are much higher than can be supplied by peripheral TPN systems.

Dr. Duff: Dr. MacDonald, one member of the audience believes your results with cimetidine are not good because the patients who received it were treated with the agent for quite a long time despite continued bleeding. In other words, surgery was delayed, and the questions are, Was surgery delayed too long in the patients to whom you gave cimetidine? and, Would an earlier operation have resulted in a better salvage rate?

Dr. MacDonald: Those are fair questions. The figures reported here are for patients from whom surgery was withheld because of prohibitive operative risk. These patients received cimetidine. The study showed that those with erosive gastritis did well, those with duodenal or gastric ulcer did not do well. But they did not die because surgery was delayed; they died because they were in severe pulmonary failure, renal failure, or liver failure.

Dr. Duff: What is your opinion of physiologic gastrectomy for acute erosive gastritis rather than a total gastrectomy in an old, medically unfit patient?

Dr. MacDonald: Physiologic gastrectomy is performed when you give cimetidine. This drug completely abolishes gastric acid production and decreases acid output from pentagastrin stimulation by 85%. But in our experience, patients will still bleed despite complete inhibition of gastric acid production. From our gastroscopy findings, I suspect that many of these individuals have a bile gastritis. We have tried cimetidine in patients who have postgastrectomy bile gastritis and they obtained no benefit. Bile can produce erosions in patients who have a compromised mucosa.

Dr. Duff: Some surgeons like to have their patients extubated quickly, others believe extubation should be delayed. How do you tell when to extubate a patient who, say, had been ventilated overnight?

Dr. Meakins: Adequate oxygenation must be proven prior to extubation — a Po_2 in the range of 80 to 100 mm Hg, a normal Pco_2 and normal pH. The breathing should be easy without straining or tachypnea. In the case of a patient who has been on a respirator for several days, if he is extubated too quickly he is likely to tire, go into respiratory failure and require reintubation. It is much more difficult to get a patient off the respirator the second time.

Dr. Duff: Is there a Po_2 value that you will tolerate or below which you will not extubate?

Dr. Meakins: In a patient without chronic chest disease who has been on a respirator, I am very reluctant to extubate that patient if the Po_2 is much under 75 mm Hg.

Dr. Duff: Dr. Cooper, have you anything to add on that point?

Dr. Cooper: An endotracheal tube does prevent coughing, and the normal negative-pressure inflation of the lungs is better than positive-pressure inflation. Therefore there is reason to extubate the patient as soon as possible. However, having said that, I would emphasize that there are very few hazards present in well-managed units and the benefits of that extra time of rest and adequate mechanical ventilation may be very important.

Dr. Duff: If a patient has had emergency thoracentesis in the emergency room and then requires positive end-expiratory pressure (PEEP) or mechanical ventilation, there is the risk of a sudden pneumothorax. Should such a patient have a chest tube inserted prophylactically?

Dr. Allardyce: We have had bad experiences with the sudden development of a tension pneumothorax in the situation you have described. I think you have to balance the risk of a sudden pneumothorax and your ability to detect it in time against the need for PEEP.

Dr. Cooper: Yes, the likelihood of spontaneous pneumothorax is probably high, so keep the chest tube near the bedside if you have tapped the patient with multiple injuries in the emergency ward. I very often insert a chest tube as a prophylactic measure in a patient going to the operating room for an abdominal procedure who has had multiple injuries and pleural effusions or rib fractures, even though he has no pneumothorax.

Dr. Meakins: I really do not like the concept of a prophylactic chest tube. All volume-cycle respirators have a gauge that indicates the pressure required to achieve adequate inspiration. As a pneumothorax develops, that pressure is going to increase. Careful monitoring can identify this problem so that the needless insertion of chest tubes is avoided.

Dr. Duff: Dr. Meakins, does splenectomy affect the cutaneous anergic response?

Dr. Meakins: Not as far as we know. Patients who have had splenectomy for isolated splenic injury have not become anergic.