ACUTE GASTROINTESTINAL COMPLICATIONS AFTER OPEN HEART SURGERY

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ABSTRACT

Retrospective analysis revealed that 24 of 4401 adult patients (0.5%) developed severe gastrointestinal complications after open heart surgery during a 3-year period from January 1995. There were 4 women (17%) and 20 men (83%). Mean age was 61.7 ± 2.02 years. Gastrointestinal bleeding (33.3%), mesenteric ischemia (20.8%), pancreatitis (20.8%), hepatic dysfunction (16.7%), and cholecystitis (16.7%) were the most common complications. Mortality was 41.7% (10 patients). During the same period, mortality in the patients who did not develop gastrointestinal complications was 1.89% ($p < 0.0001$). Emergency basis, reoperation, combined operations, peripheral vascular disease, diabetes mellitus, chronic lung disease, and impaired left ventricle function were found to be risk factors for the development of postoperative gastrointestinal complications.

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INTRODUCTION

Gastrointestinal (GI) complications affect approximately 1% to 2% of patients undergoing open heart surgery.[1,2] Although this is a low incidence, such complications can increase morbidity, length of postoperative hospital stay, and mortality.[3,4] Since the onset is early in the postoperative period when the patient is fully sedated, identification may be difficult because symptoms may be masked by postoperative analgesia. This retrospective study reports our experience with acute GI complications after cardiac surgery during a 3-year period.

PATIENTS AND METHODS

All 4401 adult patients who underwent open heart surgery in our institution between January 1995 and January 1998 were retrospectively evaluated for early major and minor GI complications (within 7 days after operation). A major GI complication was defined as one that required consultation with an abdominal surgeon, transfer to an intensive care unit, surgical intervention, or treatment that prolonged the hospital stay.

Preoperatively, all patients were premedicated with midazolam 0.07 to 0.1 mg·kg^{-1} intramuscularly. Anesthesia was induced with fentanyl 25 μg·kg^{-1} and midazolam 0.15 to 0.35 mg·kg^{-1} with vecuronium 0.14 to 0.18 mg·kg^{-1} for muscle relaxation. Anesthesia was maintained with 60% nitrous oxide in oxygen and supplementary doses of

fentanyl and midazolam. All patients received standard doses of morphine 10 to 20 mg·kg^{-1}·h^{-1} and midazolam infusion at 8 to 15 µg·kg^{-1}·h^{-1} for basal sedation and analgesia in the early postoperative period. Diltiazem infusion at 0.1 mg·kg^{-1}·h^{-1} was started at the induction of anesthesia and continued in the intensive care unit for 24 hours.

Myocardial protection during cardiopulmonary bypass (CPB) and aortic crossclamping was achieved by infusion of antegrade-retrograde tepid (32°C) blood cardioplegia. The perfusate was allowed to cool to 32°C and all patients received nonpulsatile flow at rates of 2.2 to 2.4 L·min^{-1}·m^{-2} to maintain a mean perfusion pressure of 55 to 60 mm Hg. Epinephrine infusion at 0.01 to 0.1 µg·kg^{-1}·min^{-1} was the first choice of inotropic agent during weaning from CPB, regulated according to hemodynamic parameters. Dobutamine was added as a second inotropic drug when necessary, instead of raising epinephrine doses. Cefuroxime was given for antibiotic prophylaxis, H$_2$-receptor antagonists were used routinely for prophylaxis against GI bleeding.

The unpaired Student's *t* test and the chi-squared test with the Yates correction were employed to assess differences between means and groups.

RESULTS

Twenty-four patients (0.5%) developed major GI complications after cardiac surgery. Patient characteristics are shown in Table 1. Operative procedures in the 24 patients with major GI complications are listed in Table 2. Perioperative variables that were analyzed in both groups are given in Table 3.

Thirty major GI complications were diagnosed in the 24 patients; the type, mode of treatment, and mortality are shown in Table 4. Bleeding occurred in 8 patients (33.3%) between the 1st and 4th postoperative days (mean, 52 ± 6.2 hours). Diagnosis was made by endoscopy in 5 cases, clinical judgment was used in the other 3. Bleeding was stopped by nasogastric tube irrigation with cold saline and antacid solution in 3 patients, one underwent a successful endoscopic procedure to coagulate the bleeding area, and 4 with unremitting hemorrhage underwent surgery. Two of these also had duodenal perforation and died of multiorgan failure. This group of patients needed massive blood transfusions (mean, 5.4 ± 2 units). The 5 patients with mesenteric ischemia underwent reoperation; 4 were still intubated when the diagnosis was made. Mean onset of symptoms was 30 ± 4.4 hours. Severe distension, undefined metabolic acidosis, hemodynamic instability, and leukocytosis ($> 30 \times 10^9$/L) were common findings. Although bedside ultrasonography was performed in most patients, diagnosis was confirmed by bedside minilaparotomy. One patient who could undergo localized bowel resection survived but the other 4 had necrosis too extensive for resection; one of these also had splanchnic necrosis. One patient who developed signs of peritonitis on the second postoperative day underwent a minilaparotomy that revealed a perforated diverticulum of the colon. The diverticula was sutured primarily and a temporary colostomy was performed. The colostomy was closed 3 months later. Four patients were diagnosed with acute cholecystitis, by ultrasonography in 2 and by exploratory laparotomy in the other 2. Three of these patients underwent successful open cholecystectomy, the other was controlled medically and surgery was performed one month later. Five patients developed pancreatitis that was subclinical in 3 who did well with medical treatment. Two with fulminant pancreatitis died and postmortem examination revealed necrotizing pancreatitis. Hepatic dysfunction was defined as abnormal liver function tests,

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Table 1. Profile of 4401 Open Heart Surgery Patients

Variable	Major GI Complications		No or Minor GI Complications		*p*
	n	%	*n*	%	
Total	24	0.5	4377	99.5	
Mean age (years)	61.7 ± 2.02		60.2 ± 11.9		> 0.05
Male:Female ratio	5:1		4:1		
Emergency operation	4	16.7	220	5	< 0.001
Routine operation	20	83.3			
LVEF < 30%	6	25	525	12	< 0.05
Redo operations	3	12.5	92	2.1	< 0.00l
Combined operations	11	45.8	488	11.1	< 0.001
IABP	1	4.2	42	1	< 0.001
Diabetes mellitus	8	33.3	812	18.5	< 0.002
PVD	7	29.2	82	1.9	< 0.001
COPD	3	12.5	196	4.5	< 0.002
Renal dysfunction*	0	0	32	0.7	> 0.05

*Preoperative serum creatinine > 16 mg·L^{-1}. COPD = chronic obstructive pulmonary disease, GI = gastrointestinal, IABP = intraaortic balloon pump, LVEF = left ventricular ejection fraction, PVD = peripheral vascular disease.

hyperbilirubinemia, elevated bleeding time, and decreased albumin levels. Two of the 4 patients with severe hepatic dysfunction died from multiorgan failure; postmortem examination in 1 revealed severe hepatocellular necrosis. Preoperative liver function tests were normal in all 4 cases.

During the same period, 68 patients were diagnosed as having mild GI problems such as distension, decrease in bowel sounds, paralytic ileus, diarrhea and mild jaundice. They were evaluated as a separate group because symptoms were not life-threatening, did not cause any organ dysfunction, and subsided in 2 to 5 days without the need for surgical intervention. GI distension developed in 48 patients, which was diagnosed as paralytic ileus. They were kept on total parenteral nutrition with nasogastric tube decompression until the return of peristaltic activity. In some cases, a rectal tube was also used. One case of distension was diagnosed as colonic pseudo-obstruction and treated with colonoscopy.

Nineteen of these patients had elevated liver enzymes and slight increases in bilirubin and amylase levels without any morbidity or mortality. Mortality in the 4377 patients who developed no or only mild GI complications was 1.89% compared with 41.6% in those with major GI complications ($p < 0.0001$).

Analysis of the cardiac surgery patients with major GI complications revealed that emergency basis, combined operations, left ventricular ejection fraction less than 30%, diabetes mellitus, peripheral vascular disease, and chronic obstructive lung disease were risk factors for early GI complications (Table 1).

DISCUSSION

The incidence of complications involving the entire GI tract after cardiac surgery has been reported as between 1% and 2% and associated mortality rates ranged from 40% to 60%.[5–7] The common mechanism is a low cardiac output state that contributes to inadequate tissue perfusion, mucosal ischemia, and "acute GI focal necrosis syndrome." Stress ulceration, mucosal atrophy, bacterial overgrowth from stress-ulcer prophylaxis, and loss of barrier function with increased permeability may lead to bacterial translocation, sepsis, and multiorgan failure.[6,8] The findings in this study agree with previous reports that advanced age, reoperation, combined or complex surgical procedures, and emergency surgery are risk factors for GI complications.[2,4,8] In addition, impaired left ventricular function, peripheral vascular disease, and chronic obstructive lung disease also emerged as risk factors. Low cardiac output requiring high doses of inotropics,

Table 2. **Cardiac Operations in 24 Patients With Major Gastrointestinal Complications**

Operation	No. of Patients
CABG	12
Valve reconstruction	1
CABG + valve replacement	4
CABG + LV aneurysm repair	3
CABG + PV surgery	4

CABG = coronary artery bypass grafting, LV = left ventricular, PV = peripheral vascular.

Table 3. **Operative and Postoperative Variables**

Variable	Major Gastrointestinal Complications	No or Minor Gastrointestinal Complications	p
Cardiopulmonary bypass time (min)	108.73 ± 13.47	83.62 ± 14.70	< 0.05
Crossclamp time (min)	64.50 ± 9.64	41.20 ± 8.50	< 0.05
New myocardial infarction (n)	4/24 (16.7%)	72/4377 (1.6%)	< 0.002
Inotropics > 0.03 µg·kg^{-1} epinephrine (n)	12/24 (50%)	786/4377 (18%)	< 0.002
Intensive care unit stay (days)	6.96 ± 1.91	1.26 ± 0.7	< 0.001

Table 4. **Major Gastrointestinal Complications and Mortality in 24 Patients**

Complication	n	%	Deaths
Gastrointestinal bleeding	6	25	0
Gastrointestinal bleeding + duodenal perforation	2	8.3	2
Mesenteric ischemia	5	20.8	4
Pancreatitis	5	2.8	2
Hepatic dysfunction	4	16.7	2
Acute cholecystitis	4	16.7	0
Bowel diverticula perforation	1	4.2	0
Acute appendicitis	1	4.2	0

especially in patients with poor ventricular function, further aggravates acidosis, vasoconstriction, and GI dysfunction. Although preoperative renal function was normal in those who developed GI complications, the incidence of postoperative renal dysfunction was much higher, mainly because of multiorgan failure.

The presence of fever, high white blood cell count, abdominal distension, marked tenderness on abdominal palpation, hemodynamic evidence of sepsis, or positive blood cultures can be manifestations of an acute intra-abdominal phenomenon. Reaching the correct diagnosis is usually very difficult. Laboratory tests may not distinguish cholecystitis from perforated viscus, mesenteric ischemia, or pancreatitis. Bedside abdominal ultrasound and endoscopy are sometimes helpful but abdominal computed tomography and angiography are difficult to perform in these critically ill patients. Peritoneal lavage and exploratory minilaparotomy are most helpful for diagnosis.[7,8] Endoscopy and bedside laparotomy procedures were readily performed in this study.

Among 8 patients who had upper GI tract bleeding, 2 had a history of gastritis and one had a preexisting ulcer. They developed GI bleeding in spite of taking H_2-receptor blockers. Patients who responded to medical treatment (3), or endoscopic laser bipolar coagulation (1) did well. Four patients with unremitting hemorrhage had to undergo reoperation, of whom 2 died from duodenal perforation. In view of the high mortality, prevention is most important and any patient with a history of ulcer should receive medication to prevent stress-related mucosal damage and GI bleeding.[9–11] In addition, any patient on prolonged ventilatory support should receive stress-ulcer prophylaxis.[12–14]

Mesenteric ischemia is usually noted in elderly patients who have prolonged low cardiac output states requiring pharmacological or mechanical support. Patients with atherosclerotic aorta are also at risk of mesenteric ischemia due to embolism.[15,16] Profound ileus or abdominal pain out of proportion with physical findings, sepsis, acidosis, and respiratory distress are common findings.[16] Although the diagnosis can be made by arteriography, this is usually not practical for a critically ill patient and a minilaparotomy is more convenient for diagnosis. Four of the 5 patients who underwent abdominal exploration for bowel necrosis died. The survivor had an early laparotomy and could undergo localized bowel resection, whereas the others had extensive necrosis and multiple areas of ischemic bowel that did not permit resection. Common laboratory findings in this group were leukocytosis and high levels of serum lactate.

Hyperamylasemia has been noted in up to 35% of patients following CPB, but it is associated with clinical pancreatitis in only 1% to 3%.[17,18] Three patients in our series were diagnosed with subclinical pancreatitis. They had mild symptoms of anorexia, nausea, and ileus, with elevation of serum lipase levels. A brief period of bowel rest was sufficient in these patients. On the other hand, two patients who developed fulminant pancreatitis died. Postmortem examination in one of these patients revealed necrotizing pancreatitis.

There has been a documented shift towards increasing age and severity of illness in the patient population undergoing cardiac surgery who are prone to complications.[4,8] Patients with GI complications usually have a very complex course after their cardiac surgery, such as cardiogenic shock, respiratory and renal failure prior to the development of their acute surgical problem.[7] Older patients, especially those with a history of GI problems, prolonged CPB times, low cardiac output, or prolonged ventilatory support, should be under greater suspicion. Surgery must be performed promptly because unnecessary delay is associated with unacceptable mortality rates.[8] We believe that good collaboration and cooperation with a general surgery team experienced with postcardiotomy GI complications is essential. Liberal use of bedside exploratory small laparotomy and endoscopic techniques should be encouraged since inappropriate conservative therapy is poorly tolerated in this high-risk group. The frustratingly high mortality rates due to late diagnosis calls for a low threshold to exploratory minilaparotomy. Prevention and early diagnosis seem to be the only reliable assets for better results. Only heightened awareness and prompt surgical action will succeed in reducing the high mortality.

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