World J Surg (2019) 43:798–805
https://doi.org/10.1007/s00268-018-4849-6

ORIGINAL SCIENTIFIC REPORT

Decision-Making in the Emergency Laparotomy: A Mixed Methodology Study

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Published online: 19 November 2018

Abstract

Introduction More than 30,000 emergency laparotomies take place annually in England and Wales (Symons et al. in Br J Surg 100(10):1318–1325, 2013; Shapter et al. in Anaesthesia 67(5):474–478, 2012). They are associated with high morbidity and an average inpatient 30-day mortality rate of 11%. Inextricably linked to outcomes is the decision-making process of whether or not to operate (NELA Project Team First patient report of the National Emergency Laparotomy Audit. RCoA, London, 2015; Crebbin et al. in Aust N Z J Surg 83(6):422–428, 2013). A mixed-methods study was undertaken to investigate decision-making in the emergency laparotomy and influencing factors.

Methods Semi-structured interviews were undertaken amongst general surgeons, exploring the decision-making process. Results helped guide design of an online survey, consisting of vignettes and subsequent questions. Respondents were asked to decide whether or not they would perform a laparotomy for each vignette and the results compared to grade, risk attitudes and reflective practice. Responses were analysed for effect of previous positive and negative experiences and for consistency.

Results Interviews revealed multiple important factors when considering whether or not to perform an emergency laparotomy, broadly categorised into patient-related, surgeon-related and external factors. A total of 116 general surgeons completed the survey: 12 SHOs, 79 registrars and 25 consultants. Non-consultants were 10.4% (95% CI ±9.7%) more likely to perform an emergency laparotomy than consultants ($p = 0.036$) on multivariate analysis. No association was observed between operative practices and risk attitudes ($p = 0.22$), reflective practice ($p = 0.7$) or previous positive or negative experiences in univariate ($p = 0.67$) or multivariate analysis. Surgeons were not proven to be either consistent nor inconsistent in their decision-making.

Conclusion The decision to operate or not in an emergency laparotomy directly effects patient outcome. This study demonstrates a difference in decision-making and risk attitudes between consultants and their juniors. To address this, formal teaching of models of decision-making, influencing factors and vignette-based consultant-led discussions should be introduced into surgical training.

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00268-018-4849-6) contains supplementary material, which is available to authorized users.

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Introduction

The emergency laparotomy forms a substantial part of the emergency general surgery workload worldwide. In England and Wales alone, more than 30,000 patients undergo emergency laparotomies annually [1, 2], with high morbidity and an average national inpatient thirty-day mortality of 11% [3]. The National Emergency Laparotomy Audit (NELA) has resulted in renewed focus on outcomes for emergency laparotomy patients in the UK. Inextricably linked to outcomes is the complex and multifactorial initial decision-making process of whether or not to operate [3, 4].

Decision-making is a key component of the emergency general surgical curriculum internationally [4, 5]. This skill is developed over time and with experience [4, 6, 7]. Different surgeons reach different decisions on whether to operate, and individual surgeons may not be consistent with their decisions in comparable cases. Despite decision-making being a vital skill in emergency surgery, there is a relative deficit in the literature regarding the methods involved, influencing factors and consistency within the process [6, 8]. It is rarely formally taught upon and practitioners have varying insight into what shapes their decisions [4, 9].

It is vital that we seek to better understand the decision-making process in the emergency laparotomy if surgeons are to see improved outcomes and teach trainees how to make good decisions.

The aim of this study was to explore what influences surgeons' decisions of whether or not to operate in the emergency laparotomy.

Materials and methods

The study utilised both qualitative and quantitative techniques and comprised of three phases, in order to explore decision-making both thematically and statistically.

Phase one

Individual interviews were conducted amongst a convenience sample of general surgeons of all grades, at St Mary's Hospital, Isle of Wight, a district general hospital, to explore ideas regarding decision-making and its influencers in the emergency laparotomy.

All interviews were audio recorded, transcribed and thematic content analysis undertaken and checked by two data analysers. Interviews continued until relative saturation point was reached. No surgeons declined participation.

Phase two

Themes identified in phase one were used to design a survey with six vignettes. In all cases data included: age; gender; clinical history; comorbidities; examination findings; observations; relevant investigations, and a Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (P-POSSUM).

Cases included one positive and one negative control case, and four 'grey area' cases, in which both operative and non-operative management was considered reasonable. Two 'grey area' cases were matched for age, ASA grade, premorbid function and operative risk (P-POSSUM). For the matched vignettes, two versions existed, describing a recent similar case with either a positive or negative outcome (paragraphs A and B). Respondents were randomised to paragraph A for one matched vignette and paragraph B for the other, to assess both the surgeons' consistency and the effect of previous outcomes.

For all vignettes, participants were asked to decide whether or not they believed an emergency laparotomy was indicated (Yes/No) with optional free text boxes. Vignette order was randomised. Participants then completed a series of questions relating to identified themes influencing decision-making, including grade, risk attitude (Pearson's modification of the Jackson Personality Index) [10] and reflective practice.

The survey and vignette cases were validated using semi-structured, face-to-face, audio-recorded interviews performed amongst consultants with regular emergency surgery on call commitments.

Phase three

The survey was released online using the SurveyGizmo platform [11]. The survey link was circulated nationally in the UK via deaneries, regional research collaboratives, the Edinburgh Surgical Sciences Qualification website, Wessex regional contacts participating in the Emergency Laparotomy Collaborative, NELA leads and personal contacts. The survey was also advertised on the Association of Surgeons in Training website.

Eligibility criteria required participants to be working within the NHS as a surgical doctor above foundation grade, with on call commitments in emergency general surgery. Surgeons interviewed in prior phases were excluded.

The survey can be found as Online Resource 1.

Statistical analysis

Based on sample-size calculations, we aimed for a minimum of 80 responses [12]:

$N = 10 \times k/p$

$N = 10 \times 4/0.5 = 80$

$k =$ number of variables (four)

p = out of all cases lowest percentage decision to operate (estimated at 50% given that cases are chosen as 'grey area').

Analysis of quantitative data was performed using XLStat Premium software [13]. Statistical significance was set at $p < 0.05$. Chi squared (χ^2 and Fisher's Exact tests were used for categorical data, the Mann–Whitney U test for continuous, non-parametric data and multiple logistic regression to ascertain the relationship of each variable to the decision to operate. Free text was analysed using thematic content analysis.

Results

Phase one interviews

Individual interviews were conducted in early 2016 with four consultants, one training registrar, one associate specialist and two core surgical trainees.

For excerpts from interviews, see Online Resource 2 and for a schematic of Phase 1 interview themes see Online Resource 3.

Patient factors

Fitness in terms of age, comorbidities, premorbid state and anaesthetic risk were all considered important when contemplating an emergency laparotomy. Clinical indication, assessed by history, examination, relevant investigations and differential diagnosis was deemed unanimously crucial. Other frequent considerations included response to initial resuscitation and the urgency of, and optimal timing for, operative intervention.

Patients' wishes were considered highly relevant. It was recognised, however, that the way in which surgeons present information might sway a patient's decision, and that due consideration should therefore be given to how information is presented. Patients were believed to be generally receptive to their surgeon's suggestions.

Surgeon factors

Personality was felt to influence decision-making; traits of boldness and confidence versus caution and wariness potentially affecting the decision to operate, although juniors emphasised these points more. Consultants focussed more on attitudes towards uncertainty, awareness of risk, perception of the clinical issues and differing management approaches.

Interviewees believed that previous positive or negative clinical outcomes made a surgeon more or less likely to perform an emergency laparotomy in similar cases, respectively.

Grade and experience

Juniors were felt to adopt a more fact-orientated approach to decision-making. There was awareness from all grades that consultants rely on the information provided by juniors, meaning the portrayal of the clinical picture may influence decisions. All grades believed that juniors are often keener to operate.

Juniors believed decision-making improves with experience, whereas consultant opinion was divided; some felt that the individual making the decision was more important than their grade.

External factors

External factors identified as influential were predominantly institution and resource-related, including: emergency operating list; availability of critical care beds; access to alternative management options e.g. interventional radiology; attitudes and availability of the wider team; anaesthetists' and intensivists' attitudes and opinions and prioritisation of the case amongst other emergencies.

Reflection/insight

Reflection during and following decision-making was considered important. Insight into one's own tendencies and external influences were recognised as potential regulating factors, although it was acknowledged that such awareness may not necessarily alter the final decision.

Interviewees noted that whilst reflective practice is becoming more commonplace in the medical profession, individual surgeons vary in their amount of insight and willingness to reflect on their practice.

Training

None of the surgeons interviewed had received formal teaching in decision-making. Consultants felt that much

Table 1 Number and percentage of surgeons choosing to perform or not perform a laparotomy for each vignette case

Vignette N°	1	2	3	4	5: +ve prior experience	5: -ve prior experience	6: +ve prior experience	6: -ve prior experience
Vignette description	Positive control	Negative control	Perforated PUD	Gastric outlet obstruction	Small bowel obstruction		Diverticular perforation	
Total	116	115	116	116	47	69	69	47
N° operating	90 (77.6%)	2 (1.7%)	94 (81.0%)	39 (33.6%)	32 (68.1%)	48 (69.6%)	51 (73.9%)	31 (66.0%)
N° not operating	26 (22.4%)	113 (98.3%)	22 (19.0%)	77 (66.4%)	15 (31.9%)	21 (30.4%)	18 (26.1%)	16 (34.0%)

could be learned from the 'apprentice' model in the clinical environment. Morbidity and mortality meetings were identified as an opportunity to learn from and discuss decisions. It was widely acknowledged that, despite being a requirement of the general surgical curriculum, education in decision-making is not well incorporated into UK surgical training.

Consistence

Consistence was viewed as an important characteristic of good decision-making, whilst also remaining flexible enough to adapt depending on the individual case.

Following thematic content analysis of Phase One, we chose to investigate how 'surgeon factors' influence decision-making during Phase Three, namely: grade; attitude to risk; previous experience and reflection. Other factors, which are numerous and often institution specific, were beyond the remit of this study. As none of the interviewees had undergone formal training in decision-making, this 'surgeon factor' was not studied further during Phase Three.

Phase two

Three individual consultant interviews were performed in March 2016. All agreed that the control cases were appropriate and that surgeons could reasonably justify a decision for or against an emergency laparotomy for the remaining vignettes.

With the two matched cases, it was felt that differences in their pathology and clinical picture limited comparability. Wording of the two cases and P-POSSUM scores were therefore reviewed, with differing pathologies recognised as a limitation.

All interviewees felt that the format was suitable and the information needed to make a decision was available. Cases, including wording, information provided and physiological parameters, were adapted based on feedback given.

Phase three

A total of 116 surgeons completed the survey in April and May 2016: 12 SHOs; 78 registrars, one associate specialist and 25 consultants. For analysis, the associate specialist was grouped with the registrars.

90 respondents (77.6%) opted for an emergency laparotomy for the positive control and 113 (98.3%) for non-operative management for the negative control. Statistical analysis was therefore performed both including and excluding the positive control. The overall number of decisions to operate for the 'grey area' cases was 295/464 (63.6%) (Table 1).

Grade

Univariate analysis demonstrated that registrars and SHOs were more likely to recommend an emergency laparotomy than consultants. A statistically significant difference was demonstrated when the positive control was included in analysis, and when grades were grouped into Consultants and non-consultants ($p = 0.04$) (Table 2). This association remained on multivariate analysis, with non-consultant grades 10.4% (95% CI ±9.7%) more likely to proceed to an emergency laparotomy than consultants ($p = 0.036$) (Table 3).

Risk attitudes

For analysis, responses were converted into an aggregate risk attitude score (RS) whereby one = highly risk averse and five = highly risk-seeking. Scores for risk-averse questions were inverted in order to form an aggregate. The median RS was 2.67 (IQR = 2.33–3.17).

No significant difference was found in the tendency to operate between respondents with a RS greater than and those with an RS less than or equal to the median; 68.9% versus 64% of cases respectively ($p = 0.22$). No association was found on multivariate analysis for grouped RS (Table 3). Consultants had higher median RS than non-

Table 2 Number and percentage of surgeons choosing to perform or not perform a laparotomy for all vignette cases according to grade, excluding and including the positive control case (Case 1)

Vignettes	Grade	Consultant	Registrar	SHO	*P**	*P***
Excluding positive control (case 1)	N° operating	58 (58%)	202 (64.7%)	32 (66.7%)	0.42	0.29
	N° not operating	42 (42%)	110 (35.3)	16 (33.3%)		
Including positive control (case 1)	N° operating	73 (58.4%)	266 (68.2%)	43 (71.7%)	0.08	0.04
	N° not operating	52 (41.6%)	124 (31.8%)	17 (28.3%)		

p* all grades separate and analysed with Chi Squared from a 2 × 3 contingency table
p** grades combined to form consultant versus non-consultant grades and analysed with Fisher's exact test from a 2 × 2 contingency table

Table 3 Multivariate logistic regression analyses including and excluding the positive control case

Variable	Likelihood of operating (%)	P	Lower 95% CI (%)	Upper 95% CI (%)
Including positive control				
Grade				
Consultant	0.0	[a]		
Non-consultant	+10.4	0.036	+0.7	+20.1
Reflective practice as part of decision-making?				
No/unknown	0.0	[a]		
Yes	+0.4	0.938	−9.5	+10.3
Aggregate Risk Attitude Score (RS)				
RS < 2	0.0	[a]		
2.5 ≤ RS < 3	−0.9	0.924	−19.5	+17.6
3-2 ≤ RS < 2.5	−6.4	0.484	−24.2	+11.4
3 ≤ RS < 3.5	+3.9	0.689	−15.4	+23.3
RS ≥ 3.5	−2.3	0.772	−17.9	1 + 3.3
Excluding positive control				
Grade				
Consultant	0.0	[a]		
Non-consultant	+7.1	0.198	−3.7	+17.9
Reflective practice as part of decision-making?				
No/unknown	0.0	[a]		
Yes	−0.9	0.866	−11.8	+9.9
Aggregate risk attitude score (RS)				
RS < 2	0.0	[a]		
2.5 ≤ RS < 3	−3.7	0.720	−24.2	+16.7
3-2 ≤ RS < 2.5	−8.5	0.397	−28.1	+11.2
3 ≤ RS < 3.5	+2.7	0.805	−18.6	+24.0
RS ≥ 3.5	−5.6	0.523	−22.7	+11.5

Dependent variables are: grade (consultant and non-consultant); reflective practice as part of decision-making (no/unknown and Yes) and Aggregate Risk Score (ranging from 1 to 5, 1 = highly risk averse, 5 = highly risk-seeking), positive = increased likelihood and negative = decreased likelihood. p values were calculated with Wald χ^2
[a]contain reference data against which likelihood of operating for all other variables is calculated

consultants: 3.00 (IQR 2.50–3.33) versus 2.67 (IQR 2.17–4.00) (p = 0.024).

Reflection

Respondents were categorised into those who actively reflected during the decision-making process and those who did not or were unsure. No difference was found in

Table 4 Percentage of respondents choosing to operate versus not to operate for matched cases five and six, according to described positive or negative prior experience (paragraph A or B respectively)

Case	Five		Six	
	Positive prior experience (paragraph A) (%)	Negative prior experience (paragraph B) (%)	Positive prior experience (paragraph A) (%)	Negative prior experience (paragraph B) (%)
Percentage of respondents choosing to operate	68.1	69.6	73.9	66.0
Percentage of respondents choosing not to operate	31.9	30.4	26.1	34.0

Table 5 Consistency of decision-making compared with measured variables: grade (consultant, registrar, SHO); Reflective practice as part of decision-making (no/unknown and yes) and aggregate attitude risk score (ranging from 1 to 5, 1 = highly risk averse, 5 = highly risk-seeking)

Variable	Consistent	Inconsistent
Grade		
Consultant	13 (52%)	12 (48%)
Registrar	41 (53%)	37 (47%)
SHO	6 (50%)	6 (50%)
Reflective practice as part of decision-making?		
No/unknown	13 (62%)	8 (38%)
Yes	47 (49.5%)	48 (50.5%)
Aggregate risk attitude score		
RS < 2	6 (75%)	2 (25%)
$2 \leq$ RS < 2.5	12 (44%)	15 (56%)
$2.5 \leq$ RS < 3	15 (47%)	17 (53%)
$3 \leq$ RS < 3.5	20 (59%)	14 (41%)
RS > 3.5	7 (47%)	8 (53%)

tendency to operate between those who reflected and those who did not in univariate analysis (64% vs. 67% respectively, $p = 0.7$) or multivariate analysis (Table 3).

Previous experience

There was no statistically significant difference in the tendency to operate when the effects of a previous experience, either positive or negative, were taken into account ($p = 0.67$) (Table 4).

Consistency

60 (52%) respondents made the same decision to operate or not to operate in the matched vignette cases and 56 (48%) made differing choices. This dichotomy remained when analysed alongside grade and aggregate risk scores (Table 5).

Phase 3 qualitative analysis

103 respondents (89%) commented on all cases. In general, there was a large amount of overlap in the comments made by those opting to perform an emergency laparotomy and those opting not to, with similar thought processes and reasoning demonstrated. In multiple scenarios, respondents showed an appreciation of the wider factors which impact upon decision-making and a well-reasoned thought process.

For excerpts from survey free text comments, see Online Resource 4.

Positive control

Whilst more surgeons of all grades opted not to perform an emergency laparotomy than anticipated, thematic content analysis revealed similar rationale in both groups.

The majority of those who opted not to perform an emergency laparotomy justified their response by explaining that they would further resuscitate and investigate the patient first, then likely proceed to laparotomy depending on the indication.

Negative control

Of the two respondents who opted for operative intervention, one made no comment, and the other described that the patient would not survive without surgery. However, they also recognised that the patient was unlikely to survive a laparotomy, and that alternative management would be palliative.

Matched cases

Comments related to: expected outcomes with and without surgery; the patients' comorbidities and current state; ease or difficulty of surgery; how likely surgery was to improve their condition; the patient's and family's wishes and the opinion of intensivists and anaesthetists. Comments were equivalent and did not vary depending on whether

respondents had been randomised to a previous negative or positive experience.

Grey area cases

Many respondents who chose to operate commented that careful discussion with the patient and their family, including the risks and benefits of the procedure, was essential and that the involvement of the wider multidisciplinary team would be necessary. Some commented that they would consider laparoscopy first.

For those who felt that an emergency laparotomy was not indicated, common themes included the need for careful preoperative optimisation and discussion with the multidisciplinary team followed by a planned operation. Some felt that other less-invasive options should be considered and a few opted for palliative management.

Discussion

The decision of whether or not to perform an emergency laparotomy is complex, with multiple influencing factors.

Thematic content analysis demonstrated careful consideration of multiple factors is required. Factors repeatedly raised as important included: patient wishes; the patient's clinical condition and progress; the indication for surgery; the perceived likelihood of good or poor outcomes with or without surgery; other management possibilities, and the involvement or opinions of intensivists and anaesthetists. Lack of formal training in decision-making in the UK surgical curriculum was highlighted. Recurrent themes in thematic content analysis demonstrated consistent and well-reasoned decision-making processes.

In this study, consultants were less likely to recommend an emergency laparotomy than non-consultants. Non-consultant surgeons were more risk averse than consultants according to their self-reported risk attitudes. This may explain the difference in tendency to recommend an emergency laparotomy, with non-consultants keen to seek diagnostic certainty in the form of an emergency laparotomy, and seniors more comfortable with lack of certainty. Risk attitudes, previous positive or negative experience and reflection during decision-making, were not demonstrated to alter the overall decision. Surgeons were not demonstrated to be consistent nor inconsistent in their decision-making.

There is little current literature relating to decision-making specifically in the context of the emergency laparotomy. However, cognitive processes and factors to consider in surgical decision-making described by Campbell et al. [9] and Francis et al. [8] closely resemble those highlighted in phase one. Our findings that novice surgeons are more likely to seek certainty also fit with descriptions by Crebbin et al. [4] and Campbell et al. [9]. Szatmary et al. [7] also noted that novices were more likely to operate than expert surgeons in their multimethod study of decision-making in emergency surgery. We note our findings to be contrary to that of Nakata et al. [14], who found older surgeons to be more risk averse in their attitudes. However, our study compared only the risk attitudes of non-consultants to consultants, with no subgrouping of consultants by length of experience or age. Formal training incorporating the aforementioned models may provide a useful framework for juniors learning the skill of decision-making. Use of vignettes, or real-life scenarios in consultant-led discussions, may serve as useful teaching tools and highlight differences in the decision-making process.

Limitations

This study has several limitations to consider. Interviews were from a convenience sample at a single district general hospital and were assumed to be representative; some views may have represented the institution's culture, and additional themes might have arisen if interviews were undertaken at multiple centres. The survey was circulated via multiple routes to an unknown total number of surgeons, meaning it was not possible to calculate a response rate. Whilst it is assumed that surgeons from a range of geographical locations and institutions completed the survey, response bias may have impacted upon results.

Vignettes and description of previous experience may not accurately represent the challenge of decision-making in the clinical environment and are subject to response bias. Pathology differing between vignettes means decisions may differ due to this factor alone. Respondent-specific external factors, such as resource availability and practices at their current place of work, may have confounded decisions. A large proportion of respondents chose not to operate in the positive control case; this may have been avoided by interviewing more experts in phase two. Less consultants completed the survey than juniors; a higher proportion of consultant responses may have altered results. Grade of registrar was not subcategorised; doing so may have further demonstrated how experience alters decision-making.

Conclusion

The decision to operate or not in an emergency laparotomy directly effects patient outcome. This study demonstrates a difference in decision-making and risk attitudes between consultants and their juniors. It is therefore crucial that consultants be involved in decision-making from an early

stage. To address this difference in decision-making, formal teaching of models of decision-making, influencing factors and vignette-based consultant-led discussions should be introduced into surgical training. Further study to assess efficacy of such measures would be required.

Acknowledgements This research was undertaken as part of the third year of the MSc in Surgical Sciences or Edinburgh Surgical Sciences Qualification (ESSQ) www.essq.rcsed.ac.uk.

Compliance with ethical standards

Conflict of interest The authors have no potential or real conflict of interest to declare.

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