Current outcomes of emergency large bowel surgery

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ABSTRACT

INTRODUCTION Emergency large bowel surgery (ELBS) is known to carry an increased risk of morbidity and mortality. Previous studies have reported morbidity and mortality rates up to 14.3%. However, there has not been a recent study to document the outcomes of ELBS following several major changes in surgical training and provision of emergency surgery. The aim of this study was therefore to explore the current outcomes of ELBS.

METHODS A retrospective review was performed of a prospectively maintained database of the clinical records of all patients who had ELBS between 2006 and 2013. Data pertaining to patient demographics, ASA (American Society of Anesthesiologists) grade, diagnosis, surgical procedure performed, grade of operating surgeon and assistant, length of hospital stay, postoperative complications and in-hospital mortality were analysed.

RESULTS A total of 202 patients underwent ELBS during the study period. The mean patient age was 62 years and the most common cause was colonic carcinoma ($n=67$, 33%). There were 32 patients (15.8%) who presented with obstruction and 64 (31.7%) had bowel perforation. The overall in-hospital mortality rate was 14.8% ($n=30$). A consultant surgeon was involved in 187 cases (92.6%) as either first operator, assistant or available in theatre.

CONCLUSIONS ELBS continues to carry a high risk despite several major changes in the provision of emergency surgery. Further developments are needed to improve postoperative outcomes in these patients.

KEYWORDS

Large bowel – Emergency – Surgery – Outcome

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Approximately 30,000–50,000 emergency laparotomies are performed annually in the UK with an associated high risk of mortality and morbidity.^{1–3} Emergency large bowel surgery (ELBS) represents a major part of the general surgical emergency workload⁵ and 15–20% of patients with large bowel cancer present with acute obstruction requiring emergency surgery.⁴ This intervention is associated with significant mortality as it has been shown that 25% of deaths following surgery for bowel cancer occur in patients who require emergency surgery.⁵

In 1985 a seven-year audit reported an overall mortality rate of 17.2% for emergency surgery involving large bowel obstruction.⁶ Similarly, in 1988 Mealy *et al* documented a mortality rate for ELBS of 14.3%.⁷ This relatively high morbidity and mortality has been, in part, attributed to lack of senior cover and a consultant-delivered service.⁸ Consequently, there have been increasing demands to improve outcomes in this subgroup of high risk patients.⁹

Several changes have taken place in the provision of emergency surgery over the past two decades including implementation of structured surgical training with better training in the management of critically ill surgical

patients, greater consultant involvement in decision making and operating, and improved quality and availability of out-of-hours imaging. However, there has not been a recent study to reassess the outcomes of ELBS following these changes in practice to find out whether they have actually resulted in improved outcomes or whether further developments are needed to optimise the prognosis in these patients. The aim of this study was to evaluate the current outcomes of ELBS in comparison with the studies published previously.

Methods

A retrospective review was carried out of a prospectively maintained database of clinical records of all patients who had ELBS between 2006 and 2013. Large bowel surgery was defined as any surgery involving the large bowel. Appendicectomy was excluded. Data pertaining to patient demographics, ASA (American Society of Anesthesiologists) grade, date of surgery, clinical presentation, diagnosis, use of computed tomography (CT), surgical procedure performed, findings, time of surgical intervention (office hours

or out of hours), grade of the operating surgeon and assistant (consultant or surgical trainee), length of hospital stay, admission to the intensive care unit (ICU) or high dependency unit (HDU), postoperative complications, in-hospital mortality, date of death and cause of death were extracted.

The results were analysed statistically with SPSS® (IBM, New York, US). Statistics for 2x2 grids were analysed with a chi-squared test. A *p*-value of <0.05 was considered statistically significant.

Results

A total of 202 patients underwent ELBS between 2006 and 2013. There were 113 women (55.9%) and 89 men (44.1%). The mean age was 62 years (median: 65 years, range: 20–95 years).

Preoperatively, the most common ASA grade was 2 (*n*=65, 32.2%) followed by ASA grade 3 (*n*=58, 28.7%). The patients' preoperative medical co-morbidities included: gastrointestinal conditions (31.7%), cardiovascular co-morbidities (20.8%), respiratory co-morbidities (16.3%), endocrine related diseases (11.4%), rheumatological conditions (10.0%), genitourinary conditions (8.4%), neurovascular conditions (5.0%) and haematological co-morbidities (4.0%).

Underlying pathology requiring emergency large bowel surgery

CT of the abdomen and pelvis was used in 129 cases (63.5%) to aid in the diagnosis. The most common underlying pathology requiring ELBS was colorectal carcinoma (*n*=67, 33.0%) followed by perforation (*n*=64, 31.7%). There were 32 patients (15.8%) who presented with tumour obstruction, 13 (6.4%) had bowel perforation due to colorectal carcinoma, and 3 (1.5%) had a combination of obstruction and perforation on a background of colorectal carcinoma (Fig 1).

Timing of surgery and grade of surgeon

Surgery was performed during office hours in 105 patients (52%) with the remaining 97 (48%) having surgery out of office hours. Consultant surgeons performed 152 operations (75.2%) and trainee surgeons performed 50 (24.8%). Of the latter, 25 procedures (12.4%) were performed with a consultant surgeon as assistant and 10 (5%) by a surgical trainee with a consultant available in theatre but not scrubbed. Only 15 procedures (7.4%) were performed by an unsupervised senior surgical trainee who had completed his or her exit examination and was near to receiving or had already received the Certificate of Completion of Training. A consultant surgeon was available in 187 cases (92.6%) as either first operator or assistant (Table 1).

Surgical intervention

The most common ELBS procedures performed were Hartmann's procedure (*n*=48, 23.8%), hemicolectomy with primary anastomosis (*n*=45, 22.3%) and colectomy with ileostomy (*n*=35, 17.3%). Other ELBS procedures performed included defunctioning colostomy (*n*=14, 6.9%), colectomy with stoma formation (*n*=14, 6.9%), colectomy with ileostomy

Figure 1 Indications for emergency large bowel surgery

and mucous fistula formation (*n*=9, 4.5%), resection with anastomosis formation (*n*=7, 3.5%) and refashioning of colostomy (*n*=4, 2.0%). For the 57 patients (28.2%) with an anastomosis, 42 (20.8%) had an ileocolic anastomosis, 11 (5.4%) had a colocolic anastomosis, 3 (1.5%) had a colorectal anastomosis and 1 (0.5%) had an ileorectal anastomosis. A total of 120 patients (59.4%) had a stoma (Table 2).

Postoperative care

Following emergency large bowel obstruction, 177 patients (87.6%) were admitted to either the HDU or ICU; 39 (19.3%) were admitted to the ICU and 138 (68.3%) to the HDU. Only 25 (12.4%) were admitted to a normal surgical ward as they had uncomplicated ELBS procedures: hernia repair for incarcerated bowel (*n*=7), defunctioning colostomy (*n*=6), palliative laparotomy (*n*=4) where gangrenous and necrotic bowel was found, palliative colectomy (*n*=3), refashioning of colostomy (*n*=2) due to stoma stenosis, limited right hemicolectomy (*n*=2), right hemicolectomy (*n*=1).

Postoperative complications

A breakdown of the complications following emergency large bowel surgery is shown in Table 3. Seven patients developed pneumonia following ELBS and were treated with intravenous

Table 1 Time of surgery and grade of operating surgeon

	Frequency
Surgery time	
During office hours	105 (52.0%)
Out of hours	97 (48.0%)
Operating surgeon	
Consultant	152 (75.2%)
Consultant assisting trainee	25 (12.4%)
Consultant available in theatre but not scrubbed	10 (5.0%)
Unsupervised senior surgical trainee	15 (7.4%)

Table 2 Surgical procedures performed

Procedure	Frequency
Hartmann's procedure	48 (23.8%)
Hemicolectomy and anastomosis	45 (22.3%)
Colectomy and ileostomy	35 (17.3%)
Defunctioning colostomy	14 (6.9%)
Colectomy and stoma	14 (6.9%)
Colectomy, ileostomy and mucous fistula stoma	9 (4.5%)
Resection and anastomosis	7 (3.5%)
Refashioning of colostomy	4 (2.0%)
Others	26 (12.9%)

Table 3 Postoperative complications following emergency large bowel surgery

Complication	Frequency
Sepsis	8 (4.0%)
Pneumonia	7 (3.5%)
Wound infection	7 (3.5%)
Acute renal failure	5 (2.5%)
Anastomotic leak	5 (2.5%)
Intraperitoneal collection	5 (2.5%)
Septic shock	3 (1.5%)
Atrial fibrillation	2 (1.0%)
Multiorgan failure	2 (1.0%)
Myocardial infarction	2 (1.0%)
Ascites	1 (0.5%)
Deep vein thrombosis	1 (0.5%)
Ischaemic colitis	1 (0.5%)
Peritonitis	1 (0.5%)
Prolonged neuromuscular block	1 (0.5%)
Pulmonary embolism	1 (0.5%)
Pulmonary oedema	1 (0.5%)
Pyelonephritis	1 (0.5%)
Respiratory failure	1 (0.5%)
Splenic injury	1 (0.5%)
Others	8 (4.0%)

antibiotics. They all recovered from the pneumonia but one subsequently developed multiorgan failure and died.

Eight patients developed sepsis and were treated with intravenous antibiotics; five of these recovered. Two patients subsequently developed peritonitis secondary to bowel ischaemia, and one developed multiorgan failure; these three patients died.

Figure 2 Length of hospital stay following emergency large bowel surgery

Seven patients developed wound infection, which was treated with intravenous antibiotics. Five recovered but one developed severe sepsis post-peritonitis and one developed bowel ischaemia. Both of these patients died.

There were five patients who developed an anastomotic leak following emergency large bowel obstruction. Four had a laparotomy and formation of a colostomy or ileostomy and one underwent Hartmann's procedure. Four patients recovered but one died from sepsis.

Hospital stay

The mean hospital stay was 16 days (range: 1–92 days). There were five patients who had emergency large bowel obstruction on the day of admission and all five died on this day (Fig 2).

Postoperative mortality

In-hospital mortality was highest for patients who required ICU admission following ELBS at 46.7% ($n=14$, $p<0.05$), followed by HDU patients at 40.0% ($n=12$, $p<0.05$). The overall in-hospital mortality rate was 14.4% ($n=29$). The one-week postoperative mortality rate was 10.8% ($n=22$) and the same-day mortality rate was 3.4% ($n=7$).

In-hospital mortality was highest for ASA grade 4 patients at 6.4% ($n=13$, $p<0.05$) and it was the same for ASA grade 2, 3 and 5 patient groups with each 2.5% ($n=5$, $p<0.05$). The patients were grouped according to range of age and in-hospital mortality was found to be highest in the age group of 56–75 years at 8.4% ($n=17$, $p<0.05$).

The most common cause of in-hospital mortality was peritonitis ($n=13$, 44.8%) followed by bowel ischaemia ($n=12$, 41.3%). Other causes of in-hospital mortality were intraoperative bleeding and multiorgan failure ($n=4$, 13.8%).

Peritonitis

Thirteen patients (6.4%) succumbed to peritonitis after ELBS. Their ages ranged from 35 to 95 years. Six patients had a Hartmann's procedure, two had an exploratory laparotomy, two had a subtotal colectomy, two had a right hemicolectomy and one had a stoma reversal. Postoperative complications included sepsis ($n=5$), septic shock ($n=1$) and acute kidney injury with wound infection ($n=1$). Six patients were admitted to the ICU and one was admitted to the surgical ward to be palliated.

Large bowel ischaemia

Twelve patients (5.9%) did not survive owing to bowel ischaemia or gangrenous large bowel. Their ages ranged from 51 to 79 years. The ELBS procedures performed for these patients included subtotal colectomy and ileostomy ($n=2$), revision of colostomy ($n=2$), hemicolectomy ($n=2$), open and close laparotomy ($n=1$), laparotomy for mesenteric ischaemia ($n=3$), debridement of perineum with formation of colostomy for necrotising fasciitis ($n=1$) and subtotal colectomy for sigmoid volvulus ($n=1$). Postoperative complications included septic shock ($n=1$) and wound infection ($n=1$). Five patients were admitted to the ICU. The decision to palliate the patients was made when gangrenous bowel was found during surgery.

Multiorgan failure

Four patients in total (2%) died from multiorgan failure. One presented with an incarcerated parastomal hernia and underwent repair of the hernia and resiting of the colostomy. Postoperatively, this patient developed pneumonia, atrial fibrillation, acute renal failure, pulmonary oedema and sepsis. Another patient had retroperitoneal haematoma; a laparotomy was performed and the patient was admitted to the ICU. These two patients were aged 86 and 72 years. Both succumbed to multiorgan failure.

There were also two other patients, aged 60 years and 74 years, who had intraoperative bleeding. One had fulminant pseudomembranous colitis with deranged clotting and required an emergency subtotal colectomy and ileostomy formation with abdominal packing while the other had intraperitoneal bleeding and underwent a left hemicolectomy and splenectomy. Both of these patients deteriorated and died from a combination of sepsis and multiorgan failure.

Comparing key outcomes between malignant and benign pathology requiring ELBS

In this study, 67 patients (33%) had a malignancy that required ELBS compared with 135 (67%) with benign disease. Comparison of key outcomes showed a mortality rate of 3.0% ($n=2$) in patients with malignancy and 20.7% ($n=28$) in patients with benign disease ($p<0.05$). For patients with malignancy, there were 12 postoperative complications (17.9%) compared with 31 (23.0%) in patients with benign disease ($p<0.05$). This indicates that patients requiring ELBS who had malignancy tended to have significantly lower mortality and postoperative complications.

Discussion

ELBS continues to carry high morbidity and mortality despite several changes in surgical training and developments in the provision of emergency surgery. Our study has demonstrated an overall mortality rate of 14.8%. This has not changed much from UK studies published in 1985 and 1988.^{6,7} However, in 1997 Isbister and Prasad reported a postoperative overall mortality rate of 6.9% in a study carried out in New Zealand.¹⁰ This indicates that there might be other factors that could be addressed in an attempt to improve outcomes in this group of patients.

The difference in outcomes may have come about owing to differences in demographics, the screening process prior to surgery or the guidelines implemented in different countries. In addition, outcomes for different case series are difficult to compare as they depend on the patient's presentation, age, type of surgical intervention and medical co-morbidities. Furthermore, the increased diversity in treatment options and lack of standardisation in choice of surgical procedure for most large bowel emergency conditions make it even more difficult to compare outcomes between different studies. Nevertheless, our findings support the calls by national bodies for more to be done to improve outcomes in this group of patients.⁹

The literature has shown that morbidity and mortality in these patients depend on age, preoperative health status, operating surgeon, time of surgical intervention and type of surgical procedure.^{5,8,11,12} Our study has confirmed that predictors of unfavourable outcome following ELBS include ASA grades 3–4, preoperative renal failure and the presence of proximal colon perforation with or without peritonitis.¹⁵ In our study, patients requiring ELBS who had malignancy had significantly lower mortality and postoperative complication rates. This reflects the poor outcome associated with some of the underlying benign pathology such as colonic ischaemia.

Higher life expectancy due to advances in healthcare leads to more elderly patients with co-morbidities presenting with large bowel surgical emergencies. The overall aging of the population and an increasing tendency of surgeons to operate on older patients¹⁴ could have contributed to lack of reduction of mortality in more recent studies, including ours. It should be noted that 12.9% of patients were above 80 years and all of them had associated medical co-morbidities. There are few studies that have looked specifically at the outcomes of emergency bowel surgery in the elderly. Klah *et al* reported a mortality rate of 28% in patients aged over 65 years.¹⁴ In our study, the in-hospital mortality rate for patients over 65 years was 12.5% and most of the deaths were due to bowel ischaemia.

While there might be limited scope for improving outcomes in patients requiring large bowel surgery owing to underlying mesenteric ischaemia, patients who present with large bowel obstruction secondary to an obstructing colorectal carcinoma could represent an ideal opportunity to improve the outcomes. Emergency surgery for obstructing colorectal cancer is associated with an increased postoperative morbidity and mortality with poor five-year survival as 25% of all deaths after surgery for bowel cancer occur in patients who present with bowel obstruction.^{5,15,16} Increasing implementation of screening programmes could help to reduce the number of patients presenting as an emergency with malignant large bowel obstruction. It should be noted that our study was completed in a population that had access to a well established bowel screening programme.

Colorectal carcinoma remains the most common cause of large bowel obstruction requiring emergency intervention.^{8,10} ELBS in this subgroup of patients is associated with a prognosis that is often poorer than for elective

surgery with reported mortality rates between 12.6% and 16.5%.^{5,8} The UK guidelines for the management of colorectal cancer recommend that the overall mortality rate for emergency/urgent surgery should be 20%.¹⁷ Even though in our study 35 patients (17.3%) required emergency surgery for obstructing colorectal carcinoma with a 5.7% ($n=2$) mortality rate, we feel that other strategies should be explored and adopted to reduce this mortality rate.

Several studies have confirmed that colonic stenting followed by semiurgent resection in patients presenting with malignant large bowel obstruction is associated with reduced morbidity and mortality, shorter hospital stay and lower colostomy rates when compared with emergency surgery. Funding and training should be instituted to allow progressive wider availability of stenting services to reduce the number of patients requiring emergency resections for malignant large bowel obstruction.

There has been some suggestion that increasing specialisation in emergency gastrointestinal surgery could improve its results.^{9,18} However, others feel that the data are not convincing enough⁵ as the Association of Coloproctology of Great Britain and Ireland (ACPGBI) has shown that the mortality following surgery for malignant large bowel obstruction was similar for ACPGBI and non-ACPGBI members.⁵

There is strong evidence to suggest that consultant surgeons are committed and contributing more to emergency surgery than a decade ago.⁹ In our study, consultants were available as either first operator or assistant in 92.6% of cases. We fully acknowledge that surgical trainees need to acquire both the non-technical and technical skills in managing emergency surgical patients. No significant difference in mortality rate was found in this study between grade of surgeon and time of surgical intervention, and this could be attributed to the high availability of consultants as operator or assistant. Similarly, Chester and Britton assessed the impact of surgical training on patient survival, and found no significant difference between the perioperative mortality rates where surgery was carried out by a consultant or a trainee.¹⁹

As this study was carried out in a tertiary referral hospital, some cases were transferred, owing to their medical co-morbidities, from local, smaller hospitals. Consequently, mortality rates in this series could be higher than in other hospitals, according to their local set-up. It has been generally agreed that there is variability in outcomes of ELBS,^{1,5,9} which could be related to variety of reasons including local pattern of case referral.

ELBS is financially demanding as it often involves ICU/HDU admission, has an increased rate of postoperative complications and a prolonged hospital stay. Despite maximum use of resources, mortality rates continue to be high as the same-day mortality rate was 3.4% and the 7-day rate was 10.8% in our study. Various scoring systems and studies have tried to predict the outcomes in this group of patients to help better allocation of resources.^{4,5,15} In our study, 65% of patients were admitted to the HDU but the in-hospital mortality rate was higher in those admitted to the ICU. It is interesting to note that although major improvements have been made in the management of

critically ill surgical patients over the last 20 years, mortality from ELBS continues to be relatively high.

We acknowledge that this study is subject to the limitations of single centre retrospective studies even though the data were collected prospectively and patients from previously published studies were used as a control group. It would not be ethical (or acceptable), however, to design a prospective study with a control group of patients lacking consultant input in their management. Nevertheless, our data are still useful to guide future efforts attempting to improve outcomes in emergency large bowel obstruction, as other strategies, in addition to greater consultant involvement, are clearly needed to address this challenge.

Furthermore, the study could be criticised as it included patients with diverse underlying pathology that required varied surgical procedures. It could be argued that the outcome for each group should be studied separately. While we agree that this might provide additional insight on the outcomes of individual underlying pathology that requires ELBS, we feel that discussing outcomes under a subheading is somehow artificial and does not represent everyday practice.

We also believe that our study could be useful when counselling patients prior to operative intervention as it provides an overall insight for clinicians on the current outcomes of ELBS patients as a group because the underlying pathology might not be known for definite prior to surgery despite preoperative investigations. Another criticism of the study could be the involvement of various consultant surgeons, anaesthetists and radiologists in managing these patients, with different subspecialty interests. However, the current clinical outcomes reflect the practice of 'teams' rather than individual consultants and this study could therefore serve as a useful guide on the current outcomes in this group of patients.

Conclusions

ELBS continues to carry a high risk despite several developments in the provision of emergency surgical care. Further developments are needed to improve postoperative outcomes in these patients.

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