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Gastrointestinal complications after cardiac surgery

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Gastrointestinal complications after cardiac surgery are uncommon, but are associated with a high morbidity and mortality. Over 11 years 8559 procedures requiring cardiopulmonary bypass were performed in this unit and 35 patients were identified who developed gastrointestinal complications after surgery, an incidence of 0.41%. There were nine deaths in this group, a mortality of 25.7% compared with an overall mortality after cardiac surgery in Ireland ranging from 3.24% to 4.81%. These complications required surgery in 21 patients. The most common indication for surgical intervention was upper gastrointestinal bleeding in 10 patients, three patients had acute pancreatitis, two patients had perforated peptic ulcer; two patients had intestinal ischaemia, with five cases of colon pathology. The difficulties of making an early diagnosis are outlined and a low threshold to exploratory laparotomy is recommended.

Gastrointestinal complications after cardiac surgery are infrequent. The reported incidence varies from as low as 0.12% *(1)* to 2% *(2)*; most series quote an incidence between 0.9% and 2% *(1,3–5)*. The mortality due to these complications is high, ranging from 12% *(1)* to 67% *(5)*. This study reports the experience of gastrointestinal complications in this unit over an 11.25-year period and is aimed at identifying those patients most at risk of developing these complications.

Methods

Hospital records dealing with the period September 1979 to June 1990 were consulted, identifying those patients who developed gastrointestinal complications after cardiac surgery. A gastrointestinal complication was defined as any postoperative complication involving the gastrointestinal tract requiring medical or operative therapeutic intervention. Patients' records were studied to obtain details of age and sex, the cardiac surgical procedure performed, the type, time and mode of presentation of the gastrointestinal complication, pre- and postoperative drug therapy, the occurrence of other major complications, inotropic and mechanical circulatory support and the length of time on peroperative cardiopulmonary bypass.

Results

During the 11.25 years of the study, 8559 procedures involving cardiopulmonary bypass (excluding transplants) were performed in the Mater Cardiac Surgery Unit. In this group, 35 patients were identified who developed gastrointestinal complications after cardiac surgery. These 35 patients developed a total of 37 gastrointestinal complications.

The group comprised 20 males and 15 females. The affected patients ranged in age from 14 to 71 years, with a mean age of 59.6 years. The modal age of the affected group was 65–69 years.

These 35 patients underwent a range of cardiac operations (Table I), the majority of patients having coronary artery bypass grafts, valve replacements or a combination of these. The mean number of grafts performed was 3.3 (range 2–4) and the mode was three grafts. Nine patients had single valve replacement (6 mitral and 3 aortic) and three had double valve replacements (one patient had mitral and aortic valve replacement and two had mitral and tricuspid valve replacement). Two patients had triple

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Table I. Nature of cardiac procedure

Procedure		*No.*
Coronary artery bypass graft (CABG)		18
Valve replacement		15
Single	9	
Double	3	
With CABG	2	
With repair of sinus of Valsalva	1	
Repair of aortic dissection		2

coronary bypass with aortic valve replacement, and one patient had an aortic valve replaced with repair of an aneurysm of the sinus of Valsalva.

The time on cardiopulmonary bypass for the affected group ranged from 47 to 242 min, with a mean bypass time of 100 min, compared with an overall mean bypass time during the 11 years of 96.1 min. Of 35 patients who developed gastrointestinal complications after cardiac surgery, nine died; a mortality rate of 25.7%.

Failure in at least one organ system other than the gastrointestinal tract developed in 25 patients in the group. All the patients who died had developed failure in one other organ system, and most experienced failure in two organ systems other than the gastrointestinal tract.

In order of frequency, the three most common other organ failures were: cardiac, 18 patients had low cardiac output states postoperatively; renal, 10 patients had renal failure postoperatively; and respiratory failure affected 10 patients. One patient developed postoperative hepatic failure.

A total of 11 different types of gastrointestinal complications were encountered after cardiac surgery. Table II shows the number of patients who developed each complication and the mortality in each of the 12 groups. The mean hospital stay for these patients in the final 4 years of the study was 38.6 days, with a mean stay in intensive care of 17.3 days, compared with a hospital stay of 10 days and 1 or 2 days in intensive care for the uncomplicated cardiac surgery patient.

Table II. Abdominal complications and mortality

Complication	*No. of cases*	*No. of deaths*	*Mortality (%)*
Upper gastrointestinal bleed	22	5	22.7
Acute pancreatitis	4	2	50
Perforated peptic ulcer	2	2	100
Acute cholecystitis	1	0	0
Biliary colic	1	0	0
Small bowel ischaemia	1	0	0
Large bowel ischaemia	1	0	0
Large bowel perforation	2	0	0
Pseudo-obstruction of large bowel	2	0	0
Acute appendicitis	1	0	0
Totals	37	9	25.7

Gastrointestinal bleeding

This was the most common gastrointestinal complication encountered, affecting 22 patients, five of whom died. The bleeding presented from the 2nd postoperative day to the 32nd postoperative day. At this stage postoperatively, patients with prosthetic valve implants are routinely anticoagulated with warfarin. Those patients in whom coronary artery bypass grafts are performed start aspirin therapy on the 1st or 2nd day postoperatively, unless there are specific contraindications to this.

Gastrointestinal bleeding presented most commonly as melaena, which occurred in 14 patients. Four patients presented with a combination of melaena and haematemesis and four patients presented with haematemesis in the absence of other symptoms.

Five patients had a past history of peptic ulceration and one patient had a past history of hiatus hernia. Endoscopy disclosed the site of bleeding in 17 patients. In another patient the site of bleeding was discovered at laparotomy, and in one patient the site of bleeding was confirmed at post-mortem.

Bleeding duodenal ulcers were the source of bleeding in 11 patients and gastric erosions in eight patients. In three patients the site of bleeding was undetermined. Two patients who developed bleeding duodenal ulcers has also developed some other gastrointestinal problem requiring operation.

Medical therapy consisting of H_2 receptor antagonists, blood transfusions and temporary withholding of anticoagulation where appropriate, was started in all patients with gastrointestinal bleeding. Twelve patients were treated medically, of whom three died. Operation was required in 10 patients when medical treatment failed to control their bleeding; two of these patients died of multiorgan failure. One patient had a persistently bleeding gastric ulcer excised and two patients with gastric erosions had these undersewn. Seven duodenal ulcers were treated by undersewing, combined with truncal vagotomy and pyloroplasty in six cases and antrectomy in the other case.

Pancreatitis

This, the second most frequently encountered gastrointestinal complication, occurred in four patients, one male and three female, of whom two patients (both female) survived. One of the patients had a past history of gallstones. Two patients presented early on the 1st and 2nd postoperative days and two on the 10th postoperative day.

The most common symptom was upper abdominal pain or discomfort, which occurred in three patients.

The patient who presented on the 1st day postoperatively was a 69-year-old man who had undergone triple

coronary bypass. He presented with painless abdominal distension. A laparotomy was performed on the 6th postoperative day, revealing a haemorrhagic necrotic pancreas; no further surgery was performed. He developed renal failure and septicaemia and died on the 21st postoperative day.

The patient who presented on the 2nd postoperative day was a woman with severe abdominal pain. A laparotomy revealed haemorrhagic pancreatitis; again, no other surgical procedure was performed. She also developed renal failure and died. Another female presented with lower abdominal swelling at 10 days. A pancreatic abscess was discovered at laparotomy. This was drained and the patient made a protracted recovery. The patient who presented at 17 days was a female who presented with abdominal pain, nausea and vomiting. She was treated conservatively and recovered well.

Perforated peptic ulcer

This complication occurred in two patients, both of whom had repair of dissecting aortic aneurysms performed and who were both making a protracted complicated recovery. One of the patients had a past history of peptic ulceration. In both cases, perforation was not discovered until it was well established. In one patient, it was diagnosed after obtaining turbid fluid after insertion of a peritoneal dialysis catheter. The other patient developed signs of toxicity and abdominal distension. At laparotomy, one patient was found to have a perforated gastric ulcer, the other a perforated duodenal ulcer; both with established peritonitis and free pus in the peritoneal cavity. Both patients died.

Biliary pathology

Acute cholecystitis occurred in one 65-year-old female patient who presented with right upper quadrant pain and tenderness 2 days after a triple coronary bypass. She had no past history of gallstones. Ultrasonography at 7 days postoperatively revealed the presence of a thickened gallbladder wall and showed the presence of gallstones. A gangrenous gallbladder was removed at laparotomy, performed on the day of the ultrasound. This lady made a complicated recovery, required postoperative parenteral nutrition and a shunt for haemofiltration for renal failure.

Biliary colic occurred in one male patient 3 days postoperatively. Ultrasonography confirmed the presence of gallstones. He was managed conservatively and discharged. He developed further episodes of pain after discharge and was readmitted for cholecystectomy 6 weeks later.

Intestinal ischaemia

This presented on the 2nd postoperative day in a patient who had undergone an uncomplicated mitral valve replacement. Laparotomy was performed on the 6th postoperative day, when patchy areas of gangrene were found on the antimesenteric border of the small intestine. This necessitated excision of 150 cm of small bowel. The patient subsequently made a good recovery.

The second case was a 68-year-old man who presented 2 days after quadruple coronary grafts with abdominal pain and vomiting. Colonoscopy was performed on the 4th postoperative day at which it was discovered that the patient's splenic flexure was ischaemic and necrotic. At operation on the same day, the patient's ascending and transverse colon were resected and an ileocolic anastamosis was performed. He subsequently made an uneventful recovery.

Colon pathology

Colonic pseudo-obstruction occurred in two patients who presented after cardiac surgery with gross abdominal distension, causing haemodynamic lability. Laparotomy performed in both patients revealed no organic obstruction. One patient was treated by fashioning a temporary transverse colostomy, the other was decompressed by passing a flatus tube per rectum. Both patients made uneventful recoveries.

Large bowel perforation occurred in two patients, the first, a 68-year-old male who presented on the 8th day after a quadruple coronary bypass with abdominal pain and rigidity. A chest radiograph showed the presence of free air under the diaphragm, a nasogastric tube was passed and intravenous fluids and antibiotics were started. Laparotomy was performed the following day. This man was found to have purulent peritonitis due to a perforated sigmoid diverticulum. The perforation was undersewn and a transverse colostomy was fashioned. The patient made a protracted recovery complicated further by renal failure. His colostomy has not been reclosed.

The second case of colon perforation was in a 68-year-old female patient after a double valve replacement (aortic and mitral). She presented with crampy lower abdominal pain, vomiting and melaena on the 12th postoperative day. At laparotomy performed the same day, a sigmoid diverticular abscess and a bleeding duodenal ulcer were discovered. A Hartmann's procedure was carried out, together with a truncal vagotomy and pyloroplasty. Her recovery was complicated by a postoperative respiratory tract infection and respiratory failure necessitating ventilation and antibiotic therapy.

Acute appendicitis

A 69-year-old male patient presented with right lower quadrant abdominal pain 16 days after double coronary grafts. Laparotomy was performed and an appendix obstructed by a faecolith was discovered. An appendicectomy was performed. A second laparotomy was required in the same patient for a bleeding duodenal ulcer 1 week later, at which a truncal vagotomy and pyloroplasty were performed; he made an uneventful recovery.

Discussion

Gastrointestinal complications after cardiac surgery are uncommon, most recent studies *(1–5)* report an incidence of between 0.7% and 2%, but are associated with a high mortality. The incidence in this study was found to be 0.41% and the mortality due to gastrointestinal (GI) complications 25.7% (9 of 35 patients died). The inhospital mortality after uncomplicated cardiac surgery for all conditions in Ireland ranged from 3.24% to 4.81% for the years 1983 to 1989. The mortality of those patients who develop GI complications after cardiac surgery in Ireland is therefore six to eight times that of patients who have uncomplicated surgery. The reported mortality in the literature varies considerably, from as low as 12% *(1)* to as high as 67% *(6)*, the most recent British study reports a mortality of 63% *(5)*. All studies to date on this subject have relatively small numbers of patients who developed a variety of GI complications (the largest study has 60 patients *(4)* who developed eight different types). High morbidity is also a feature in these patients; in this study most of the patients who developed GI complications and survived required prolonged hospital stays, on average nearly four times the routine stay for uncomplicated cardiac surgery.

In common with other studies *(2,4,5)* there were difficulties in making a diagnosis of GI complications in seriously ill patients after cardiac surgery. Those patients who required prolonged ventilation and sedation postoperatively could not communicate symptoms, postoperative analgesia tends to mask symptoms and signs of abdominal pathology; in addition seriously ill patients could not be moved from an intensive therapy unit for certain radiological investigations. The net result of all these factors is a likely delay in making a diagnosis of an intra-abdominal complication. In the present study the most graphic illustration of this was in the two patients who developed perforated peptic ulcers; both patients were unable to communicate with medical or nursing staff, in one case the perforation was a chance finding (pus being obtained via a newly inserted peritoneal dialysis catheter), in the other case the diagnosis was made clinically, the patient developing abdominal distension and becoming increasingly toxic. At laparotomy purulent peritonitis was well established in both patients, who both subsequently died from multiorgan failure.

In other studies *(2–4)* the most important aetiological factor in the development of gastrointestinal complications was poor visceral perfusion. One of the possible causative factors of poor visceral perfusion peroperatively is prolonged bypass time *(1,3,4,7)*. Krasna *et al. (2)* found that bypass time for those patients who developed GI complications was significantly longer than in uncomplicated cases. We could not confirm this finding in this study; the mean bypass time of those patients who developed GI complications was 100 min while the mean bypass time was 96 min (not statistically significant).

Bleeding from the upper GI tract was the most commonly occurring complication as it was in other recent studies *(4,5)*. The most common cause of the bleeding in this study was duodenal ulceration, followed by gastric erosion. There is an association between gastric erosion and hypoperfusion leading to mucosal ischaemia *(8)*. Other aetiological factors leading to increased likelihood of GI bleed in patients undergoing cardiac surgery is aspirin therapy in the case of those patients undergoing coronary bypass surgery and anticoagulation therapy after valve surgery. It was routine practice during the course of this study to give prophylactic H_2 receptor antagonists to those patients with a known ulcer diathesis or who remained in the intensive care unit longer than 1 day. In the final year under study sucralfate was introduced as prophylaxis against gastric erosions which has the advantage of not altering GI flora, thereby decreasing the risk of nosocomial pneumonia *(9)*. In the initial phase, management of GI bleeding should be medical; however, immediate operation is recommended in those patients who continue to bleed or rebleed. There may be a reluctance on the part of clinicians to submit an already sick patient to further surgery; however, it is these patients who are most likely to succumb to the adverse haemodynamic effects of severe upper GI bleeding. In this study no patient died as a result of laparotomy *per se*; this was also the finding of a recent UK study *(5)*, thus reinforcing the case for early surgery in those patients who fail to respond to conservative management of upper GI bleeding after cardiac surgery.

Pancreatitis has been reported frequently as a complication after cardiopulmonary bypass. Haas *et al. (7)* described a spectrum of pancreatitis ranging from a subclinical form detectable only by biochemical means to a severe necrotic haemorrhagic form occurring in 0.2% of cases. Feiner *(10)*, in an autopsy study, showed that 18% of patients who underwent cardiac surgery had evidence of acute pancreatitis. Low flow states, tissue ischaemia, microemboli gallstones and pre-existing pancreatic disease have been reported as aetiological factors. Rose *et al. (11)* recommend conservative measures as first-choice treatment in these cases; however, laparotomy with débridement and drainage may be necessary in those patients who deteriorate despite conservative management. The two patients who died as a result of acute pancreatitis had severe necrotising, haemorrhagic forms of the condition. High mortality due to this condition is reported elsewhere *(2,3)* and may well reflect its severity.

Acute cholecystitis after cardiac surgery is associated with a high mortality rate. Leitman *et al. (4)* reported a mortality of 73% for this condition and Krasna *et al. (2)* reported a mortality of 85.8% for acalculous cholecystitis. The single case occurring in this study was associated with gallstones in a woman after coronary graft surgery and was further complicated by septicaemia and renal failure requiring a hospital stay of 77 days.

Intestinal infarction may result from poor visceral perfusion during or after surgery. Those patients with pre-existing visceral artery occlusive disease are particularly vulnerable in hypotensive or low-flow states.

The management of large bowel perforation is the same as in the patient who has not had recent cardiac

surgery. Immediate operation is the treatment of choice; other studies *(1,2,6)* agree with this approach.

Pseudo-obstruction of the colon occurred in two cases in this study, both patients having laparotomies. In this condition gross abdominal distension may lead to haemodynamic instability; if allowed to progress caecal perforation may occur *(12)*. The standard treatment is colonoscopy which is both diagnostic and therapeutic.

In summary, though uncommon, gastrointestinal complications after cardiac surgery are associated with a high morbidity and mortality. They are often difficult to diagnose, requiring a high index of suspicion for their detection. Appropriate treatment must be instituted at an early stage. In this study no patient died as a direct result of laparotomy for GI complications, accordingly a low threshold to early exploratory laparotomy is recommended.

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