International Journal of Surgery 22 (2015) 131–135

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

A case-control study investigating factors of preoperative delay in emergency laparotomy

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HIGHLIGHTS

- Emergency laparotomy is associated with a high morbidity and mortality.
- Outcomes in emergency laparotomy have not significantly improved over the last few decades.
- Delay in commencing surgery has been shown to negatively impact on outcome in emergency laparotomy.
- It is not known which preoperative factors may influence a delay in commencing surgery.
- Age, operative indication and presence of a consultant surgeon have been shown to independently affect preoperative delays.

ARTICLE INFO

Article history:
Received 18 June 2015
Accepted 3 August 2015
Available online 28 August 2015

Keywords:
Emergency laparotomy
Theatre transfer time
Laparotomy delay
National emergency laparotomy audit
Patient age
Laparotomy indication

ABSTRACT

Background: Emergency laparotomy (EL) is a procedure that puts a strain on healthcare resources and is associated with a significant morbidity and mortality. Despite these implications little improvement in the outcome of patients undergoing this procedure has been made in the UK over the last few decades. A delay in transferring patients to theatre has been shown to negatively affect outcome of EL. A prospective case-control study was carried out to evaluate which preoperative factors may contribute towards a delay in theatre transfer.

Methods: The time between decision to operate and anaesthetic start time was recorded for all patients undergoing EL between April and September 2013 at Gloucestershire Royal Infirmary. Patient selection criteria were based on the National Emergency Laparotomy Audit guidelines. Patients were divided into two groups depending on whether the transfer to theatre was delayed or not. Binary logistic regression analysis was performed on perioperative factors to determine independent predictors of delay.

Results: A total of 84 EL were included for analyses with 31 classified as delayed. In the delayed group time for theatre transfer was increased at 6.9 vs. 2.3 h ($p < 0.005$) respectively. Unavailability of emergency theatres due to other cases taking priority was the most frequent cause for delay ($n = 24$). On binary logistic regression analysis, indication for laparotomy (OR 4.96, CI 1.4-17.6, $p < 0.05$), patient age (OR 1.04, CI 1.00-1.07, $p < 0.04$) and presence of a consultant surgeon (OR 0.16, CI 0.03-0.79, $p < 0.03$) were found to be independent predictors of delay in EL.

Conclusion: In this study, factors that were associated with a delay in commencing EL were operative indication and patient age whereas the presence of a consultant surgeon made a delay less likely. These findings may highlight points of interest for researchers analysing and auditing the provision of EL in the UK.

1. Introduction

In recent years significant efforts have been made in the United Kingdom (UK) to improve the outcome of trauma patients presenting to the National Health Service (NHS) [1]. On the contrary, the mortality and morbidity following non-trauma laparotomy for acute abdominal conditions has remained almost unchanged over

Abbreviations: ASA, American Society of Anaesthesiologists; DEL, delayed emergency laparotomy group; EL, emergency laparotomy; NEL, non delayed emergency laparotomy group; NELA, national emergency laparotomy audit.

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http://dx.doi.org/10.1016/j.ijsu.2015.08.028
1743-9191/

decades [2–5]. In the period of 1995–2003 the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) has instigated changes in the way that emergency surgical care is provided in the NHS. Many of these changes apply to patients undergoing emergency laparotomy (EL) such as prioritising cases to avoid queuing of patients, establishment of dedicated emergency theatres with 24 h staffing, increasing the number of nursing staff trained in postoperative care and the early involvement of intensive care and old age medicine specialists [6–9]. Within this context it was found that a delay in commencing EL can have a detrimental impact on morbidity and mortality [4,7,9]. Although this is a problem on an international level [5,10–14], so far there have been no studies investigating perioperative factors that may contribute towards delay. As well as having implications for clinical outcome, delays in EL may also have a negative impact on the efficient provision of elective services, because resources (e.g. hospital beds) reserved for elective operations may require redistribution to accommodate emergency cases.

In early 2014 the National Emergency Laparotomy Audit (NELA) was rolled out in the UK [5,15] with the aim of improving the quality of care for patients undergoing EL. Substantial amounts of perioperative data is being collected to facilitate a comparative analysis into factors that could enhance patient outcome following EL. To reduce heterogeneity of the database several common laparotomy indications such as vascular surgery, trauma surgery, cholecystectomy and appendicectomy have been excluded from analysis because they are known to have a different pathophysiology and prognosis compared to emergency laparotomy for conditions such as hollow viscus perforation and bowel obstruction [15].

The Gloucestershire Royal Hospital (GRH) is a 600 bed secondary care hospital that is participating in NELA. In preparation there have been discussions about potential areas for improvement in the care of patients undergoing emergency laparotomy. Delay in commencing surgery was identified as problematic in this patient population and a case-control study was proposed to investigate preoperative factors that may contribute towards this issue. Prospective data pertaining to the timing of EL and causes of delay was collected in conjunction with a number of preoperative factors that are also included in the NELA data collection. Because delay is a preoperative issue, postoperative outcome data has only been collected where relevant for comparison to other patient cohorts. This article intends to elucidate preoperative factors that may influence delays in EL.

2. Methods

Patient selection criteria for this study were oriented on the National Emergency Laparotomy Audit guidelines [15]. Data was collected prospectively on all patients undergoing emergency laparotomy at GRH in the period of April to September 2013. Patients undergoing laparotomy for trauma, vascular, urological or gynaecological conditions were excluded but if those patients had to undergo re-laparotomy for a postoperative complication, they were included in the study for the second procedure. Appendicectomies and cholecystectomies performed through a laparotomy incision were excluded unless they were incidental to an emergency procedure on the gastrointestinal tract.

Data collected included age, gender, American Society of Anaesthesiology (ASA) grade, type of surgical procedure, laparotomy indication, presence of preoperative CT scan and number of laparotomies performed secondary to a postoperative complication. ASA grade was collapsed into two categories of ASA < 3 and ASA ≥ 3. Patients were excluded if occurrence of delay was not recorded. Other missing data collection points did not preclude inclusion into the study. The staff level of the most senior surgeon and anaesthetist involved in the laparotomy was recorded to ascertain a potential impact on laparotomy timing. Involvement was defined as having been present in theatre at any pre- or intraoperative point in time. In addition, postoperative data such as operative findings, length of hospital stay, in-hospital mortality and hospital readmission rate was collected. For postoperative comparison, intraoperative findings of hollow viscus ischaemia, perforation and bleeding (intraperitoneal or intraluminal) were classified as “urgent” because an operative delay in these scenarios can lead to rapid clinical deterioration. All remaining cases were classified as “expedited”. Collection of data was approved by the local audit committee.

To analyse the processing time for each case the admission time, theatre booking time, and anaesthetic start time were recorded. From these time points the time taken for admission to booking and from theatre booking to anaesthetic start time were calculated. The time from booking to anaesthetic start time was defined as “time to theatre”. It was also taken into account if case booking or surgery took place over the weekend (Saturday or Sunday) or out of hours (18.00–08.00) because frequently, hospitals in the UK are not fully staffed and access to auxiliary services (e.g. interventional radiology) is limited at these times.

A member of the general surgical on call team completed a questionnaire to ascertain if a delay had taken place and what it was caused by (e.g. lack of theatre staff). If other cases booked for surgery caused a delay, the booking specialty was recorded. If an EL was commenced later due to preoperatively planned treatments (e.g. optimisations of patients with organ dysfunction) it was not considered as a delay.

Cases were divided into delayed (DEL) and non-delayed emergency laparotomy groups (NEL). Recorded variables were analysed for differences between groups. Normal distribution of continuous variables was checked with the Shapiro–Wilks test, which informed the appropriate use of a parametric or a non-parametric statistical tests to compare group values. Categorical variables were compared using the chi-square or Fishers exact test as appropriate. Values for continuous variables are reported as median with the interquartile range (IQR) given in brackets. Categorical variables are stated as frequencies.

Each individual factor was evaluated by univariate analysis and retained for multivariate analysis if a threshold of $p < 0.2$ was reached. This threshold was chosen because the low frequency of events increased the possibility of underestimating the impact of preoperative factors. Variables that qualified for inclusion, where assessed by binary logistic regression analysis. The regression model employed the backward conditional method with delay of laparotomy (DEL vs. NEL) as the dependent variable. A variable was deemed to be a significant predictor of delay if $p < 0.05$. Variables are reported as odds ratios ± standard error, with a 95% confidence interval and p-value also given. Statistical analysis was carried out with SPSS Version 21 (IBM, Armonk, NY, USA).

3. Results

For the period of April to September 2014 a total of 88 non-trauma laparotomies were performed in emergency theatres under the care of the general surgery team. Out of these four cases were excluded from the study; two because they were planned admissions that were streamlined onto the emergency pathway, and another two because an appendicectomy was the only procedure carried out. This left a total of 84 laparotomies eligible for inclusion in the study. Because 3 patients underwent re-laparotomies in this period, the total number of patients assessed was 81. Out of these 31 cases were categorised as delayed which