REVIEW ARTICLE

Review of general surgery 1981

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Introduction

This year's review has an undoubted intra-abdominal and malignant flavour. However, it does represent, once again, a survey of those publications which I have found of particular interest and which inevitably, therefore, reflect my own surgical hobbies.

Topics include the decline in the surgery of peptic ulcer, the management of gastrointestinal haemorrhage, non-operative treatment of gallstones, interesting studies on large bowel cancer, attempts to preserve the traumatized spleen and efforts to rationalize and humanize the management of breast cancer. We consider the hazards of smoking in peripheral arterial disease, the prognosis of aortic aneurysm, the prophylaxis of deep vein thrombosis and surgery on the kidney removed from the patient and put onto a work bench. Finally, a variety of the wide range of experimental studies are presented which are being carried out by surgeons in the laboratory, the wards and the operating theatres, and which demonstrate the constant quest of today's surgeons to improve the quality of service they deliver to their patients.

Gastroenterology

Dissolving gall stones

In 1972, the first hope of a non-surgical treatment was raised when the primary bile acid, chenodeoxycholic acid, was shown to be capable of dissolving cholesterol stones; 3 years later it was joined by ursodeoxycholic acid (Leading Article, 1981a). The American National Cooperative Gallstone Study has now published the results of its trial of the use of chenodeoxycholic acid; 916 patients with radiolucent stones were randomly allocated to high dose, low dose or placebo treatment. After 2 years there was complete gall-stone dissolution in 13.5% of the high dose group, 5.2% of the low dose patients and 0.8% of the placebo group. Complete dissolution was most likely in patients who were thin (but this might be related to the fact that dosage was not weight-related), those with small stones and those

with a high-normal serum cholesterol. Important side effects were diarrhoea and significant hepatotoxicity in 3% of the patients. The trial, carried out in 10 treatment centres, cost nearly 11 million dollars! (Schoenfield and Lachine, 1981).

Better results can be achieved if ursodeoxycholic acid is used. This does not seem to damage the liver nor cause diarrhoea and its efficiency is as good as that of chenodeoxycholic acid (Dowling, 1981).

Data on recurrence when treatment is discontinued are scanty, but a preliminary report suggests that as many as half the patients have new stones within 2 years of discontinuing treatment (Ruppin and Dowling, 1981). Unfortunately, there is no escaping from the fact that the great majority of patients who require treatment for their gall stones still have to be submitted to cholecystectomy (Smith and Sherlock, 1981).

A note of warning is sounded by Irving (1981) who reports a female of 58 years treated over a 5-year period for dissolution of stones using chenodeoxycholic acid. Further pain led to cholecystectomy at which three large calculi were found, together with a fundal polypoid carcinoma. He points out that carcinoma of the gall-bladder is associated with 1.2% of cholecystectomy specimens and accounts for 600 deaths annually in the United Kingdom. Stones are present in up to 98% of these cases. Infected bile may degrade bile salts into carcinogens; moreover, bile is altered by chenodeoxycholic acid with increase of the chenodeoxycholate and lithocholate conjugates which are implicated in experimental carcinogenesis.

Motson (1981) has reviewed the related topic of the management of gall stones retained in the common bile duct after cholecystectomy. There is no known solvent for pigment stones. Bile acids are not of value because of the prolonged period necessary for dissolution, but mono-octanoin (a medium chain monoglyceride), has been advocated as a result of *in vitro* studies at the Mayo Clinic. Motson points out that merely flushing out the duct with

saline through the T-tube at a pressure of 30 cm of water may be successful in about 50% of cases. If this simple treatment is not effective, 6 weeks later stone extraction can be attempted by means of a steerable catheter introduced into the T-tube tract under X-ray control. If this fails, endoscopic sphincterotomy can be performed.

Gastrointestinal haemorrhage

Bleeding from the gastrointestinal tract remains a common cause of emergency admission to hospital. In spite of increased accuracy in diagnosis, as a result of emergency endoscopy (which has virtually eliminated the need for less reliable urgent barium meal examinations), there remains a hard core mortality of between 5–10% in this country (Leading Article, 1981). A valuable report from Cardiff (Mayberry *et al.*, 1981) studied a series of 583 patients admitted between 1972 and 1978 to the University Hospital of Wales. There were 60 deaths (10.3%). Most of the patients who died were elderly, with a mean age of 75 years, and no less than three-quarters of these had additional serious medical conditions, for example malignancy, cardiovascular disease or respiratory problems. Of 565 of these patients available for detailed analysis, it is interesting that the site of bleeding was identified in only 381 patients. In 184 the source of haemorrhage was not established, but most of these had only a small haemorrhage which was not fully investigated. However, no source of bleeding was identified in 17 patients who died, and these were chiefly elderly. Of the 381 patients with an identified source of haemorrhage, duodenal ulcer headed the list, with 154 patients. Gastric ulcer occurred in 98, carcinoma of the stomach in 34 and oesophageal varices in 19. This low incidence of variceal haemorrhage is, of course, in contrast to the much higher incidence reported from many centres in the U.S.A. where alcoholic cirrhosis is a much commoner problem. Acute erosions were found in 27 of the patients, and 13 of these were localized in the oesophagus. Less common causes included the Mallory-Weiss syndrome (6 patients), two patients with the Zollinger-Ellison syndrome, and single examples included Henoch-Schönlein purpura, hereditary telangiectasia, an antral haemangioma, a Meckel's diverticulum and Hodgkin's disease of the stomach. Eighty-four of the patients were submitted to emergency surgery (15%) and there were 11 deaths.

A recent American series, in contrast, contained no less than 26% of patients with alcoholic liver disease (Peterson *et al.*, 1981). This interesting study, from a Veterans Administration Hospital in Dallas, included 100 patients randomly assigned to routine endoscopy and 106 where endoscopy was only carried out if recurrent bleeding occurred or if

X-rays disclosed a gastric ulcer or suggested a neoplasm. Of the 100 patients undergoing routine endoscopy, the cause of haemorrhage was duodenal ulcer in 22, gastric ulcer in 18, oesophageal varices in 20, the Mallory-Weiss syndrome in 16, gastritis in 6, gastric cancer in 2, a normal examination in 4 and no definite diagnosis established in 12. Interestingly enough when the two groups were compared there were no significant differences in overall hospital deaths (11 in the routine endoscopy group *v.* 8 in the selected group), recurrence of bleeding (33 *v.* 32), numbers of transfusions required, duration of hospital stay or re-admissions to hospital, incidence of further haemorrhage or frequency of surgery. These authors conclude that endoscopy should not be a routine procedure in patients with upper gastrointestinal bleeding but should be used on a more selective basis (Peterson *et al.*, 1981).

The endoscope as a therapeutic instrument—to control ulcer bleeding by argon laser coagulation—has now been submitted to a controlled trial (Swain *et al.*, 1981); 52 patients with a bleeding vessel in the base of a peptic ulcer visualized at endoscopy were randomized between conservative treatment and coagulation (both groups receiving cimetidine). Eight of 24 coagulated ulcers re-bled compared with 17 in 28 controls. Seven in the latter group died after re-bleeding but there were no deaths in the treated group. This significant reduction in bleeding and mortality is most encouraging. However, Vallon and his colleagues (1981) present a randomized trial of endoscopic argon laser photocoagulation in bleeding peptic ulcers; the series comprised 28 patients with active bleeding ulcers and 108 who had suffered recent haemorrhage. It was interesting that there was overall no statistical difference in the re-bleeds, need for surgery or mortality in those patients treated by argon photocoagulation and those treated on routine lines.

Apart from the elderly patient suffering from some other serious medical or surgical problem, there are two groups of patients with severe upper gastrointestinal haemorrhage who are a particular cause of anxiety. The first is the seriously ill patient who develops haemorrhage from stress ulceration, the second the cirrhotic with bleeding oesophageal varices.

Basso and his colleagues (1981) present an important study of the prophylaxis of stress ulceration in high risk patients. They studied 168 cases in the intensive care unit with one or more of the following high risk factors for the development of stress ulceration:—neurosurgery, head injury, severe burns, toxic shock, multiple trauma, renal failure, hypotension and serious post-operative complications. These patients were randomized into 60 who received cimetidine 200 mg 6 hourly, among whom there

were no examples of stress haemorrhage, 52 who received an antacid (Maalox) 10 ml each hour by mouth, among whom there was one haemorrhage, and 56 control patients, who received no specific treatment, among whom there were 8 haemorrhages. The difference between the two treated groups and the controls was statistically significant. All the patients who bled were subsequently treated with cimetidine. In 8 the haemorrhage ceased, although one patient died subsequently, and the remaining case was treated by angiographic embolization. It is interesting that of a further 638 patients admitted to the intensive care unit without the risk factors listed above, there were no examples of haemorrhage. This study certainly underlines the value of either alkali or cimetidine as prophylactic agents in the high risk group.

Bleeding oesophageal varices are treated conservatively in the first instances but some 30–40% of these continue to bleed. Recent years have seen increasing dissatisfaction with the results of portal-systemic shunting operations, which have a high mortality, may not control haemorrhage and have a high incidence of post-shunt encephalopathy. Surgeons are turning more and more either to injection of the varices through the oesophagoscope or fibre-optic endoscope, or oesophageal transection. Johnston (1981) reports from Belfast on a series of 170 patients treated by injection for acute bleeding episodes. The haemorrhage was controlled in no less than 93% of patients. However the overall hospital mortality was 18% and, if patients with extra-hepatic block are excluded, this rose to 25% for patients with cirrhosis. Moreover the veins gradually recanalize so that there is the risk of further haemorrhage. For this reason, the Belfast group have reported on the value of oesophageal transection using the stapling gun in poor-risk patients in whom any form of shunt was contra-indicated (Graham *et al.*, 1981; Johnston, 1981). This operation was carried out on 60 patients, 18 as emergencies with 6 deaths (33%). In the other 42 cases operation was performed at least 48 hr after the last haemorrhage and 5 of these died, giving a 12% mortality for elective operation in these relatively poor risk patients. Among the 49 patients who survived to leave hospital, there have been 7 late deaths. Thirty-three patients had their operations more than 2 years ago and two-thirds are still alive.

Osborne and Hobbs (1981) report an interesting comparison between two matched groups of patients with bleeding oesophageal varices, 20 of whom were treated by transection and 20 by mesocaval shunt using an 18 mm Dacron graft between the superior mesenteric vein and the portal vein. Of the 20 transections using the stapling gun, there were 5 early deaths, 2 mild examples of encephalopathy,

2 later deaths and 5 patients who re-bled. Among the 20 shunt patients there were 7 deaths, no fewer than 8 examples of encephalopathy, of which 4 were severe, 4 re-bled and 2 died later. This study gives some idea of the very serious prognosis of these extremely poor risk patients.

Because of the simplicity of the procedure, there is no doubt that more and more surgeons are turning to injection sclerotherapy via the oesophagoscope. In most cases the haemorrhage can be controlled satisfactorily even though the patient is likely to die of the other consequences of his cirrhosis (Lewis, Chung and Allison, 1981; McDougall, Westaby and Williams, 1981).

Terblanche and his colleagues (1981) of Cape Town, who are among the pioneers of this technique, report control of haemorrhage in 95% of 66 cases with no deaths from continued variceal bleeding. However death rate per hospital admission was no less than 28%, reflecting the very poor prognosis of the majority of these cirrhotic bleeders. Yassin and Sherif (1981) report equally effective control of haemorrhage in 20 cases with hepatic schistosomiasis complicated by bleeding varices.

An ingenious new approach to the problem of bleeding varices is presented by Taylor and Neilson (1981). It is known that the passage of an electric current across a blood vessel precipitates a thrombus at the site of the positive electrode. These authors have used this principle to construct a system of longitudinal flexible gold plated strip electrodes around the oesophageal component of a Sengstaken tamponade tube. This was used in 8 poor-risk patients in whom the tube was used to control oesophageal haemorrhage. A current of 7 volts was applied for 90 min and the tube kept inflated within the oesophagus for a total of 24 hr. In all the patients the haemorrhage was satisfactorily controlled, although 4 patients subsequently re-bled and in 2 this proved fatal. Certainly in a condition as serious as this, a further development of this ingenious device might be of value.

Massive bleeding from the large bowel is fortunately far less common and 75% of such cases can usually be managed successfully by conservative means. When haemorrhage continues, however, emergency surgery may be necessary. The commonest cause is diverticular disease and right-sided colonic diverticula have a high incidence of haemorrhagic complications (Roberts and Thomas, 1981). The introduction of selective mesenteric angiography has demonstrated an interesting group of non-neoplastic lesions of intestinal blood vessels variously termed angiodysplasia, vascular ectasia and arterio-venous malformations. These have a predilection for the right colon and occur most frequently in elderly patients. The demonstration by

angiography of a right-sided colonic bleeding site or an angiodysplastic area allows segmental resection to be performed instead of the previously advocated 'blind' sub-total colectomy. Max and his colleagues (1981) report that the colonoscope may be of value in the diagnosis of these vascular malformations. In a series of 42 patients with angiodysplastic malformations of the gastrointestinal tract, 18 had normal colonoscopic appearances but in 8 of these the lesion was in the small intestine and out of reach of the instrument. In 3 patients the examination was incomplete but in 14 the lesion was identified. These authors suggest that it may be possible, in the future, to treat at least some of these bleeding lesions via colonoscopic coagulation and thus avoid surgical intervention in often elderly and ill patients.

Other, rarer, causes of massive colonic haemorrhage include carcinoma, ulcerative colitis, radiation proctitis and coagulation disorders due to chemotherapy, immunosuppression or anticoagulation. These rarely present diagnostic problems.

Duodenal ulcer

Surgeons in this country will confess that they are operating far less frequently upon patients with duodenal ulcer than ever before in living memory. The reason is partly due to the introduction of powerful new pharmacological agents of the histamine-antagonist group, but also to an actual decline in the incidence of duodenal ulcer, quite unrelated to treatment. Indeed, during the past 30 years the hospital admission rates have fallen progressively for both perforated and non-perforated ulcer. Barker and his colleagues (1981) have studied the figures obtained from the Hospital In-Patient Enquiry for the years 1963–73 with the main diagnosis of perforated duodenal ulcer. This was used as an indicator of ulcer incidence because, in comparison with rates for non-perforated ulcer, they are less liable to be influenced by changes in hospital admission practises. Among men in the north and west regions of England and Wales, for example, the rates fell from 22.7 per 100 000 in 1963 to 16.3 in 1973. In the south and east regions, the rates fell by a similar amount from 14.7 to 10.2. The rates among women were lower than among men and the regional variations were small; there was also little variation in incidence throughout the 11-year period. It is interesting that for both men and women urban rates are higher than rural ones.

Wyllie and his colleagues (1981) carried out a survey of surgical practice in 6 centres in this country, considering the number of patients submitted to surgery for duodenal ulcer 5 years before and 4 years after the introduction of cimetidine. On average, there had been a 39% reduction in the number of patients submitted to vagotomy but interestingly

enough this figure varied between the centres from 2.4% to 66.9%! The change in pattern is certainly not confined to the United Kingdom. Fineberg and Pearlman (1981) note that over the past 20 years the incidence and severity of peptic ulcer has declined in the U.S.A. and the mortality has dropped by two-thirds since its peak in 1962. In August 1977, cimetidine was approved by the FDA and there was a large decline in the number of operations for duodenal ulcer in 1978. Admittedly there was a rise in 1979, but the numbers were significantly below the predicted trend following the figures from 1966 to 1977.

Pyloric stenosis as a result of chronic duodenal ulceration is now becoming quite an uncommon disease. Indeed, although it has long been a hobby of mine, I have only operated on one case this year. Dunn, Thomas and Hunter (1981) confirm that very conservative surgery is effective in such patients. In 15 examples of duodenal ulcer with stenosis, surgical management combined highly selective vagotomy with dilatation of the strictured pylorus. In two cases the stricture tore during dilatation and required an omental patch. The follow-up results were excellent in 14 of the patients and the single recurrence was treated successfully with cimetidine. Six of the patients had postoperative barium studies 1–5 years later and in all there was good emptying.

While on the subject of pyloric stenosis, an interesting case report by Keenan (1981) from Northern Ireland describes a male of 78 years diagnosed at laparotomy as having a pyloric obstruction due to a carcinoma of the pylorus with peritoneal seedlings and a gastro-jejunostomy was performed. Biopsy of one of the nodules showed caseating tuberculosis which responded well to specific therapy. No such case has been reported in the indigenous population of the United Kingdom for the last 20 years, although examples have been recorded in India and Africa.

Long-term results of highly selective vagotomy

Surgeons are cynics. Many of us wondered if the magnificent early results reported for highly selective vagotomy in the treatment of duodenal ulcer were too true to last. Blackett and Johnston (1981) from Leeds, the very home of highly selective vagotomy in this country, now report the follow-up studies of 433 patients submitted to elective highly selective vagotomy between 1969 and 1980. In 233 patients followed up for 5–12 years (12% of whom were lost to follow up) the incidence of recurrence was 10.7%. One patient presented with a perforation, 4 with haemorrhage and 30 with epigastric pain. Asymptomatic patients were not endoscoped and so asymptomatic recurrence would have been missed. Nine of these patients were treated by re-operation

and the remainder were controlled with cimetidine. When the 35 patients with recurrence were compared with patients without recurrence, no pre-operative factors could be identified that might be used to predict relapse and this particularly applied to assessment of pre-operative acid output. Thus, contrary to some previous reports, no evidence was found that patients who are hypersecretors of acid should be treated by vagotomy combined with antrectomy. The only factor which was found to influence the incidence of recurrent ulceration strongly was the surgeon who performed the operation. From University College, Storey and his colleagues (1981) report a follow-up of 93 patients treated by highly selective vagotomy from 5–9 years previously. The confirmed recurrence rate was no less than 16.1%. In addition, there have been patients with transient dyspeptic symptoms but in whom no ulcer has been demonstrated. Although the operation was commended for its lack of side effects, the high incidence of recurrent or persistent symptoms led the authors to some reservations about its general application in the treatment of chronic duodenal ulceration.

Intestinal obstruction

Intestinal obstruction remains a common and dangerous surgical emergency. Approximately 1750 deaths from this cause are notified each year in England and Wales, of which 750 are due to strangulated external hernias.

The aetiology of common causes of intestinal obstruction has changed quite dramatically in the active life of senior surgeons alive today. In the first three decades of the century, strangulated hernias accounted for a very high percentage of the total cases but the incidence has dropped considerably in the Western world in more recent years, no doubt because of the considerable enthusiasm with which these hernias are subjected to elective repair. Adhesions, in contrast, have become more and more common and this can be attributed, in turn, to the enormous increase in the frequency with which abdominal surgery is now being performed (Ellis, 1981a). In the 1930s, about half the cases of intestinal obstruction were due to strangulated hernia but a recent review of 405 patients with mechanical small intestinal obstruction in New York (Bizer *et al.*, 1981) showed that 74% were due to adhesions and only 8% to strangulated hernia.

This is not to say that strangulated external hernia is not still a serious problem. Andrews (1981), in a review of 195 examples of strangulated external hernia in one hospital in North West England over a 5-year period, notes a mortality in adult patients of 11%, which is almost unchanged over the last 30 years and he finds that even these days 50% pre-

sented 48 hr or more after becoming strangulated.

In developing countries, not surprisingly, strangulated inguinal hernias remains a very common cause of intestinal obstruction (Ajao, 1981). Of 273 obstructions admitted to the University Hospital in Benin, Nigeria, Chiedozi (1981) found that 163 were strangulated hernias. No fewer than 55 of those contained gangrenous bowel.

Although the vast majority of small bowel obstructions are due to adhesions or strangulated hernia and the bulk of large bowel obstructions due to cancer of the colon, diverticular disease or volvulus, the surgeon must be prepared to come across an extraordinary variety of conditions which result in mechanical intestinal obstruction. Cathcart and his colleagues (1981) review that interesting rarity of mid-gut non-rotation and point out that it is often forgotten that this may occur in the adult patient. Berardi (1981) presents a collective review of the 109 papers dealing with paraduodenal hernias and points out that there is general acceptance that these represent anomalies of peritoneal development rather than herniation into the paraduodenal fossae. Vinard and his colleagues (1981) report obstructions due to intra-mural haematomas in the small intestine in patients on long-term anticoagulant therapy and Daniell (1981) reports a previously undescribed condition in which a patient's prolapsed colostomy itself contained 60 cm of gangrenous small intestine between the two walls of the colonic prolapse. Recovery followed resection of the gangrenous small intestine and of the necrotic colostomy. From Westminster Hospital we have recorded a female patient of 43 who presented with a strangulated femoral hernia, and then 14 days later developed intestinal obstruction once again, this time from a strangulated left obturator hernia. An empty obturator hernia sac was present on the right side. This combination of bilateral obturator hernia and a femoral hernia has not been previously reported (Watkins, Ellis and Leach, 1981).

Two rare examples of large bowel obstruction are reported—Michowitz and his colleagues (1981), of endometriosis of the colon, and Anselme (1981), who records the 57th published example of intestinal obstruction due to a gall stone impacted in the colon. The unusual emergency of transverse colon volvulus is reviewed by Anderson and his colleagues (1981).

Intussusception is a particularly fascinating cause of obstruction, of course particularly associated with paediatric abdominal emergencies. Raudkivi and Smith (1981) review a 16 year experience of 98 paediatric cases in Auckland, New Zealand. A barium enema was performed in 67 cases but reduction was only effected in 13. Eighty-five laparotomies were carried out with only one death. It is interesting that gangrene was already present in 17 cases,

demonstrating that even in modern times diagnosis is often late. Although in centres where there is an enthusiastic radiologist, barium enema reduction is highly effective and safe, these authors review 1371 cases of barium enema attempted reduction in 11 published series (including their own) and point out that there is only a 62% success rate overall.

It should be remembered, of course, that intussusception may also occur in adult patients. Nargorney, Sarr and McIlrath (1981) review the 48 adult subjects treated with this condition at the Mayo Clinic between 1955 and 1978. Twenty-four involved the small and 24 the large intestine. In adults there is usually an underlying cause and in the colon this is usually a malignant tumour. Indeed, 15 of the colonic cases had an underlying malignant cause compared with only 7 in the small intestine group. These authors therefore advocate immediate resection of adult large bowel intussusception without any attempt at initial surgical reduction. In the case of the small intestine, it suffices to reduce the intussusception and to carry out a limited surgical resection of the underlying cause unless a malignant lesion is clinically suspected or obvious at the time of laparotomy. These same authors (Sarr, Nargorney and McIlrath, 1981) also point out that intussusception may occur immediately postoperatively or following recent abdominal surgery and report a series of cases in adults. This complication was particularly liable to occur when a Miller Abbott tube had been employed. They point out that, although well recognized in paediatric cases, there have been few reports of this postoperative emergency in adult patients.

While on this subject, Foldes and Fontaine (1981) record a great rarity—a jejuno-ileal intussusception due to a schwannoma.

Published mortality figures throughout the Western world demonstrate that the very high mortality (in the region of 25% of all cases) which was typical of publications in the 1920s and 1930s, has now been reduced to the region of 10–15% (Ellis, 1981b). This improvement has undoubtedly been due to a combination of improved anaesthesia, better knowledge of fluid and electrolyte replacement, efficient blood transfusion and the introduction of antibiotics. The major factors influencing survival rate in an adverse manner are strangulation of the bowel with gangrene, delay in treatment with gross fluid and electrolyte disturbance, and extremes of age; mortality is especially high in infants and the elderly.

Although hundreds of papers have been published on the differential diagnosis between simple and strangulated obstruction, attempts at such a differential diagnosis are little more than an academic exercise. Indeed, most experienced surgeons will point out the very real dangers of attempting such diagnostic accuracy and advocate early laparotomy

as a routine for acute mechanical obstruction (Ellis, 1981b; Hofstetter, 1981).

Even when the abdomen is opened, the surgeon may have great difficulty in determining whether or not a strangulated loop of bowel is viable. There has been much interest over the years, particularly in the U.S.A., in aids to making this important differential diagnosis. Marfuggi and Greenspan (1981) report their experimental and clinical studies using fluorescein injected intravenously followed by viewing of the bowel in ultraviolet light. This technique has been used from time to time over many years but these authors found it highly reliable in a rabbit experimental model and found that it was better than clinical judgement when used on 20 patients. Shah and Andersen (1981) advocate the use of a Doppler ultrasound and found, in dogs, that if flow was consistently heard on the anti-mesenteric border, the bowel remained viable after mesenteric venous occlusion. Moreover, the compromised intestine did not develop strictures during a 6 month follow-up period. These authors present four clinical cases where Doppler ultrasound was found to be useful in supplementing the usual methods of determining small bowel viability. Bulkley and his colleagues (1981) report on 28 patients operated on for acute intestinal ischaemia and compared clinical judgement against Doppler ultrasound and fluorescein. The findings were checked against microscopic examination of the resected bowel. Clinical judgement was accurate in 89% of cases and this was not improved upon when the Doppler was employed. However the fluorescein test was always correct. These authors point out that the surgeon tends to err clinically on the side of resection.

Surgeons in this country are rarely tempted to use ancillary methods and most of us would teach that, faced with bowel of questionable viability, 'when in doubt, take it out'!

Pseudo-obstruction

Pseudo-obstruction can be defined as a condition in which the physical and radiological findings are identical to those associated with mechanical obstruction and yet no organic cause is found either at contrast radiology, laparotomy or autopsy. The pseudo-obstruction may be isolated to a single segment of the intestine or be part of a more generalized process involving most or all of the gastrointestinal tract. These cases may proceed to such gross colonic distension that there may be caecal necrosis or perforation.

Careful study of the details of many patients purported to be examples of pseudo-obstruction of the intestine reveal that there is, in fact, an underlying cause even though this is not a mechanical obstruction. Golladay and Byrne (1981), in an extensive

collective review, describe many such causes, which must be excluded before a diagnosis of true idiopathic pseudo-obstruction can be made. These include collagen disease, electrolyte disturbance (particularly hypokalaemia), cathartic abuse, lead poisoning, congestive heart failure (where associated use of diuretics and consequent hypokalaemia may aggravate oedema of the intestinal wall), sepsis, spinal trauma and drug induced obstruction (including ganglion blocking agents, antidepressants, chlorpromazine and anti-Parkinsonian drugs). Batalis, Muers and Royle (1981) report an example in a patient with myxoedema who responded to intravenous triiodothyronine. They postulate an autonomic neuropathy or deposition of mucopolysaccharides in the bowel wall as possible causes.

Hanks and his colleagues (1981) review 30 case histories of chronic primary intestinal pseudo-obstruction in 21 reports published over the last 20 years. The age of onset ranged from 1–60 years with 12 male and 18 female cases. Oesophageal motility studies were carried out in 14 and revealed aperistalsis of either the entire, or a large segment, of the oesophagus. Motility distal to the oesophagus was not studied as extensively but two of three patients evaluated for gastric motility were normal and one of six investigated for small bowel motility was normal as were two of the four patients evaluated for colonic motility. Pathological examination of all or part of the gastrointestinal tract was carried out in 26 patients and abnormalities were detected in less than half of these; these included hypertrophy, villous atrophy and degeneration of ganglion cells. Only 48% of cases demonstrated clinical improvement and eight patients ultimately died. Treatment has been disappointing, although resection or bypass may lead to improvement in certain cases with well localized involvement. There are no specific histological criteria for the diagnosis of this condition. A wide number of therapeutic agents have been tried, all without long-term success.

Large bowel

Carcinoma of the large bowel is the second commonest cause of deaths from cancer in the United Kingdom and this reflects the situation throughout the Western World. It is not surprising, therefore, that this topic should feature prominently in current surgical publications. An important study by Segal and his colleagues (1981) from Baragwanath Hospital, Johannesburg, stresses the interesting difference in incidence between black and white races. Although there is a 13 per 100 000 incidence of colorectal cancer among the white population, this falls to 0.8% among the blacks. Adenomatous polyps were found in only 8% of resected specimens in black patients compared to 33% in whites and,

incidentally, polyposis coli has only been reported on three occasions in black South Africans. Multiple synchronous cancers were absent in the black patients compared with 6% in the whites and diverticula were absent in the resected specimens from black patients although present in 13% of resected colonic cancers in the white population. How far this is a genetical difference or related to diet is the subject for further study, although the diet of the black African is low in meat and fat and consists mainly of bread and maize.

From China, Ming-Chai *et al.* (1981) report that colorectal cancer is a common tumour. In some areas endemic for schistosomiasis the prevalence rate is 44 per 100 000. These authors studied 60 surgical specimens resected from patients with schistosomal large bowel disease but without malignant change and found that rather more than a third had mild to severe epithelial dysplasia, very much like the malignant potential of ulcerative colitis.

While on the subject of aetiology, we have reported two cases of transitional cell carcinoma of the rectum in male homosexuals (Leach and Ellis, 1981). One of the patients was aged 39 years, the other 36 years. Both were anoreceptive and both had had gonococcal proctitis in the past. We were able to find five other reported cases and postulate that there might be a connection between chronic infection or inflammatory disease of the rectum and carcinoma in these patients. We looked for raised antibodies to herpes simplex in our patients but they were not present, neither were inclusion bodies seen on electronmicroscopy in the second case.

From the point of view of prognosis, clinicians have become used, over the years, to the value of the Dukes classification of large bowel cancers (A, confined to the mucosa, B invading the muscle wall and C with lymph node involvement). From St Mark's Hospital, Talbot and his colleagues (1981) now introduce a new important dimension, which is whether or not there is invasion of extramural veins in the resected specimen. The prognosis under such circumstances is particularly poor, with only 15 survivors out of 91 patients at 5 years. It was interesting that in the study of a large series of patients only intramural venous invasion was found in Dukes A cases and such invasion was not correlated with metastatic spread. The combination of the presence or absence of extramural venous invasion together with the classical Dukes classification undoubtedly refines prognostication for the patient's future.

From St Mark's Hospital, also, comes a further interesting paper on prognosis of carcinoma in ulcerative colitis (Ritchie, Hawley and Lennard-Jones, 1981). They compare 67 patients with carcinoma complicating ulcerative colitis treated between

1947 and 1980 with 4817 patients without colitis seen over the same period. Although there was a higher proportion of inoperable and high grade tumours in the colitic group, the prognosis was found to be very similar in patients with and without colitis.

Undoubtedly the most important technical advance in colorectal surgery in recent years is the EEA stapling instrument which enables anastomoses to be made low down in the pelvis after rectal excision. There are now many publications reporting satisfactory results and undoubtedly patients who might otherwise have been submitted to abdominoperineal excision of the rectum can now have the anal sphincter preserved (Heald and Leicester, 1981; Rothenberger and Goldberg, 1981). Whether or not we shall see an epidemic of anastomotic recurrences over the next few years due to over-enthusiasm at preserving the sphincter at the expense of adequate excision remains to be seen.

There is undoubtedly a need to carry out careful assessment of the stapling machine against standard hand-sewing of the anastomosis. Beart and Kelly (1981) report a careful study from the Mayo Clinic in which patients with carcinoma of the rectum at least 5 cm from the dentate line were randomized between a two layer suture anastomosis and a stapling anastomosis. There were 35 patients in each group. The stapling machine was found to be quicker, especially in a technically difficult operation. Postoperative complications were the same, but use of the stapling machine was more likely to be associated with rectal tears and anastomotic defects. These authors estimate that the stapling machine will save some 12% of rectums which are at present removed.

In an effort to improve prognosis, following resection, we have been involved at Westminster as part of a multicentre trial using adjuvant razoxane after colorectal cancer resection (Gilbert *et al.*, 1981). Of patients in Dukes group B and C randomized between controls (49) and treated (47) cases the recurrence rate in the first six months was 20% and 28% respectively in the Dukes B and C controls compared with 4% and 9% in the corresponding razoxane treated patients. The adjuvant group had received 125 mg razoxane twice daily for five consecutive days every week indefinitely. Importantly, the razoxane treated patients experienced no significant toxicity apart from a readily reversible mild leukopenia in 52%, while gastrointestinal symptoms necessitated stopping the drug in only 4 patients. Taylor (1981) records his interesting randomized prospective clinical trial of adjuvant portal vein perfusion with 5-fluorouracil (5FU) by cannulation of the obliterated umbilical vein. At the latest follow up, 23 patients had died with recurrent disease in

the control group of 67 patients compared with only 7 in the perfusion group of 63 patients. Liver metastases were present in 13 control and two perfusion patients at time of death.

Invasion of adjacent structures at the time of initial laparotomy was found adversely to effect prognosis by Wood and his colleagues (1981) who consider that this should be employed, together with Dukes classification and the differentiation of the tumour in staging of colorectal growths. However, Kelley and his colleagues (1981) found that although the operative mortality was higher in such cases, the 5 year survival was not remarkably different from uncomplicated cases. Blamey and his colleagues (1981) specifically considered ovarian involvement in carcinoma of the colon and rectum. The 5 year survival of women without ovarian involvement after curative resection was 72% but this fell to 50% when ovarian involvement was present and the patient was submitted to curative excision of the lesion. Certainly radical surgery for advanced local carcinoma of the colon can be surprisingly rewarding (Ellis, 1981).

Recurrent and metastatic disease

What of the patients who develop local recurrences or metastatic disease? The presence of liver metastases, of course, is virtually a death sentence. Bengtsson *et al.* (1981) from Lund note that patients with 25% of the liver occupied by metastases lived on average for only 6 months, this fell to 5 when up to 75% of the liver was involved and when the liver was still more extensively implicated the average survival was only 3 months. The longest survival of an untreated patient with liver metastases was 36 months. Recurrence at the anastomosis, again, is often extremely serious but curative resection is still possible. Vassilopoulos and his colleagues (1981) operated on 30 patients for such recurrent disease, all referred from other institutions. There was one postoperative death. Fifteen underwent a curative second resection with a median survival rate of 59 months and a 5-year survival of 49%. Three of these patients are alive and well at 96, 91 and 72 months.

Pihl and his colleagues (1981) in Melbourne review 1315 patients with large bowel cancer treated by Sir Edward Hughes by potentially curative resection between 1950 and 1978. Thirty-five (2.7%) subsequently presented with a recurrent tumour at the site of the anastomosis, 9 following resection of colonic tumours and 26 resection of primary tumours of the rectum. Fifteen of these patients underwent further surgical resection, 14 with curative intention and one by means of palliative resection in the presence of liver metastases. The remaining 20 had such widespread local or distant organ dissemi-

nation that no further surgical treatment was considered to be indicated. The 14 patients who had attempted curative resection had a median cancer-specific survival time of 41 months whereas the median survival time of the remainder was 8.5 months.

Anastomotic recurrence must be differentiated from the development of a second metachronous tumour, which itself may be eminently resectable. Welch (1981), reviewing this situation, gives a 2.8% incidence of metachronous growths in a review of the patients at the Massachusetts General Hospital. Of 63 patients with metachronous cancers, three developed a third, and one a fourth, metachronous tumour.

Of course, there is great interest in the role of carcinoembryonic antigen (CEA) estimations in the detection of recurrent cancer of the colon at an early enough stage to make further resection possible. Wanebo (1981) reviews four reported series of patients from Columbus Ohio, Rothwell Park, Boston and the Sloane-Kettering Institute. Positive explorations were reported in between 78 and 94% of patients submitted to a 'second look' procedure on account of a rise in the CEA level. Resectable disease was found in between 7 and 72% of these patients. The true effect on patient survival requires a carefully controlled prospective trial comparing interventions done as a result of a rise in CEA levels with the results of treatment based on clinical follow up.

Early detection

Farrands, Griffiths and Britton (1981) have documented an interesting experiment in population screening in Frome, Somerset. A group of 8925 people over the age of 40 years were invited to have Haemoccult testing for occult blood. Of these, 2439 accepted. There were 39 false positive tests which became negative after dietary restriction. Patients with piles and other anal conditions had these treated and the test was repeated 6 weeks later. A total of 8 adenomas and 4 cancers were detected and one false negative (a rectal carcinoma) has occurred so far.

Splenectomy and its dangers

The commonest indication for splenectomy is trauma (and this includes accidental injury to the spleen in the course of an upper abdominal operation, for example vagotomy or hiatus hernia repair). There are a wide variety of other indications for the operation, particularly congenital spherocytosis and idiopathic thrombocytopenic purpura. These days, more and more splenectomies are being performed in staging laparotomies for Hodgkin's disease. The procedure is a major one, often performed on seriously ill patients. This is reflected in the hospital mortality, which bears a direct relation to the gravity of the primary disease. Thus MacPherson (1981) reports one hospital death in 60

patients submitted to splenectomy for congenital spherocytosis, one in 81 patients with idiopathic thrombocytopenic purpura, 2 in 11 patients with myelofibrosis and no fewer than 6 in 16 patients with secondary thrombocytopenic purpura. The rise in the platelet count after splenectomy might be assumed to carry an increased risk of postoperative venous thrombosis. However, MacPherson notes only two confirmed instances of portal thrombosis in 151 patients with an anatomically normal portal bed but there were four early and four late thromboses in 92 patients with abnormal portal drainage. However, even with radioactive scanning, he has been unable to show an increased risk of deep venous thrombosis.

Recent years have seen increasing concern about the risk of infection following splenectomy, particularly in children. King and Schumacker (1952), in a now classical paper, reported meningitis in 4 infants, one of whom died, and an undiagnosed fatal pyrexia in a fifth, within 3 years of splenectomy for congenital spherocytosis. Other reports soon confirmed that severe infection and deaths in children due to fulminating sepsis was indeed a hazard after splenectomy for haematological disorders, particularly in younger children. Further reports then appeared reporting overwhelming sepsis following splenectomy for trauma in children and then there were reports of deaths in adults under the same circumstances. Of 36 published cases of post-splenectomy sepsis, Dickerman (1981) reports that 16 have been in adults and 11 of these were fatal. The organism in these adult cases was usually the pneumococcus, and one was due to *Haemophilus influenzae*. One case developed 31 years and one other 25 years after splenectomy. The importance of the spleen in infection is due to its production of immunoglobulin (IgM) antibodies against circulating bacterial antigens. The spleen is the sole source of tuftsin, a specific cell-bound leucophilic gamma globulin fraction that is essential for maximal stimulation of phagocytic activity of neutrophils. The spleen is also important in the regulation of both T and B lymphocytes (Sherman, 1981).

The characteristic clinical picture of post-splenectomy sepsis is of sudden onset with nausea, vomiting, headache and confusion leading to coma. The infection is usually fulminant and the mortality rate exceeds 50%. The infecting organism is the pneumococcus in over 50% of cases.

Although the incidence of overwhelming infection following splenectomy for trauma is apparently low, the consequences are devastating. A number of measures have therefore been investigated in an effort to reduce or eliminate this complication, particularly in children. They include non-operative management, surgical repair of the injured spleen,

partial splenectomy, autotransplantation of portions of the spleen, prophylactic pneumococcal vaccination and antibiotic prophylaxis.

Careful conservative treatment with radioisotope scanning has been used in selected patients with minor splenic injury. Sherman (1981) details the various conservative operations, including simple suture and omental patch of minor lacerations, the use of topical haemostatic agents, partial splenectomy and occasionally ligation of the splenic artery together with suture of a capsular tear. Experimental support for the concept of preservation of at least a part of the spleen is given by Greco and Alvarez (1981). They performed up to an 80% splenectomy in one-month-old rats and showed that this residuum protected the animals against pneumococcal bacteraemia.

Oakes and Charters (1981) give an interesting account of their attempts at conservative treatment in 24 cases of splenic trauma aged between 6 and 71 years. Two of these were due to knife wounds, 7 iatrogenic during surgery and 15 were due to blunt trauma. In four cases it was impossible to do anything other than remove the spleen but in 20 a repair was attempted. In one of these cases disruption occurred on the sixth day and an emergency splenectomy was carried out, but in the others success was obtained. These authors estimate that the risk of post-splenectomy sepsis is 0.58% after trauma compared with an 0.1% risk of a septic death in the general population.

Pachter, Hofstetter and Spencer (1981) review 27 patients with splenic trauma, 18 of whom were 15 years of age or older. Three required splenectomy because of complete destruction or avulsion but in the other 24 the spleen was rescued by debridement, partial splenectomy or suture repair with no untoward consequences. An interesting series of 68 consecutive splenic injuries in children up to the age of 16 is presented by King and his colleagues (1981). Twenty-two (32%) required splenectomy, and the only two deaths in the series occurred in this group as a result of associated cranial trauma. Parenchymal repair was performed on 16 occasions (24%) and non-operative treatment in 30 of the children (44%). One of the parenchymal repairs had recurrent haemorrhage which necessitated splenectomy. Other reports of a successful conservative approach have been published this year. Cooney (1981), reviewing 31 children, noted that 20 were managed conservatively with one requiring later surgery, 5 had splenic repair and only 6 needed immediate splenectomy. Giuliano and Lim (1981) found that 33 splenic injuries could be managed by conservative surgery without complications in a series of 92 adult cases; the rest were submitted to immediate splenectomy.

Francke and Neu (1981) advise that all splenectomized patients should be vaccinated with pneumococcal vaccine and this should be given, if at all possible, in patients who are to undergo elective splenectomy. Those patients with low initial levels of antibodies to pneumococci or those with a high risk of exposure, those on chemotherapy for lymphoreticular or other malignant disorders, children under 5 years of age, and possibly all patients in the first 2 or 3 years after splenectomy should receive prophylactic penicillin therapy (penicillin V or amoxicillin). Erythromycin can be used in patients allergic to penicillin. Any 'flu-like' illness after splenectomy should initiate the taking of cultures and treatment with an anti-pneumococcal, anti-*Haemophilus influenzae* antibiotic, since early treatment may reduce morbidity and mortality pending culture results.

Schwartz (1981) is more conservative in his advice—polyvalent pneumococcal vaccine (Pneumovax) and oral penicillin until puberty for children but no active treatment for adults, where risk of infection is very low. He considers that there is need to compare the rate of sepsis in adult patients undergoing splenectomy for haematological disease treated with vaccine and antibiotics with that in those with identical disease in whom the spleen is not removed.

In a fascinating paper from Rochester, New York, Patel and his colleagues (1981) give an account of four examples of autotransplantation of slices of traumatized spleen in four patients for preservation of splenic function. In each, thinly sliced (3 mm) segments of spleen, roughly 20 g, were placed in an omental pouch. All patients survived without complications. Postoperative studies showed that, at 4 weeks, Howell-Jolly bodies and target cells had disappeared from the blood film, platelet counts returned to normal range and initially low IgM levels increased to normal. Scans at 8 weeks confirmed the presence of functioning splenic tissue. In subsequent discussion on the paper, the authors reported that a total of 10 patients had now undergone such splenic implants, 7 at splenectomy for traumatic rupture, one in whom the spleen had been removed during distal pancreatectomy, another in whom the spleen had been removed during staging laparotomy for Hodgkin's disease after the pathologist had shown that the sections were free from disease and another in whom the patient had suffered spontaneous rupture during the course of infectious mononucleosis. Obviously this procedure will require serious evaluation.*

*Editor—(A detailed review of the risks of splenectomy and conservative approaches to the management of splenic trauma has recently been published (Werbin, N. & Lodher, K. (1982) *Postgraduate Medical Journal*, 58, 65)).

Breast

Publications on carcinoma of the breast continue to proliferate, with particular interest in the conservative treatment of breast cancer, the role of adjuvant chemotherapy and the value of hormone receptors in prognosis.

For many decades, radical mastectomy was regarded as the only form of treatment for operable breast cancers—indeed, to suggest any other treatment modality was considered sacrilegious. There is now excellent evidence that comparable results can be achieved by more conservative measures involving far less mutilation of the patient. Turner and his colleagues (1981), for example, report 534 patients in Manchester randomized between radical and more conservative mastectomy. The trial took place between 1969 and 1976 and showed no difference in total survival, local recurrence, distant metastases or disease free period. In many centres, simple mastectomy is being combined with prosthetic implantation or reconstruction, either at the time of mastectomy or later (Gant and Vasconez, 1981). Although the cosmetic result is often not particularly pleasing, many patients are satisfied by the result. Some surgeons try to conserve the nipple and areola in these procedures in order to improve the cosmetic results. However, Andersen, Gram and Pallesen (1981) studied 80 consecutive mastectomy specimens and found that in no fewer than 35 (43.8%) of these histological examination revealed nipple or areolar involvement. Only six had obvious clinical changes in this area.

Some surgeons have gone to the other extreme of advising local excision of the tumour alone. However, multi-centric lesions in clinical breast cancer have been found in up to 41% of cases (depending on the care which the pathologist takes in searching for small foci of cancer in distant parts of the breast) (Leading Article, 1981). For example, Westman-Naeser and his colleagues (1981), in Sweden, reviewed 173 mastectomy specimens. Fifteen of these showed macroscopic multifocal lesions, 26 demonstrated microscopic invasive foci elsewhere in the breast and 11 showed epithelial proliferation with severe atypia or cancer, a total of 30% of multifocal lesions. These were not related to the size of the tumour or the presence of axillary metastases.

However, there is now intense interest throughout the Western world in the role of minimal surgery (local excision of the tumour itself) combined with intensive radiotherapy. Published results from centres in France, Canada and the U.S.A. give survival rates which are identical with those of radical mastectomy, combined with a high degree of local control and excellent cosmetic and functional results. At Westminster we have gone over to this technique with enthusiasm and our immediate results are

highly encouraging (Ellis, 1981). Witte (1981) considers that mastectomy is only required if the primary tumour is large and states 'removal of a female breast, a source of considerable physical and emotional trauma, is seldom necessary'. Martinez and Goffinet (1981), from Stanford University, give details of their iridium implantation technique which gives a highly localized irradiation, with excellent local control. Lavigne and Minet (1981), from Liege in Belgium note that the 5 year survival of 114 patients submitted to local excision plus radiotherapy is the same as following more aggressive and more mutilating treatment.

Many surgeons have considered that the proof that conservative surgical treatment followed by radiotherapy is comparable to conventional treatment must require a controlled randomized study but there have been obvious difficulties in a trial of this nature, particularly in the randomization of patients into a radical surgery and conservative group. However, an important paper from Veronesi and his colleagues (1981) from the National Cancer Institute in Milan now presents such a study. This was carried out from 1973 to 1980 and comprised 701 patients with breast cancer measuring less than 2 cm in diameter and with no palpable axillary nodes, who were randomized between the classical radical mastectomy and local excision of the tumour with axillary dissection and radiotherapy. There were 349 patients in the radical and 352 in the conservative group. The two groups were comparable in age distribution, size and site of the primary tumour, menopausal status and frequency of axillary deposits. There were three local recurrences in the radical mastectomy group and one in the conservative group. Actuarial curves showed no difference between the two groups in disease-free or overall survival. The authors stress that the results cannot be considered final, since the longest follow up period is 7½ years, but it appears unlikely that the two groups will show different results with respect to local recurrence after a longer follow up period since most local or regional recurrences occur within 3 years of treatment. Another unsolved problem is the risk of late carcinogenesis induced by radiation therapy in the very long term.

Prognosis and adjuvant therapy

One of the most important thrusts in clinical research in breast cancer involves attempts at defining those patients whose prognosis is grave and in whom adjuvant therapy might be indicated, and also to try and define those patients with disseminated disease who are likely to respond to hormonal or cytotoxic therapy.

The anomaly of the patient with an apparently 'early' breast cancer who yet rapidly disseminates

and dies has been studied by Nealon and his colleagues (1981) at St Vincent's Hospital New York. They divided their $T_1N_0M_0$ patients into those with or without any of the following histological characteristics: undifferentiated cytology, lymphocytic penetration, blood vessel invasion and invasion of surrounds. If none of these factors were present, there was only a 5% failure rate 3–8 years after mastectomy compared with a 38% failure rate if any one of these unfavourable features was present. At 10 years, 44% of 130 patients who had no lymph node metastases but were histologically at high risk were alive and only 30% of these were tumour free compared with 100% 10 year survival of 83 low risk patients, 99% of whom were tumour free.

Campbell *et al.* (1981) confirm that poorly differentiated breast tumours are more likely to develop regional and distal metastases at an earlier stage than well differentiated or moderately differentiated tumours. Interestingly enough, local recurrence in the mastectomy flap was not related to histology.

Important knowledge is accumulating on the prognostic value of hormone receptors in breast cancer. Croton and his colleagues (1981) have studied 414 early cases of breast cancer and confirm that oestrogen receptor positive tumours show a better survival than receptor negative cases. This they have shown to be true for both pre- and post-menopausal patients.

It is well known that oestrogen receptor negative patients with disseminated disease have less than a 10% chance of responding to hormone therapy (Carter and Rubens, 1981) and this chance drops still lower if progesterone receptor is simultaneously absent. Interestingly enough, Paone and his colleagues (1981) have now studied 50 patients treated with quadruple cytotoxic therapy for disseminated breast cancer. Of those patients who were oestrogen receptor positive, 12 out of 16 responded to cytotoxic therapy compared with only 6 out of 34 who were oestrogen receptor negative. Of 30 patients who were both oestrogen and progesterone receptor negative, only four responded. The survival time after the first recurrence was also significantly lowered in this group. The same authors found that hormonal response in another group of patients was 23 out of 33 patients who were oestrogen receptor positive compared with only three out of 22 who were oestrogen receptor negative. It must be noted, however, that other studies have shown either no, or a reversed, correlation between oestrogen receptor positive tumours and cytotoxic response (Umsawasdi *et al.*, 1981).

At present the most widely used indicator of prognosis in 'early' breast cancer is whether or not the axillary nodes are involved and it is in those

patients who are axillary node positive that trials of adjuvant therapy have been conducted. Rossi and his colleagues (1981) report their latest results in their cyclophosphamide, methotrexate and fluorouracil (CMF) programme. The 5 year results are now available on 179 patients treated by radical mastectomy *v.* radical mastectomy followed by adjuvant chemotherapy in 207 patients. This comprised 12 monthly cycles of CMF. Both relapse-free survivals (controls 44.6%, CMF group 59.5%) and total survival (controls 66.2%, CMF group 78.4%) were significantly improved and were independent of CMF-induced amenorrhoea in pre-menopausal women. The later results of this important trial will be awaited with considerable interest.

Of course, an important question to ask is whether adjuvant hormonal therapy might be of value in patients who have oestrogen receptor positive tumours (Powles, 1981). Fisher and his colleagues (1981) report on a multi-centre trial at 68 institutions in the U.S.A. and Canada which suggests that the addition of tamoxifen to adjuvant chemotherapy using L-phenylalanine mustard combined with fluorouracil enhances the disease-free survival of patients with primary breast cancer and positive axillary nodes in cases over the age of 50 years with oestrogen receptor positive tumours. These benefits were achieved during a 2-year period of the trial and the authors point out that how well the benefits achieved will be subsequently maintained requires additional follow-up study.

In assessing the implications of adjuvant cytotoxic therapy, it must always be remembered that there are often marked side effects to the treatment. McArdle and his colleagues (1981) note that 85% of their patients receiving adjuvant CMF therapy had nausea and vomiting and over one-third of the patients required a wig because of alopecia or developed mucosal ulceration. Twelve months after mastectomy, psychiatric morbidity was present in 13 of 34 patients receiving chemotherapy compared with only one of 18 in the control group and this trend was still present 6 months after the completion of CMF therapy.

An important study on prophylactic oophorectomy has been published by Bryant and Weir (1981) from Regina, Canada. This comprises a group of 359 patients followed up for 5 years (240 of these observed for 10 years) randomized between mastectomy alone and mastectomy combined with oophorectomy. When 1–3 of the axillary nodes were involved, women under the age of 50 in the oophorectomy group benefitted as regards relapse-free status at 5 years, and both relapse-free and survival status at 10 years, compared with controls. Patients who were older than 50 years or who were node negative showed no benefit. A further similar study

combined with oestrogen receptor estimations would be of intense interest.

A fascinating report from Bergen (Hartveit *et al.*, 1981) suggests, on a small series of 63 mastectomy specimens, that node involvement is less common on the left than the right. These authors suggest that it may be that right-handed patients palpate the left breast more accurately in self-examination—an observation that might or might not be confirmed on a larger series of patients. These authors also state that it has long been held that the left breast is more prone to cancer than the right. They point out that in many cases the side of the breast tumour is not recorded. Again, this is an observation that modern computer-aided programmes could soon confirm or refute.

We have carried out a study to assess the types of breast pathology likely to be encountered in a general surgical out-patient clinic (Cox and Ellis, 1981). A review of 383 consecutive patients referred by general practitioners with breast complaints revealed that no less than one-third had no detectable breast pathology. Fibroadenosis accounted for 18%, and cancer for 13% (53 patients). The remainder had various benign lesions, particularly cysts (15%) and fibroadenomas (7%).

Peripheral vascular disease

There is a strong correlation between the prognosis of patients with arteriosclerotic occlusion of the lower limb and smoking. The subject has been well reviewed by Thomas (1981), who points out that 90% or more of patients with peripheral vascular disease smoke. The relationship between smoking and arteriosclerosis is complex and not simply cause and effect. Thus a comparison of the mortality rates from arterial disease between American and Japanese has shown the former to be seven times as great, even though the Japanese are the heavier smokers. Having developed symptoms of peripheral vascular disease, patients and even their doctors sometimes argue that the damage has already been done and there is therefore little point in giving up smoking. However, a 5-year follow-up study at the Mayo Clinic showed that patients with peripheral vascular disease who continued to smoke underwent amputation in 11.4% of cases, while in those who gave up smoking none suffered amputation (Thomas, 1981).

Unfortunately, it is difficult to persuade people to stop smoking and the results of anti-smoking clinics are disappointing, with success rates between 15 and 25% even though people who visit these clinics are probably the most motivated. Indeed, the patient's word is unreliable, and measurement of the serum thiocyanate level or the blood carboxyhaemoglobin (COHb) will reveal that many patients who state

that they have given up smoking have not, in fact, kicked the habit.

Greenhalgh (1981) and Greenhalgh and his colleagues (1981) have studied 64 patients who had undergone arterial reconstructive surgery. In 12 instances the surgery had failed in an interval from 3 months to 5 years after operation. Only one of these 12 patients had a low COHb level, in contrast to 50% of the patients who still had patent vascular reconstructions.

Thomas (1981) concludes his review by stating 'Vascular surgery has reached the point where new patients attending clinics with intermittent claudication should not be offered elective arterial reconstruction unless it is confirmed that they have stopped smoking. A vascular surgeon may be doing his smoking claudicant patient a disservice by operating on him as surgical options will be reduced when later symptoms of rest pain or gangrene appear'.

Lusby and his colleagues (1981) point out that little is known about the acute effects of smoking on the major vessels. They studied two groups of middle-aged men, all habitual smokers, but divided into those with no history or signs of vascular disease and those awaiting reconstructive arterial surgery. Using Doppler probes, they showed that patients with occlusive arterial disease had a significant shortening in the transit time delay between arrival of the pulse at the radial and posterior tibial arteries, suggesting a stiffening in the main vessels in response to smoking, which was not seen in the control subjects. In patients with occlusive disease, the digital pulse volume recorder amplitude decreased significantly in response to both low and high nicotine cigarettes, suggesting that little is to be gained by switching from high to low nicotine cigarettes. The plasma noradrenaline concentration increased at the end of smoking and returned to the basal level at 15 min in both the patients with occlusive disease and the matched normals. There was no increase in plasma noradrenaline concentration associated with sham smoking. This study has shown an increase in cigarette-induced vascular reactivity, particularly a main vessel response, in patients with atherosclerosis compared with normal subjects. The increase in vessel wall stiffness may play a role in the development of main vessel atherosclerosis. Since not all smokers develop the symptomatic lesions, these authors suggest that individual susceptibility to the effects of cigarette smoking may be an important antecedent to the later development of atheroma.

Aneurysm of the aorta is always a subject of intense interest to the abdominal and vascular surgeon. Its rupture constitutes probably the most dangerous and testing of the common emergency situations that these surgeons are called upon to

treat. Kessler and Gaylis (1981) report a 6.3% mortality for elective surgery for non-ruptured aortic aneurysms at the Johannesburg General Hospital over a 15-year period, but this rose to 58% in the 105 patients with ruptured aneurysms.

Fielding and his colleagues (1981) present a masterly review of the subject from the Queen Elizabeth Hospital, Birmingham. They present a 20-year experience of 528 abdominal aortic aneurysms. The marked difference in prognosis between those dealt with electively (with a mortality of 8%) or in the acute phase (with a mortality of 19%) compared with those that have ruptured by the time the patient is admitted to hospital (with a mortality of 42%) is well demonstrated. In this series there were 222 elective, 72 acute, and 174 ruptured aneurysms. A further four patients had already developed an aorto-duodenal fistula. Fifty-six (11%) were not resected because they were too ill or for some other reason. In 91% of the cases the diagnosis could readily be established by the presence of a pulsatile abdominal mass on clinical examination. After successful resection the overall 5 year survival was 65% and there was no significant difference between elective, acute and ruptured cases. This survival after resection compares favourably with the expected 76% survival of a similar normal population. It is interesting that 22 of the patients who had had resection deferred for medical reasons or small size of the aneurysm subsequently required emergency surgery and no fewer than 10 of these died. The Birmingham group consider that conservative management should be advised only in asymptomatic poor risk patients with aneurysms less than 6 cm in diameter. These should be kept under close observation and modern non-invasive investigations should be used, such as ultrasound or computerized tomography; should the aneurysm enlarge or symptoms develop, resection should be undertaken forthwith. The Birmingham group emphasize, however, that the standard management for aortic abdominal aneurysms should be surgical treatment.

Once the aneurysm has ruptured, control of the aorta above the aneurysm is a matter of life and death. Many techniques have been advised, including opening the chest with temporary cross clamping of the thoracic aorta, laparotomy with clamping of the aorta at the hiatus, direct pressure on the aorta, either with the surgeon's fingers or a special compressor, or inserting the thumb or an inflated Foley catheter through the open aorta. All of these involve opening the abdomen (or the chest) and, if the aneurysm has already ruptured intraperitoneally, the patient may well exsanguinate before control can be obtained. Sensening (1981) reports a most ingenious technique to obtain rapid control under such cir-

cumstances. He passes a Fogarty catheter of 8/22 F gauge under local anaesthetic in a retrograde manner from the femoral artery upwards into the thoracic aorta. The balloon is inflated with 43 ml of saline after administering heparin. This technique is aimed at avoiding the often fatal hypotension that occurs on induction of general anaesthesia or opening the abdomen in the hypovolaemic patient. This technique was carried out successfully in a patient of 89 who was then able to undergo an immediate graft replacement of the ruptured aneurysm. The author was hoping to be able to claim that this was the oldest patient to survive a ruptured aortic aneurysm, a search of previous publications, however, revealed that this was not so—the oldest was aged 90! If it proves impossible to pass the Fogarty catheter retrograde through the aneurysm, it may be necessary to proceed to laparotomy and to introduce the catheter directly through a small opening in the aneurysm wall itself.

Ex-vivo arterial surgery

A fascinating spin-off from renal transplantation and renal preservation techniques is the removal of a diseased kidney from the patient, carrying out reconstructive surgery (often using microvascular surgical procedures) on a 'work bench' and then transplanting the repaired kidney back into the patient. More and more reports of such surgery have been published over the last 7 or 8 years. Among the conditions amenable to this technique are the repair of renal vascular lesions, traumatic lesions to the solitary kidney, renal tumour in a solitary kidney, staghorn renal calculi and ureteric injuries. The *ex-vivo* repair can be performed under continuous hypothermic perfusion or simple cold storage using cold sterile saline slush solution. The organ does not necessarily need to be totally removed but can be placed on the abdominal wall on a specially constructed platform with the ureter still connected. With the kidney widely exposed, reno-vascular operations may be performed using microvascular instruments along with optical magnification. Munda and his colleagues (1981) present six such cases in which renal vascular reconstruction was performed. There was one example each of fibromuscular hyperplasia, medial arterial fibroplasia, renal artery aneurysm, atherosclerosis, iatrogenic arteriovenous fistula and traumatic venous laceration. These authors also give a useful review of previous publications in this field.

Novick, Straffon and Stewart (1981) describe a remarkable experience from the Cleveland Clinic of extracorporeal renal operations carried out on 43 patients for complicated urological disorders. There were 21 examples of reno-vascular hypertension with microvascular arterial reconstruction,

16 examples of ureteral disease (including 12 iatrogenic ureteric injuries), 6 centrally located carcinomas in solitary kidneys treated by partial nephrectomy (with 3 of the patients alive and well one to 5 years later) and two patients with recurrent stones in a solitary kidney.

This exciting development allows for the conservation of renal tissue that might not be possible by standard vascular techniques and should be considered before a nephrectomy is undertaken, especially in the patient with a single kidney where the only alternative is donor renal transplantation.

Venous thrombosis

The incidence of deep vein thrombosis in patients undergoing general surgical operations exceeds 30% in the United Kingdom and pulmonary embolism remains a much feared complication of major abdominal and hip operations. The magnitude of this problem has led to increasing efforts to control the development of deep vein thrombosis by two major prophylactic measures. One technique limits the thromboembolic process by decreasing the coagulability of the blood through anticoagulation therapy; the other reduces the development of venous clots in the leg by increasing venous velocity by the use of mechanical techniques. It would appear that there has been a reduction in surgical deaths from pulmonary embolism as a result of these and other measures. Ruckley (1981) notes that analysis of operations and mortality data from nine units in the Edinburgh Surgical Audit shows that the overall incidence of pulmonary embolism in patients who died fell from 0.4% of all operations in 1959 to 0.2% in 1979. In patients below the age of 80 years who have an otherwise good prognosis, the incidence fell to a fifth of the 1959 level, from 0.28% to 0.06%.

The complications associated with the use of anti-coagulants have stimulated interest in the use of mechanical methods for preventing deep vein thrombosis. For example, we have published a trial from Westminster (Scurr *et al.*, 1981) of a simple machine which causes plantar flexion and dorsiflexion of the feet while the patient is on the operating table. Sixty-six patients over the age of 40 undergoing major abdominal surgery were randomized between the controls and the pump group. The presence or absence of deep vein thrombosis was determined using ¹²⁵I-fibrinogen and positive scans were confirmed by phlebography. Forty-five percent of the control patients developed deep vein thrombosis compared with 18% in the pumped group ($P=0.05$). Moser and his colleagues (1981) in Geneva compared subcutaneous heparin as a prophylactic measure with pre-operative mechanical boot compression for legs combined with active

postoperative physiotherapy. The incidence of deep vein thrombosis and pulmonary embolism was comparable in both groups as assessed by radioactive fibrinogen scanning and Doppler studies of the lower limbs.

While on the subject of confirmation of diagnosis, Grimley and his colleagues (1981) describe an interesting new technique for the diagnosis of deep vein thrombosis—autologous platelets were labelled with radioactive indium and re-injected into patients, who were then imaged with a gamma camera and the data processed by a computer. Areas of increased uptake on imaging were correlated with the sites of thrombi identified by bilateral ascending venography. Venography in 27 patients with clinically suspicious deep vein thrombosis identified 12 unilateral and five bilateral thrombi. The overall correlation between venography and labelled platelet scanning was 84%. False negative images of deep vein thrombosis of the thigh occurred at 3 sites in 3 patients, 2 of whom had been receiving heparin therapy and the third had venography before completion of the scan. In the calf, 8 false negative images occurred in 6 patients, 4 of whom had received heparin therapy, one had an ischaemic calf and the other had a venography on the day of imaging. The authors conclude that this technique offers a useful method for the diagnosis of both early and established thrombi at any site in the lower limb.

Experimental and clinical studies

The explosion in technology places a wide variety of exciting new tools and materials into the hands of the surgeon. Moreover, each time he carries out an operation, a surgeon, in effect, performs an experiment. Is there any wonder, therefore, that to-day's surgical journals are replete with animal and clinical studies which hold considerable promise for future progress?

As examples of new technological applications, Wels, Rainstein and Heller (1981) report experiments in dogs in the use of a coagulum made up of thrombin and cryoprecipitate within the common bile duct to remove stones and have applied this to one patient. This may well prove to be useful in dealing with a common bile duct filled with gravel and sludge, particularly if the coagulum extends into the finer radicals of the bile ducts in the liver. Colasante and his colleagues (1981) have studied the value of low frequency sound as a prophylaxis against adhesions in the rat. They found that adhesion formation was reduced when the animal's abdomen was exposed to infra-sound for a period of 12 days. They postulate that the sound waves generate micro-motion of the abdominal organs and thus decrease spanning fibrin formation.

Surgeons spend much of their time in close observation of wound healing and it is not surprising therefore, that this subject continues to engender a vast amount of experimental and clinical work. Arnaud and his colleagues (1981) from Strasbourg have confirmed experimental work we carried out some years ago at Westminster that obstructive jaundice produced by common bile duct ligation in the rat produced histological and bursting strength evidence of delayed healing in abdominal wounds. We have now studied the effects of jaundice on wound healing by growing fibroblasts in normal culture media, in culture media to which bilirubin has been added and in culture media containing sera from jaundiced patients. In both the latter cases there were marked morphological changes in the fibroblasts and impairment in cell growth. Fibroblasts die in culture media containing concentrations of bilirubin above 170 $\mu\text{mol/l}$. The site of the toxic action of bilirubin may well be on the membrane of the fibroblast although more work is required to determine the exact mechanism and site of this effect (Taube, Elliott and Ellis, 1981).

An interesting and unexplained observation in our laboratory is that splenectomy in the rat, carried out 100 days previously, impairs the healing process of a fresh laparotomy wound compared with sham-operated controls (Werbin and Bucknall, 1981). Splenectomy carried out at 5 days previously has no such effect.

Seifter and his co-workers (1981) from the Albert Einstein College of Medicine, New York, who have already demonstrated that vitamin A appears to stimulate the early inflammatory response to wounding, now report that the malign effect of streptozotocin-induced diabetes on wound healing in the rat is prevented by supplemental vitamin A. Since the diabetic patient presents such a clinical problem to the operating surgeon, this is obviously a topic worthy of further investigation.

Protein deficiency in the experimental animal has been shown in the past to affect wound healing. As a result of this, strenuous efforts are often made to restore protein loss in patients with such conditions as carcinoma of the oesophagus or severe granulomatous disease of the large bowel. However, Higgins, Keighley and Allan (1981) studied 106 patients with inflammatory bowel disease subjected to major surgery and could find no correlation between pre-operative weight loss and morbidity as regards postoperative sepsis or delayed wound healing. There is no doubt that it would be of immense interest to know if there is a level of protein depletion below which surgical intervention becomes a hazard.

Whether fibroblasts and macrophages in healing wounds are derived from circulating leucocytes or

local tissue precursors has been debated since the times of Virchow and Cohnheim. An ingenious human experiment was reported by Stewart and his colleagues (1981) which took advantage of a marrow graft from a boy to his sister for aplastic anaemia. Ninety-seven days after transplantation, a skin biopsy was obtained from the girl's chest and 5 days later the biopsy wound was excised. Fibroblast-like cells emigrating from explants of the skin wound had the host karyotype, whereas macrophages had donor markers. These results suggest that the wound fibroblast in man is of local tissue origin, whereas wound macrophages are derived from haemopoietic tissue.

The search for the ideal technique to close laparotomy wounds continues. Pollock (1981), in a study of nearly 1000 major laparotomies, found that the incidence of incisional hernia was 10%. Significant factors were male sex, old age, postoperative chest complications and, particularly, wound infection. The same author's team in Scarborough (Mayer *et al.*, 1981) carried out a controlled trial comparing nylon closure of laparotomy wounds placed under ordinary tension and tightened using a 5 kg spring balance to exert tension on each loop. Surprisingly enough, the incidence of incisional hernia fell from 10% to 5.5% when the compression sutures were used. Under 5 kg tension, nylon stretches by 9% and this accounts for the commonly observed fact that nylon placed under ordinary tension in the abdominal wound is found to lie in loose loops when subsequently exposed, presumably due to the stretching of the nylon by postoperative distension.

Remarkably good results are claimed for the new synthetic braided long-term absorbable suture material polyglactin (Vicryl). Corman, Veidenheimer and Collier (1981), from the Lahey Clinic, compare 53 laparotomies for bowel surgery closed with interrupted single layer prolene (a monofilament non-absorbable suture) with 59 comparable cases closed with Vicryl. In the latter, there were no sinuses, no burst abdomens and no hernias compared with an incidence of 5.7% of sinus, 4.4% of hernia and one example of burst abdomen in the prolene group. Another group of 49 cases sutured with braided nylon gave a 12.2% incidence of sinus and 8.9% hernia, although there were no burst abdomens. Sloop (1981) claims no hernias or burst abdomens in a consecutive series of 134 cases closed either with Vicryl or polyglycolic acid (Dexon). However, the series included an unspecified number of infants and children and one notes that, apart from the vascular cancer cases, other patients were not seen in follow up unless the patient so wished. Our own results with Dexon were far less happy. Of 104 major laparotomy wounds sutured by the mass closure technique using polyglycolic acid (Dexon) there was one burst abdomen and 12 incisional

hernias (12.5% failure rate). Of 106 patients closed with mass nylon there was one burst abdomen and four hernias (a 4.7% failure rate). The difference between these two was significant at the $P=0.04$ level (Bucknall and Ellis, 1981). Interestingly there was no reduction in the incidence of sinus formation with the absorbable suture. Like Pollock's work, quoted above, we found incisional hernia to be related to male sex, postoperative chest complications and, especially, to infection.

Two interesting studies have demonstrated that braided suture material provides an excellent nidus for bacteria compared with monofilament sutures. Katz, Izhar and Mirelman (1981), in Jerusalem, demonstrated that bacterial adherence, implantation of bacteria into the wound, and removal of bacteria from implanted sutures was greater with braided material than monofilament nylon and their electron microscopic studies showed a high adherence of bacteria to the braided material, particularly Dexon. At Westminster, Bucknall (1981) studied implanted silk, braided nylon, polyglycolic acid and monofilament nylon contaminated with *Staphylococcus aureus* and again was able to demonstrate the increased transmission of infection with the braided material. Interestingly enough, the normal absorption of polyglycolic acid was somewhat delayed in the infected wounds, probably because the surrounding polymorphs prevented macrophage absorption of the sutures. The fact that polyglycolic acid lost 96% of its tensile strength in infected wounds at 30 days and 92% of its strength in non-infected wounds might be related to our findings of a high incidence of incisional hernia using this material (Bucknall and Ellis, 1981).

Obviously the reduction of wound infection would be an important factor in improving the results of abdominal closure, as well as reducing the nuisance of postoperative sepsis and its potential danger. Gray and Lee (1981) found that topical povidone iodine reduced the incidence of wound infection in contaminated abdominal surgery from 52% to 11% and considered this to be a 'safe and effective means of reducing wound sepsis following gastrointestinal surgery'. Walsh and his colleagues (1981), in contrast, found no overall reduction in the infection rate using povidone, although the patients in the povidone iodine group had on average a shorter stay in hospital, suggesting that at least the severity of the infection was reduced! Certainly much work still needs to be carried out on postoperative wound sepsis following abdominal surgery since this persists as a common bugbear which pesters the surgeon.

A relatively uncommon but serious problem in wound healing is presented by the extensive full thickness loss of the abdominal wall. This subject

has been reviewed in detail by Stone and his colleagues (1981) of Atlanta who present 167 cases treated over a 20-year period. The mortality is in the region of 25%. Causes include necrotizing infection, trauma and *en bloc* tumour excision. Attempts to close the wound under tension are disastrous and best results are obtained using a prolene mesh placed over the defect. Damaged bowel should be exteriorized and final reconstruction should be delayed until all fistulae have been closed. Eventually cover is obtained with skin or myocutaneous flaps. They found that skin grafts could be placed directly over granulations growing through the prolene mesh. Randle-Voyles and his colleagues (1981), however, were less happy with skin grafts placed over the granulations through polypropylene mesh (Marlex) for acute full thickness closure. They found that the mesh often extrudes and may be complicated by bowel fistulae. They recommend using the mesh as a temporary measure and then removing this at the time of either a formal closure or, if this is not possible, placing a full thickness flap over the mesh.

A wide variety of clinical practices continue to be investigated by carefully designed studies. For example, Godfrey and his colleagues (1981) have studied ventilatory capacity after 3 methods of anaesthesia for inguinal hernia repair—epidural, general and local anaesthesia. General anaesthesia was found to produce more depression of the FEV₁ and FVC than the other techniques but there were no more clinical chest complications than with the other methods in a total of 100 cases.

Intolerance of oral fluids is, of course, extremely common in the immediate postoperative period after abdominal surgery. Ingram and Sheiner (1981) have studied the ability of the stomach to empty 100 ml of water by means of a radioisotope technique following elective cholecystectomy. There was wide variation in the findings in 20 patients, being normal in some but absent in others. There was no correlation between gastric emptying and the age of the patient, plasma potassium, duration of the operation or the anaesthetic. However, a significant correlation was found between gastric emptying and the drugs administered in the peri-operative period. In particular, gastric emptying was grossly retarded following an injection of opiate, but this returned to normal if more than 5 hr had elapsed since the last injection was given. These authors suggest that opiate therapy is a major factor in the patient's inability to tolerate fluids following cholecystectomy.

I have always believed that it is wrong to insist on active shoulder exercises following mastectomy or axillary dissection although many a physiotherapist or Sister of the old school will insist that the patient must exercise the shoulder. Lotze and his colleagues (1981) have now put this to the discipline of a con-

trolled trial. Patients were randomized to early (1 day) or delayed (7 days) shoulder movements after axillary dissection for melanoma or extended mastectomy. Early motion was accompanied by increased amount of drainage, more days of drainage, more wound breakdown and infection and later discharge from hospital than in the conservative group. No difference in the range of movement achieved was found at one, 3 or 6 months post-operatively—a triumph for conservatism.

Perhaps the most surprising study of the year was the report by Orr (1981) entitled 'Is a mask necessary in the operating theatre?'. He pointed out that the efficacy of masks in reducing wound infection has not been established even though their efficiency in reducing bacterial contamination has been studied in the greatest detail. Over a 6-month period masks were not used in the operating theatre. No restrictions were imposed on talking, movement, beards or colds. In fact, the theatre routine remained unchanged except that no-one wore a mask. Of 432 operation wounds, the infection rate was 1.8%. This showed no increase in the rate of wound infection over the previous four years. In fact, there was a significant decrease! The 8 infections which did occur bore no relation to the throat or nose cultures from the theatre teams, all 8 infections being the result of bowel organisms. Seven of these operations involved opening the gut or the bladder and one was in the repair of an incisional hernia. The author concludes that the wearing of a mask has very little relevance to the well-being of patients undergoing routine general surgery.

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