A Review of 2255 Emergency Abdominal Operations Performed over 17 years (1996–2013) in a Gastrointestinal Surgery Unit in India

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Abstract There is little information regarding the clinical spectrum and outcome of emergency abdominal operations from specialized units in India. We examined these in our gastrointestinal surgery and liver transplantation unit from a prospective database maintained between July 1996 and April 2013. Out of 9966 operations performed, 2255 (26%) were emergency procedures (reoperations during the same admission, e.g., for necrotizing pancreatitis were excluded). The primary outcome was 30-day postoperative mortality. The mean age of the patients was 47 years (range 1–107) and included the following age groups: 0–18 years ($n = 105$, 4.7%); 19–64 years ($n = 1766$, 78.3%), and >65 years ($n = 384$, 17.0%). The majority were males (1609, 71%), and there were 646 females (29%). The most common indications were small bowel emergencies (598, 26.5%), followed by pancreatic (417, 18.5%) and colonic (281, 12.5%) emergencies. Pancreatic operations were the second commonest in the adult and middle aged group. Colorectal operations were the second commonest in the geriatric age group (>65 years). Emergency operations for other conditions were: postoperative complications following elective operations

171 (7.5%), gastroduodenal bleeding or perforation in 144 (6.3%), and liver surgery in 93 patients (4.1%) patients. In the small bowel emergencies, 223 patients (37.2%) had primary diagnosis of adhesive obstruction, gangrene in 135 patients (22.5%), perforation in 121 patients (20%), and fistula in 56 patients (9.3%). Mesenteric venous thrombosis was found to be the primary cause of small bowel emergencies, either as a primary cause in gangrene or as a secondary cause in perforations and adhesions. The postoperative mortality after emergencies was 12.6% compared to 2% in elective procedures. Mortality was significantly higher in males (14%) than females (9.6%), $p < 0.005$. Category wise mortality was as follows: pancreatic surgery ($n = 86$, 20.6%), surgery for postoperative complications ($n = 33$, 19.3%), duodenal surgery ($n = 18$, 12.5%), small intestinal surgery ($n = 68$, 11.4%), and colonic surgery ($n = 35$, 12.45%). Emergency operations comprise a significant proportion of a GI surgical unit's workload. The mortality is greatest after pancreatic operations followed by those done for postoperative complications. Despite advances in surgical and postoperative care, emergency operations for abdominal emergencies are associated with

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mortality which is six times higher compared to elective procedures.

Keywords Abdominal emergency surgeries · Mesenteric ischemia · Pancreatic necrosectomy · Mortality

Introduction

Abdominal surgical emergencies constitute a significant portion of a surgeon's clinical experience and often present with diagnostic and treatment challenges. The major causes of abdominal emergencies vary from region to region, and even within the same region socioeconomic, cultural, or geographical factors may alter the pattern. Although being one of the most common urgent surgical procedures in India, there is a scarcity of data concerning indications and postoperative mortality rates after emergency laparotomy. Studies continue to show that an emergency status contributes significantly to morbidity and mortality in patients undergoing abdominal surgery [1–3]. In India, perforation peritonitis is the most common emergency in general surgical departments and despite advances in surgical techniques, antimicrobial therapy, and intensive care support, the management of peritonitis continues to be highly demanding, difficult, complex and the causes of perforation are different from those of western countries [4]. However, there is little data on the diagnostic spectrum and results of management of abdominal emergencies from the new specialized gastrointestinal (GI) surgery centers which have now been established in India. The aim of our study was to study the profile of emergency abdominal operations performed in a single GI surgical unit at a major tertiary care center over a period of 17 years.

Patients and Methods

We conducted a retrospective study on prospectively collected data of all emergency operations performed in patients admitted to the Department of Surgical Gastroenterology and Liver Transplantation, Sir Ganga Ram Hospital, New Delhi, India, from July 1996 to April 2013. Reoperations, e.g., in patients with necrotizing pancreatitis, were excluded in order to avoid duplication of data. The primary end point was 30-day postoperative mortality after primary surgery. The data included the patient's age, sex, organ system involved, operation performed, initial diagnosis in the emergency room, final diagnosis, and outcome of treatment retrieved from the database. The SPSS version 15.0 was used in data analysis. Frequencies, proportions, means, and standard deviations were determined. Test of significance was done using chi-square, and *p* value was set at 0.05.

Results

Demography

Of the total of 9966 operations performed during this period, 2255 (26%) were emergency procedures. The mean age of the patients was 47 years (range 1–107), and they were divided into following groups: pediatric (0–18 years, *n* = 105, 5%), adult and middle age (19–64 years, *n* = 1766, 78%), and geriatric (>65 years, *n* = 384, 17.0%). The majority were males (*n* = 1609, 71%), and male to female ratio was 2.5:1.

Profile of Emergency Operations (Organ Systems)

There was a wide variation in the operation type as defined by the organs systems of the gastrointestinal tract. These were categorized according to the organ system involved and are summarized in Tables 1 and 2.

The most common indications were small bowel emergencies (*n* = 598, 26.5%) followed by pancreatic (*n* = 417, 18.5%) and colonic emergencies (*n* = 281, 12.5%). Small bowel emergencies were also the most common indications in both adult and geriatric age groups. Pancreatic operations were the second commonest operation in the adult and middle age group, while colorectal operations were the second commonest in

Table 1 Summary of the pattern of organ system involvement

Disease patterns	Number of patients
Small bowel	598
Pancreas	418
Colon	281
Postop complications	171
Duodenum	144
Liver	93
Stomach	78
Gall bladder	62
Hernia	56
Appendix	55
Peritoneum	54
Biliary	53
Rectum	34
Portal hypertension	31
Obscure GI bleeding	29
Anus	27
Esophagus	15
Spleen	15
Retroperitoneum	6
Splenic disease	5
Ovary	3
Liver transplant	2

Table 2 Major organ systems involved and associated etiologies

Operated organ	Diagnosis	Number	Percent
Small bowel		598	
	Obstruction	223	37.2
	Gangrene	135	22.5
	Perforation	121	20.2
	Fistulae	56	9.3
Pancreatic	Others	63	10.5
		418	
	Open necrosectomy	270	64.5
	Pseudocysts	66	15.8
	Fistulae	50	11.9
Colonic	Gall stones	32	7.7
		280	
	Ulcerative colitis	62	22
	Perforation	61	21
	Obstruction	56	20
Postoperative complications	Bleeding	19	6.8
	Gangrene	15	5.3
	Others	67	23.9
		171	
	Bleeding	50	29.2
Duodenal disorders	Abscess	22	12.8
	Anastomotic leaks	17	10
	Anastomotic perforations	16	9.3
	Others	66	38
		144	
	Perforation	93	64.5
	Bleeding	44	30.5
	Necrosis	7	5

geriatric age group (>65 years). Emergency operations for other conditions are categorized in Tables 1 and 2.

Profile of Emergency Surgeries (Etiology)

In the small bowel emergencies, 223 patients (37.2%) had primary diagnosis of adhesive obstruction, gangrene in 135 patients (22.5%), perforation in 121 patients (20%), and fistula in 56 patients (9.3%). Mesenteric venous thrombosis was found to be the primary cause of small bowel emergencies, either as a primary cause in gangrene or as a secondary cause in perforations and adhesions. There were 24 categories of operations and involved diverse etiologies ranging from pancreatic necrosis to obscure GI bleeding. In pancreatic surgeries, the etiologies included pancreatic necrosis (64%), pseudocysts (16%), fistulae (12%) and gall stones (8%). In colonic surgeries, the etiologies included ulcerative colitis (22%), perforation (21%), obstruction (20%), bleeding (7%), gangrene (5%) and others (24%). Regarding postoperative complications, the main etiologies included bleeding (29%), abscess (13%), anastomotic leaks (10%), perforations (9%) and others (38%). In duodenal surgeries, the etiologies included perforation (65%), bleeding (30%), and necrosis (5%). In gastric surgeries, the etiologies included complications related to gastric tumors (42%), gastric ulcers (21%), gastric outlet obstructions (23%) and others (14%). Regarding

hepatobiliary system, major etiologies included hepatic injury (21%), bile leaks (14%), biliary strictures (6%) and abscesses (8%). Appendicular pathologies constituted only 2.4% of all cases.

Mortality

During the study period, in 2255 patients operated, there was postoperative mortality in 286 patients (12.6%). Category wise mortality was as follows: pancreatic surgery ($n = 86$, 20.6%), surgery for postoperative complications ($n = 33$, 19.3%), duodenal surgery ($n = 18$, 12.5%), small intestinal surgery ($n = 68$, 11.4%) and colonic surgery ($n = 35$, 12.45%). In this study, there was wide variation in mortality among 16 different categories of operations. The above conditions only highlight the five common causes of mortality which accounted for over three quarters of mortalities. Table 3 describes the postoperative mortality in all the patients who underwent emergency surgery. The postoperative mortality was 12.6% compared to 2% in elective procedures. Mortality was significantly higher in males (14%) than females (9.6%), $p < 0.005$. Mortality was divided into 4-year blocks, and Fig. 1 shows the distribution of the mortality over this period.

Discussion

This study adds to the limited body of literature on emergency operations in India collected prospectively over a long period. The majority of admissions for emergency surgery were referred from public as well as private facilities within and outside Delhi and our results represent a completely different profile of emergency cases from those seen in developed countries. The mean age of our patients presenting for emergency operations was 47 years, which is in contrast to mean

Table 3 Mortality by organ system

Mortality by organ system	Number
Pancreatic necrosectomy	86
Small bowel	68
Colonic	35
Postop complications	33
Duodenal	18
Hepatic	17
Gastric	7
Biliary tract	5
Obscure bleeding	4
Peritonitis	3
Portal hypertension	3
Gall bladder	2
Rectal	2

Fig. 1 Mortality over 4-year block periods

age reported from a study in Japan [4], which was 85 years, and in UK [5], where it was 65 years. In a retrospective study of patients treated for peritonitis in a single surgical unit at the All India Institute of Medical Sciences, Delhi, from January 1995 to September 2006, the mean age of patients was 34.2 years (13–90 years) [6]. However, in view of wide variation in the referral, we had patients ranging from 1 to 107 years. Small bowel emergency was the most common indication in both adult and geriatric age group. Pancreatic operations were the second commonest operation in the adult and middle aged groups, while colorectal operations were the second most common in geriatric age group (>65 years). In our study, the total number of patients with perforation peritonitis was 334 (15%) and the causes included small bowel perforation ($n = 121$, 36%), peptic ulcer perforation ($n = 119$, 35%), colonic perforation ($n = 61$, 17%) and anastomotic site leakage and disruptions ($n = 33$, 10%). In the AIIMS study, the common sites of perforation were the small bowel in 113 (43%, 96 ileal and 17 jejunal), the stomach or the duodenum in 61 (23%), the appendix in 36 (15%), and the large bowel in 14 (6%) [6]. In patients operated for small bowel conditions, many middle aged patients had acute mesenteric ischemia ($n = 120$, 5%). Mesenteric venous thrombosis was the cause of acute mesenteric ischemia in 57 patients (48%) and mesenteric artery occlusion in 63 (52%). Schoots et al., in his report on acute mesenteric ischemia which included 3692 patients, found that mesenteric artery occlusion accounted for 71% of cases, only 12% were due to mesenteric venous thrombosis and the remaining 17% were due to nonocclusive mesenteric ischemia. None of our patients had nonocclusive mesenteric ischemia. The median age of patients reported in the west is approximately 70 years for all causes of acute mesenteric ischemia, while that of our patients was only 53 years [7]. It is well documented that appendicitis is the most frequent abdominal emergency worldwide [8]. The same trend was observed in other studies from UK and Nigeria [9, 10]. In our study, incidence of appendicitis as a reason for emergency abdominal surgery was 2%. The reason for this is that ours is a tertiary care referral unit, and most patients with appendicitis are managed in local centers or in the general surgery department of our own institution. Almost 15–20% of patients

with acute pancreatitis will develop more severe form of the disease [11]. The most recent International Association of Pancreatology Guidelines recommend that a patient with infected PN has to undergo surgery in the third or fourth week after onset of symptoms [12]. However, it should be noted that postponing surgical intervention in PN can lead to prolonged use of antibiotics and an increased antibiotic resistance and higher incidence of *Candida* infection. Currently, the overall percentage of patients with SNP ultimately subjected to operative treatment has decreased to less than 20%. In our study, the pancreatic etiologies that led to emergency surgeries included pancreatic necrosis (64%), pseudocysts (16%), fistulae (12%), and gall stones (8%). Most of the patients with pancreatic necrosis were operated after fourth week of illness. Pancreatic pseudocysts complicated by bleeding, infection, biliary obstruction, and rupture were operated under emergency settings. Subtotal colectomy and ileostomy (SCI) is now urgently used as a life-saving management of the severe, life-threatening progression in the course of ulcerative colitis (UC). In published reports, 48% of patients operated for ulcerative colitis required emergency surgery [13–15]. In our study, emergency surgery for ulcerative colitis constituted the most common indication in emergency colorectal surgeries (22%) mainly due to refractory acute severe colitis, fulminant colitis, toxic megacolon and, rarely, massive hemorrhage. Other indications for emergency colonic surgeries included colonic obstruction (20%) and perforation (21%), most of which had underlying colonic cancer. Apart from the varied spectrum of emergency surgeries, postoperative complications (7.5%) constituted an important indication of emergency surgeries and included bleeding (29%), abscess (13%), anastomotic leaks (10%), perforations (9%), and others (38%). The overall mortality of 12.6% is slightly less than UK's report with overall figure of 14.9% [16]. Our data represents a heterogeneous group of patients and includes cases of varying complexity and sickness severity. In a nationwide study of patients undergoing surgery in the USA from 2005 to 2007 and involving both low- and high-volume hospitals, the mortality rate for emergency varied from 18.3 to 19.5% [17]. Fukuda et al. found a mortality rate of 16% [4]. A 10-year study conducted at India's leading institute, AIIMS, revealed generalized peritonitis as the commonest cause of emergency operations, and the mortality rate was 10% which is lower than that of our study [6]. In UK, the first report of the Emergency Laparotomy Network was presented in 2012 which showed a national, multicenter, and prospective audit that nonrisk-adjusted mortality from emergency laparotomy is 14.9%, rising to 24.4% in those aged 80 or above [16]. High-risk emergency operations have higher mortality. Pancreatic necrosectomy had a 30% mortality, which is high compared to the historically known rates ranging from 10 to 20% [18–21]. In one recent North American study, the mortality rate was found to be as low as 6.8%. During the past decade, a wide

spectrum of procedures has been advocated for the surgical management of severe necrotizing pancreatitis and there has been dramatic improvement in intensive care of these patients. Nevertheless, neither “conservative” surgical strategies, nor aggressive resections have accomplished a significant reduction in the overall mortality of necrotizing pancreatitis [22]. In a Turkish study conducted 10 years ago, the mortality from emergency operation on small bowel surgery was 66% in the elderly as a result of mesenteric ischemia [23]. In our study, 48 patients died (38%), 16 with venous occlusion and 32 with arterial occlusion. One study reported multiorgan failure to be the most common cause (75%) of death in these patients, the others being rethrombosis, myocardial infarction, and obstructive pulmonary disease. Similarly, we found multiorgan failure to be the cause of mortality in 28 of our patients (61%) [24].

Apart from being retrospective, our study was limited by the fact that it is skewed, as it represents data from a specialised private tertiary healthcare center. It presents a completely different scenario of emergency surgeries that may not be representative of the general population. So, we propose a multicentre private and public sector study, to study nature and outcome of emergency gastrointestinal tract surgeries that will be representative of whole population.

Conclusion

From this study of emergency surgeries from a single tertiary care center, we found that the most common age group was adult and middle age (72%), the mean age was 47 years, predominant sex was male (71%) and hollow viscera related surgery, especially of the small intestine, most commonly followed by pancreatic surgery (55 vs 19%). Colorectal operations were second commonest in the geriatric age group. Our postoperative mortality during this period was significantly lower in elective (2%) compared to emergency cases (12.6%) and pancreatic emergency surgery carried the highest mortality.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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