An audit of process and outcome for emergency colectomy in England and Wales

E. M. Burns*,†, T. Poulton‡, M. Deputy*,†§, T. Pinkney§ and R. Guy¶

*St Mark’s Hospital and Academic Institute, London, UK, †Department of Cancer and Surgery, Imperial College London, London, UK, ‡Health Services Research Centre, National Institute of Academic Anaesthesia, London, UK, §Academic Department of Surgery, University of Birmingham, Birmingham, UK, and ¶Wirral University Teaching Hospital NHS Foundation Trust, Wirral, UK

Received 29 June 2020; revised 22 July 2020; accepted 5 August 2020; Accepted Article online 14 September 2020

Abstract

Aim The aim of this work was to describe process and outcome for patients undergoing emergency colectomy for colitis in England and Wales.

Method The National Emergency Laparotomy Audit (NELA) is a national audit including patients undergoing emergency laparotomy and laparoscopic resectional procedures. Data from adult patients under 65 years of age who underwent emergency subtotal colectomy or panproctocolectomy for colitis between 2013 and 2016 were analysed.

Results In total 1204 patients were included. Although approximately a third of patients underwent a colectomy within 5 days of admission [37% (440/1204)], 32% (383/1204) were admitted for more than 10 days prior to surgery. Colorectal surgeons were present at operation in 72% (869/1204) of cases and consultant surgeons attended 94% (1137/1204) of procedures. Laparoscopy was attempted in 32% (390/1204) of operations with wide institutional variation in its use (0–100% of cases). The overall 30-day inpatient mortality was 2.9% (35/1204). On multivariable regression analysis, age > 55 years [OR 3.59 (1.05–12.21), P = 0.041], female gender [OR 2.88 (1.27–6.52), P = 0.011] and American Society of Anesthesiologists grade 5 [OR 37.43 (2.72–514.52), P = 0.007] were associated with increased mortality.

Conclusion There is a consultant-driven service that is largely delivered by specialist colorectal surgeons. Laparoscopy rates were high although there was wide variation in use across institutions. Preoperative delays were evident, and further work is necessary to determine the underlying reasons for these.

Keywords Colectomy, colitis, inflammatory bowel disease

What does this paper add to the literature?

This paper shows that patients requiring an emergency colectomy have an increased risk of death if they are older than 55, female or have many comorbidities. It finds evidence of preoperative delays to theatre. It shows a wide range in the use of laparoscopy nationally in a largely consultant-delivered service.

Introduction

Inflammatory bowel disease (IBD) is a chronic relapsing condition involving inflammation of the bowel. Primary care data from northern England in the mid-1990s estimated the incidence of ulcerative colitis (UC) and Crohn’s disease (CD) to be 13.9/100 000 patients per year and 8.3/100 000 patients per year, respectively [1]. The National Institute for Health and Care Excellence (NICE) has estimated the prevalence of UC and CD in the UK to be 240 per 100 000 [2] and 157 per 100 000 people [3], respectively. There have been suggestions that these incidences are increasing [4].

The indications for an emergency subtotal colectomy for colitis are failed medical therapy, toxic colonic dilatation, perforation and severe bleeding [5]. A cohort study has estimated that up to 30% of patients with extensive UC will require a colectomy within 10 years [6]. The emergency colectomy rate following an episode of acute severe colitis remains high. Even in the biological era this rate is estimated to be approximately 19% [7].

Outcome following emergency colectomy for UC has certainly improved since the 1950s when the mortality rate was 30% [8]. Scandinavian data suggest that...
the 30-day mortality among emergency cases is 5.3%, with a higher mortality amongst those patients with CD who require an emergency colectomy (8.1%) [9].

This study aimed to describe current practice in emergency colectomy in England using data from the National Emergency Laparotomy Audit (NELA).

Method
All patients who underwent a subtotal colectomy in England and Wales and whose data were submitted to the NELA in the first 3 years (1 December 2013 to 30 November 2016) of initiation of the audit were included. NELA data collection is performed by clinical and administrative staff within hospitals and data collation is carried out by the Royal College of Anaesthetists, with surgical input from the Clinical Effectiveness Unit at the Royal College of Surgeons. It is a mandatory audit in National Health Service (NHS) hospitals in England and includes any patient who has an emergency laparotomy or laparoscopy. Data are entered prospectively into a national database, which includes demographic, disease severity scoring, process and outcome data.

Population
All patients who were recorded as having undergone a subtotal colectomy or panproctocolectomy as an emergency procedure were included. This encompassed both open and laparoscopic procedures.

There was no single definition for IBD on the database. To create a homogeneous cohort the definitions of included diagnoses were narrow. The diagnostic terms used in the audit changed between 2014 and 2015. Thus, for the first 2 years patients with a diagnosis of colitis or CD were included. From 2015, patients with a diagnosis of UC, CD or other colitides were included. Throughout the study period, only patients aged between 18 and 65 years were included.

Patients with a surgical indication of intestinal obstruction, large bowel obstruction, pseudo-obstruction or volvulus were all excluded. Operative findings of diverticulitis, colorectal cancer, localized/or disseminated malignancy or volvulus were also excluded.

Outcome variables
Thirty-day inpatient mortality is defined as a death in hospital within 30 days of surgery as entered by clinical and administrative staff within the audit tool. Reoperation is defined as any return to theatre during the index hospital admission. This was a self-reported outcome entered by clinical and administrative staff. Postoperative length of stay (LOS) is the time in days from date of colectomy to first discharge date following surgery.

Statistical methodology
Chi-square analyses were used to determine differences between population groups. Nonparametric data were explored using the Mann–Whitney U-test. Binary logistic regression analyses investigated 30-day inpatient mortality and reoperation rate. Factors with a significance level of ≤0.1 on bivariate analysis were included in the regression analyses. Statistical analyses were carried out using Stata IC version 13 (StataCorp. 2013, Stata Statistical Software: release 13., StataCorp LP, College Station, Texas, USA) For tests of significance, a P-value of <0.05 was considered significant. The median and interquartile ranges are given for nonnormal variables. Funnel plots using exact Poisson control limits were constructed using the web tool available at http://www.erpho.org.uk/topics/tools/funnel.aspx.

Results

Demographic and process factors
Between 1 December 2013 and 30 November 2016 a total of 1204 patients who underwent an emergency subtotal colectomy for colitis were included. Table 1 details the demographics of these patients.

After a decision had been made to operate, most patients were booked as ‘urgent’ (6–18 h) or ‘expedited’ (>18 h) [75% (814/1091)] (Table 2) with few

Table 1 Demographic of patients undergoing an emergency subtotal colectomy for colitis.

| Category   | Number | %  |
|------------|--------|----|
| Age (years)|        |    |
| 18–25      | 236    | 19.6|
| 26–35      | 293    | 24.3|
| 36–45      | 228    | 18.9|
| 46–55      | 233    | 19.4|
| 56–65      | 214    | 17.8|
| Gender     |        |    |
| Male       | 648    | 53.8|
| Female     | 556    | 46.2|
| ASA grade  |        |    |
| 1          | 66     | 5.5 |
| 2          | 633    | 52.6|
| 3          | 417    | 34.6|
| 4          | 80     | 6.6 |
| 5          | 8      | 0.7 |
| Indication |        |    |
| Colitis    | 1102   | 91.5|
| Crohn’s disease* | 157 | 13.0|

ASA, American Society of Anesthesiologists.
*These categories are not mutually exclusive.
Table 2 Booking classification and timing of surgery of patients undergoing an emergency subtotal colectomy for colitis.

| Category | Number | %  |
|----------|--------|----|
| CEPOD classification* | | |
| 1 Immediate < 2 h | 55 | 5.0 |
| 2A Urgent 2–6 h | 222 | 20.3 |
| 2B Urgent 6–18 h | 319 | 29.2 |
| 3 Expedited > 18 h | 495 | 45.4 |
| Time from admission to operation (h) | | |
| ≤ 24 | 105 | 8.7 |
| > 24–72 | 183 | 15.2 |
| > 72–120 | 152 | 12.6 |
| > 120–240 | 381 | 31.6 |
| > 240 | 383 | 31.8 |
| Time from decision to operate (h) | | |
| < 2 | 109 | 10.7 |
| 2 to < 6 | 260 | 25.4 |
| 6 to < 18 | 180 | 17.6 |
| 18 to < 72 | 421 | 41.2 |
| ≥ 72 | 52 | 5.1 |

*One hundred and thirteen patients operated on prior to 2014 (CEPOD, Confidential Enquiry into Perioperative Deaths).

patients considered as needing ‘immediate’ surgery. Most procedures [95% (970/1022)] occurred within 72 h of the decision to operate, suggesting that once this decision was made there were few delays in accessing theatre (Table 2). The majority of patients underwent colectomy after 5 days or more in hospital [63% (764/1204)]. Of these, 50% (383/764) of patients had been in hospital for more than 10 days prior to surgery. Amongst those patients operated on beyond 10 days postadmission (383 patients), 320 had a recorded decision to operate time. Of these patients, 216 (68%) were operated on within 24 h of the decision to operate.

In England and Wales, most procedures were performed by consultant colorectal surgeons (Table 3). There are missing data [8.2% (99/1204)] indicating the designated specialty of operating surgeons, but colorectal surgeons were present in at least 72% (869/1204) of cases. Consultant presence overall in theatre was also high.

Most patients were managed in a Level One care ward postoperatively [Level One 49% (589/1204)], with use of other levels being Level Two 34% (411/1204) and Level Three 17% (204/1204).

Laparoscopic surgery

Although the majority of patients had open surgery, colectomy was attempted laparoscopically in 32% (390/1204), with an 11% (41/390) overall conversion rate (Table 3).

Table 4 describes the differences in patients selected for laparoscopic and open approaches, with a laparoscopic approach being utilized more often in younger patients (P < 0.001). The laparoscopic approach had a trend to being utilized more often in female patients, but this did not reach statistical significance (P = 0.05).

There was wide variation in the use of laparoscopy across NHS institutions contributing to the audit (range 0–100% cases attempted laparoscopically) (Fig. 1). The total volume of cases submitted to the audit also varied significantly by NHS institution (Fig. 1).

Outcome

The overall 30-day inpatient mortality was 2.9% (35/1204) with a reoperation rate of 9.6% (115/1187) and an unplanned return to intensive care in 4.4% (52/1188). The median postoperative LOS was 11 days (7–17 days).

Table 5 describes the recorded mortality, return to theatre, preoperative LOS and postoperative LOS amongst patients undergoing a colectomy in the laparoscopic and open groups. Mortality was found to be significantly higher in the open group (P = 0.007) and LOS was significantly shorter in the laparoscopic group. There was no significant difference in the rate of return to theatre amongst the laparoscopic and open groups.

Following regression analysis, older age, high American Society of Anesthesiologists (ASA) grade and female gender were associated with an increased risk of mortality (Table 6).

Discussion

Despite advances in medical therapy for IBD, colectomy remains a common operation in the emergency setting.

This analysis of emergency colectomy data suggests that in England and Wales there is a consultant-driven service that is largely delivered by specialist colorectal surgeons. Laparoscopy rates were high, although there was wide variation in use across institutions. Despite such a specialty service, preoperative delays remain evident.

These data show that many patients will undergo a colectomy within 5 days from admission but nearly a third were admitted for more than 10 days before an operation. When a decision was made to operate there was little further delay in progressing to resection – most cases were operated on within 72 h. There may be a collective delay from admission to making a timely decision to operate involving the surgeon, gastroenterologist and patient. This may be a necessary and appropriate delay to ensure good medical management and a multidisciplinary decision is made before definitive surgical treatment. However, prolonged medical treatment of acute severe colitis is associated with higher rates of postoperative morbidity and complications.
Both NICE and European Crohn’s and Colitis Organization guidance advise assessing the response to corticosteroid treatment after 72 h. If there is little clinical improvement, second-line therapy should be delivered or surgery considered. In this cohort it is unclear what the drivers of delays in decision-making for colectomy might be. It may be that biological therapies are preferred by clinicians and patients as a first line. Further work would be useful to identify, at an early point, those patients who will not respond to steroids and biologicals. Although we are not able to demonstrate it from our data, future work may show that targeting these patients for early colectomy could reduce morbidity following subtotal colectomy.

The 30-day inpatient mortality in this study was 2.9%, which compares favourably with international observations. Mortality rates have varied significantly in the literature from 1.3% to 13.2% [9,13–15]; such variation possibly reflects historical data but also the definitions of an emergency subtotal colectomy. In this study, an emergency colectomy was self-defined within NELA. In addition, all patients with colitis were included. Previous studies have suggested that Crohn’s colitis is associated with a higher mortality [9,13].

Mortality was significantly higher in the open group compared with the laparoscopic group but we urge caution in interpretation here. We have shown that patients in the open group have a higher ASA grade and are older than patients in the laparoscopic group.

Due to the small number of deaths in this cohort we were unable to assess institutional variation in mortality. Previous work has shown lower postoperative mortality in hospitals performing colectomies at a higher volume [9,16] and improved outcomes are associated with higher volume in other procedures for IBD. Pouch failure rates, for example, are lower in higher-volume pouch centres [17,18]. NELA strives to improve the care of emergency surgical patients and is limited to examining perioperative outcome. However, wider work

### Table 3

| Category                          | Number | %  |
|-----------------------------------|--------|----|
| Level of operating surgeon        |        |    |
| Consultant                        | 1137   | 94.4 |
| Training registrar                | 39     | 3.2 |
| Noncertified specialist            | 28     | 2.3 |
| Speciality of operating surgeon   |        |    |
| Colorectal                        | 869    | 72.2 |
| Other                             | 236    | 19.6 |
| Unknown/missing                    | 99     | 8.2 |
| Laparoscopic approach*             |        |    |
| Open                              | 814    | 67.6 |
| Laparoscopic or laparoscopic assisted | 349  | 29.0 |
| Laparoscopic converted to open     | 41     | 3.4 |

*For further analysis the laparoscopic, laparoscopic assisted and converted are combined on an intention to treat basis.

### Table 4

Demographics of patients undergoing an emergency open and laparoscopic subtotal colectomy for colitis.

| Category | Open | %   | Laparoscopic | %   | P-value |
|----------|------|-----|--------------|-----|---------|
| Age (years) |      |     |              |     |         |
| 18–25     | 144  | 17.7| 92           | 23.6| < 0.001 |
| 26–35     | 168  | 20.6| 125          | 32.1|         |
| 36–45     | 166  | 20.4| 62           | 15.9|         |
| 46–55     | 169  | 20.8| 64           | 16.4|         |
| 56–65     | 167  | 20.5| 47           | 12.1|         |
| Gender    |      |     |              |     |         |
| Male      | 454  | 55.7| 194          | 49.7| 0.050   |
| Female    | 360  | 44.2| 196          | 50.3|         |
| ASA grade |      |     |              |     |         |
| 1         | 46   | 5.7 | 20           | 28.3| < 0.001 |
| 2         | 414  | 50.9| 219          | 32.3|         |
| 3         | 272  | 33.4| 145          | 32.5|         |
| 4         | 74   | 9.1 | 6            | 7.0 |         |
| 5         | 8    | 1.0 | 0            | 0.0 |         |

ASA, American Society of Anesthesiologists.
is required to understand the system factors determining longer term outcomes such as restoration of intestinal continuity for colitic patients.

Our data shows that LOS is shorter in patients treated with the laparoscopic approach compared with an open one. However, there is still a wide variation in the use of laparoscopy as the initial approach to colectomy (0–100% range). Fifteen trusts were low outliers for use of laparoscopy. Five trusts who performed more than 10 colectomies per year did not attempt any cases laparoscopically. There is evidence of an increasing use of laparoscopy for major abdominal surgery over time

Table 5 Outcome following surgery.

| Category                  | Laparoscopy | Open | Total | P-value |
|---------------------------|-------------|------|-------|---------|
| 30-day inpatient mortality| 4           | 31   | 35    | 0.007   |
| Return to theatre         | 39          | 76   | 115   | 0.737   |
| Preoperative length of stay (h) |           |      |       |         |
| ≤ 24                      | 16          | 89   | 105   | 0.003   |
| > 24–72                   | 67          | 116  | 183   | 0.152   |
| > 72–120                  | 50          | 102  | 152   | 0.126   |
| > 120–240                 | 126         | 255  | 381   | 0.136   |
| > 240                     | 131         | 252  | 383   | 0.138   |
| Missing*                  | –           | –    | 53    | 0.44    |
| Postoperative length of stay (days) |           |      |       | < 0.005 |
| < 5                       | 39          | 13   | 52    | 4.3     |
| 5 to < 7                  | 93          | 91   | 184   | 0.153   |
| 7 to < 10                 | 98          | 167  | 265   | 0.22    |
| 10 to < 14                | 54          | 179  | 233   | 0.194   |
| ≥ 14                      | 100         | 317  | 417   | 0.346   |

*Fifty three patients were censored or died.
and the variation in use of laparoscopy is similar to other emergency procedures such as emergency appendicectomy [21,22] as well as elective procedures performed in the UK [23].

Consultant presence in theatre (94% of recorded cases) is high in this cohort. A colorectal specialist was present at 72.2% of operations, suggesting that, once a decision to operate is made, patients are likely to have their procedure done by a senior specialist surgeon. Such high consultant presence maybe partly responsible for the comparatively good outcome demonstrated in this potentially morbid population. Initiatives such as NELA have led to a culture change. Emergency colorectal care in England has shifted to being much more consultant-driven for both anaesthetic and surgical teams. The standards for unscheduled care developed by the Royal College of Surgeons state that in cases with >5% predicted mortality, a consultant surgeon and consultant anaesthetist should be present for the operation [24].

The data included in this study were prospectively collected encompassing the majority of patients who underwent an emergency laparotomy. This includes both laparoscopic and open resections. It is unlikely to include those patients operated on a ‘next planned list’ basis, so will not collect those patients considered semi-urgent. This, alongside the age limitations, may be reflected in the lower mortality. Forty-day mortality after colectomy has been found to be highest in those aged over 59 [13]. There is, unfortunately, no definition of IBD in the database. To create a homogeneous cohort, narrow definitions were used to exclude other colitides, including pseudomembranous and ischaemic aetiologies. This may have excluded some relevant cases from the analysis, but the number of such patients is likely to be low.

There is a consultant-driven service that is largely delivered by specialist colorectal surgeons in England and Wales. Laparoscopy rates were high although there was wide variation in use across institutions. There is evidence for preoperative delay. Further work is necessary to determine the underlying reasons for delays aiming to improve morbidity.

**Acknowledgement**

The National Emergency Laparotomy Audit (NELA), Royal College of Anaesthetists. NELA was commissioned by the Healthcare Quality Improvement Partnership (HQIP), funded by NHS England and the Welsh Government and it is part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP).

**Conflicts of interest**

There are no conflicts of interest to declare.

**Data Availability Statement**

The data that support the findings of this study are available from NELA, Royal College of Anaesthetists. NELA was commissioned by the Healthcare Quality Improvement Partnership (HQIP). Restrictions apply to the availability of these data, which were used with approval from HQIP for this study.
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