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ORIGINAL ARTICLE

The risk and predictors of mortality in octogenarians undergoing emergency laparotomy: a multicentre retrospective cohort study

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Abstract

Objectives This study aims to evaluate the risk of postoperative mortality in octogenarians undergoing emergency laparotomy.

Methods In compliance with STROCSS guideline for observational studies, we conducted a multicentre retrospective cohort study. All consecutive patients aged over 80 with acute abdominal pathology requiring emergency laparotomy between April 2014 and August 2019 were considered eligible for inclusion. The primary outcome measure was 30-day postoperative mortality, and the secondary outcome measures were in-hospital mortality and 1-year mortality. Statistical analyses included simple descriptive statistics, binary logistic regression analyses, and Kaplan–Meier survival statistics.

Results A total of 523 octogenarians were eligible for inclusion. Emergency laparotomy in octogenarians was associated with 21.8% (95% CI 18.3–25.6%) 30-day postoperative mortality, 22.6% (95% CI 19.0–26.4%) in-hospital mortality, and 40.2% (95% CI 35.9–44.5%) 1-year mortality. Binary logistic regression analysis identified ASA status (OR, 2.49; 95% CI 1.82–3.38, $P < 0.0001$) and peritoneal contamination (OR, 2.00; 95% CI 1.30–3.08, $P = 0.002$) as predictors of 30-day postoperative mortality. The ASA status (OR, 1.92; 95% CI 1.50–2.46, $P < 0.0001$), peritoneal contamination (OR, 1.57; 95% CI 1.07–2.48, $P = 0.020$), and presence of malignancy (OR, 2.06; 95% CI 1.36–3.10, $P = 0.001$) were predictors of 1-year mortality. Log-rank test showed significant difference in postoperative survival rates among patients with different ASA status ($P < 0.0001$) and between patients with and without peritoneal contamination ($P = 0.0011$).

Conclusions Emergency laparotomies in patients older than 80 years with ASA status more than 3 in the presence of peritoneal contamination carry a high risk of immediate postoperative and 1-year mortality. This should be taken into account in communications with patients and their relatives, consent process, and multidisciplinary decision-making process for operative or non-operative management of such patients.

Keywords Emergency surgery · Laparotomy · Mortality · Octogenarians

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Introduction

Emergency laparotomies in elderly patients are associated with significant reduced quality of life, morbidity, and mortality due to age-related loss of skeletal muscle mass, underlying frailty, reduced physiological reserve, and comorbidity.[1–4] The increased life expectancy and rapid expansion of the ageing population resulted in a significant increase in the number of emergency laparotomies being performed on elderly patients.[5] This highlights the importance of appropriate preoperative risk assessment and prognostication of postoperative outcomes in elderly patients.

It is expected that the number of individuals aged over 80 will double over the next two decades[6]; nevertheless, the prognostic outcomes of emergency laparotomies in this population are poorly understood. Knowledge about the risk of postoperative mortality in individuals aged over 80 is crucial for accurate risk assessment and stratification, decision-making, and allocation of resources, and for identifying the patients who are likely or unlikely to benefit from a high-risk major operation. In view of this, we aimed to conduct a multicentre cohort study to evaluate the risk of postoperative mortality in octogenarians undergoing emergency laparotomy.

Methods

This multicentre retrospective cohort study was conducted and presented in compliance with the strengthening the reporting of cohort studies in surgery (STROCSS) guideline for observational studies[7] and followed an agreed predefined protocol. Considering the nature of this study, patient consent and approval by research ethics committees were not required; however, the study was conducted in accordance with institutions' policies and internal arrangements approved by the local clinical governance units.

Study design and patient selection

We conducted a multicentre retrospective cohort study involving four emergency general surgery centres located in the UK (one centre in the North Wales; two centres in the North West England; one centre in the West Midlands). The study period was between April 2014 and August 2019. All consecutive patients aged over 80 who underwent an emergency laparotomy due to an acute abdominal pathology were considered eligible for inclusion. The indications for emergency laparotomy included intestinal ischaemia, visceral perforation, large bowel obstruction, small bowel obstruction, intraabdominal sepsis of any source, intraabdominal bleeding, and intraabdominal abscess. We excluded the patients who underwent trauma-related laparotomy.

Outcome measures

The primary outcome of this study was 30-day postoperative mortality which was defined as death due to any cause occurring within 30 days after emergency laparotomy. The secondary outcome measures were in-hospital mortality and 1-year mortality.

Data collection

Data collection was performed by two independent authors, and an independent third author was consulted in the event of disagreement. An electronic data collection pro forma was developed which included data on the following parameters: patients' demographic data (age and sex), the American Society of Anaesthesiologists (ASA) score, background of cognitive impairment (defined as formal diagnosis of Alzheimer's disease, vascular dementia, Lewy body dementia, frontotemporal dementia, or any other type of dementia), indication for emergency laparotomy (intestinal ischaemia, visceral perforation, large bowel obstruction, small bowel obstruction, intraabdominal sepsis of any source, intraabdominal bleeding, and intraabdominal abscess), performed procedure, colon resection, small bowel resection, presence of intraabdominal malignancy, type and extent of intraperitoneal contamination, postoperative admission to the intensive care unit (ICU), length of ICU stay, length of hospital stay, 30-day mortality, in-hospital mortality, and 1-year mortality. In order to obtain data regarding 30-day and 1-year mortality, patients' medical records including primary care (community) and secondary care (hospital) records were explored to confirm whether the patient has survived or not.

Data synthesis and statistical analyses

The statistical analyses were performed using MedCalc 13.0 software. Simple descriptive statistics were used to present the baseline characteristics and outcome data. Data were summarised with mean ± standard deviation (SD) for continuous variables and frequencies or percentages for categorical variables. Binary logistic regression models were constructed to investigate predictors of postoperative mortality. Postoperative mortality was considered as dependent variable, and the patient's sex, baseline ASA score, cognitive impairment, colon resection, small bowel resection, type and extent of intraperitoneal contamination, and presence of intraabdominal malignancy were considered as independent variables. All statistical tests were two-tailed, and statistical significance was assumed at $P < 0.05$. Postoperative survival was illustrated with Kaplan–Meier survival statistics stratified according to the predictors identified in regression models, and the log-rank test was used to identify significant differences. Moreover, in order to further evaluate the association between the identified variables and postoperative mortality, Cox proportional-hazards regression was conducted using stepwise approach allowing variables with $P < 0.05$ to enter the model.

Results

Baseline patient characteristics

A total of 531 patients were identified; 8 patients were excluded as they underwent emergency laparotomy due to abdominal trauma. Therefore, 523 patients were eligible for inclusion. The mean age of the included patients was 84.3 (95% CI 84.0–84.6), and 236 out of 523 (45%) were male. In terms of ASA status, 3 out of 523 (0.6%) patients were classified as ASA 1; 97 out of 523 (18.5%) as ASA 2; 249 out of 523 (47.6%) as ASA 3; 163 out of 523 (31.2%) as ASA 4; and 11 out of 523 (2.1%) as ASA 5. A total of 20 out of 523 (3.8%) patients had cognitive impairment. Colon resection was required in 182 out of 523 (34.8%) patients, and small bowel resection was required in 130 out of 523 (24.9%) patients. Peritoneal contamination was present in 157 out of 523 (30%) patients of which 42 (26.8%) were classed as feculent, 51 (32.5%) as purulent, and 64 (40.7%) as gastrointestinal content. The extent of contamination was classed as localised in 74 out of 157 (47%) patients and as generalised in 83 out of 157 (53%) patients. Abdominal malignancy was present in 121 out of 523 patients (23.1%). Postoperative ICU admission was required in 396 out of 523 (75.7%) patients, and the mean length of ICU stay was 4.8 days (95% CI 4.0–5.6). The mean length of hospital stay was 25.7 days (95% CI 22.9–28.5). The follow-up data was available for all the included patients. The study flow chart and the baseline characteristics of the included population are demonstrated in Fig. 1 and Table 1, respectively. The indications for emergency laparotomy are provided in Table 2.

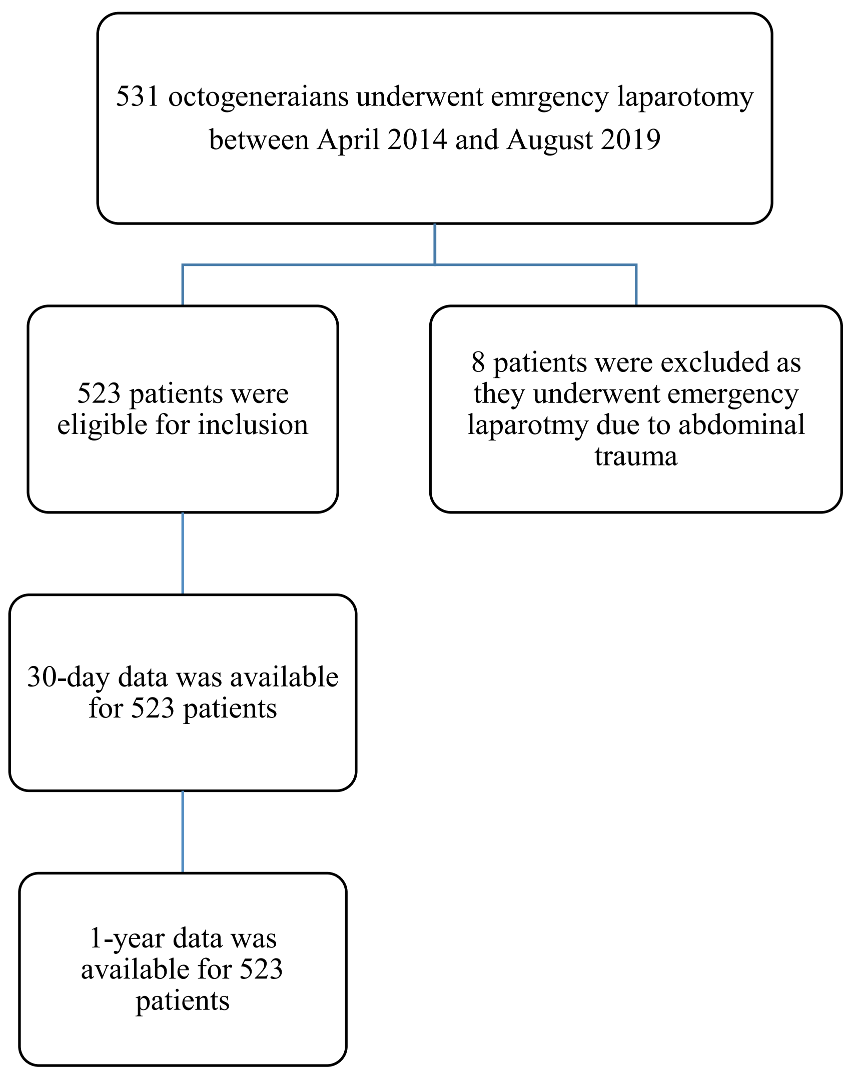

Fig. 1 The study flow chart

Table 1 Baseline characteristics of the included population

Number of patients	523
Mean age, years (95% CI)	84.3 (84.0–84.6)
Male	236 out of 523 (45%)
Female	287 out of 523 (55%)
ASA status	
1	3 out of 523 (0.6%)
2	97 out of 523 (18.5%)
3	249 out of 523 (47.6%)
4	163 out of 523 (31.2%)
5	11 out of 523 (2.1%)
Cognitive impairment	20 out of 523 (3.8%)
Colon resection	182 out of 523 (34.8%)
Small bowel resection	130 out of 523 (24.9%)
Peritoneal contamination	157 out of 523 (30%)
Type of contamination	
Feculent	42 out of 157 (26.8%)
Purulent	51 out of 157 (32.5%)
Gastrointestinal content	64 out of 157 (40.7%)
Extent of contamination	
Localised	74 out of 157 (47%)
Generalised	83 out of 157 (53%)
Abdominal malignancy	121 out of 523 (23.1%)
Postoperative ICU admission	396 out of 523 (75.7%)
Mean length of ICU, days (95% CI)	4.8 (4.0–5.6)
Mean length of hospital stay, days (95% CI)	25.7 (22.9–28.5)

ASA, American Society of Anaesthesiologists; *ICU*, intensive care unit; *CI*, confidence interval

Outcomes (Table 3)

30-day postoperative mortality The risk of 30-day postoperative mortality was 21.8% (95% CI 18.3–25.6%) in the entire cohort. The risk was 24.6% (95% CI 19.3–30.7%) in male patients; 19.4% (95% CI 15.0–24.5%) in female patients; 21.4% (95% CI 15.7–28.1%) in patients who had colon resection; 24.6% (95% CI 17.5–32.9%) in patients who had small bowel resection; 20.7% (95% CI 15.4–26.7%) in patients who did not have bowel resection; 30.6% (95% CI 23.5–38.4%) in patients with peritoneal contamination; 18% (95% CI 14.2–22.4%) in patients without peritoneal contamination; 29.7% (95% CI 19.7–41.4%) in patients with localised contamination; 31.3% (95% CI 21.6–42.4%) in patients with generalised contamination; 20.7% (95% CI 13.8–29.0%) in patients with abdominal malignancy; and 22.1% (95% CI 18.2–26.5%) in patients without malignancy.

Table 2 Indications for emergency laparotomy in the included cohort

Indication	No of patients
Colon perforation	72 out of 523 (14%)
Small bowel perforation	39 out of 523 (8%)
Peptic ulcer perforation	33 out of 523 (6%)
Large bowel obstruction	92 out of 523 (18%)
Small bowel obstruction	208 out of 523 (40%)
Intestinal ischaemia	49 out of 523 (9%)
Anastomotic leak	12 out of 523 (2%)
Intraabdominal bleeding	5 out of 523 (1%)
Intraabdominal abscess	4 out of 523 (0.8%)
Intestinal fistula	4 out of 523 (0.8%)
Bleeding peptic ulcer	3 out of 523 (0.6%)
Colitis	2 out of 523 (0.4%)

In-hospital mortality The risk of in-hospital mortality was 22.6% (95% CI 19.0–26.4%) in the entire cohort. The risk was 26.4% (95% CI 20.9–32.5%) in male patients; 19.4% (95% CI 15.0–24.5%) in female patients; 22.0% (95% CI 16.2–28.7%) in patients who had colon resection; 27.7% (95% CI 20.2–36.2%) in patients who had small bowel resection; 20.2% (95% CI 15.0–26.2%) in patients who did not have bowel resection; 32.5% (95% CI 25.2–40.4%) in patients with peritoneal contamination; 18.3% (95% CI 14.5–22.7%) in patients without peritoneal contamination; 32.4% (95% CI 22.0–44.3%) in patients with localised contamination; 32.5% (95% CI 22.6–43.7%) in patients with generalised contamination; 19.0% (95% CI 12.4–27.1%) in patients with abdominal malignancy; and 23.6% (95% CI 19.6–28.1%) in patients without malignancy.

1-year mortality The risk of 1-year mortality was 40.2% (95% CI 35.9–44.5%) in the entire cohort. The risk was 43.4% (95% CI 37–50.0%) in male patients; 37.5% (95% CI 31.9–43.4%) in female patients; 43.4% (95% CI 36.1–50.9%) in patients who had colon resection; 40.0% (95% CI 31 5–49.0%) in patients who had small bowel resection; 37.6% (95% CI 31.0–44.4%) in patients who did not have bowel resection; 47.8% (95% CI 39.7–55.9%) in patients with peritoneal contamination; 36.9% (95% CI 31.9–42.1%) in patients without peritoneal contamination; 51.4% (95% CI 39.4–63.1%) in patients with localised contamination; 44.6% (95% CI 33.7–55.9%) in patients with generalised contamination; 53.7% (95% CI 44.4–62.8%) in patients with abdominal malignancy; and 36.1% (95% CI 31.4–41.0%) in patients without malignancy.

Binary logistic regression (Table 4)

30-day postoperative mortality Binary logistic regression analysis identified ASA status (OR, 2.49; 95% CI 1.82–3.38; $P < 0.0001$) and peritoneal contamination (OR, 2.00; 95% CI 1.30–3.08; $P = 0.002$) as predictors of 30-day postoperative mortality. The analyses did not identify sex (OR,

Table 3 The risk of mortality in octogenarians undergoing emergency laparotomy

Subgroups	Outcomes		
	30-day mortality	In-hospital mortality	1-year mortality
Entire cohort	114 out of 523 (21.8%)	118 out of 523 (22.6%)	210 out of 523 (40.2%)
Male	58 out of 235 (24.6%)	62 out of 235 (26.4%)	102 out of 235 (43.4%)
Female	56 out of 288 (19.4%)	56 out of 288 (19.4%)	108 out of 288 (37.5%)
Colon resection	39 out of 182 (21.4%)	40 out of 182 (22.0%)	79 out of 182 (43.4%)
Small bowel resection	32 out of 130 (24.6%)	36 out of 130 (27.7%)	52 out of 130 (40.0%)
No bowel resection	44 out of 213 (20.7%)	43 out of 213 (20.2%)	80 out of 213 (37.6%)
Peritoneal contamination	48 out of 157 (30.6%)	51 out of 157 (32.5%)	75 out of 157 (47.8%)
No contamination	66 out of 366 (18%)	67 out of 366 (18.3%)	135 out of 366 (36.9%)
Localised contamination	22 out of 74 (29.7%)	24 out of 74 (32.4%)	38 out of 74 (51.4%)
Generalised contamination	26 out of 83 (31.3%)	27 out of 83 (32.5%)	37 out of 83 (44.6%)
Abdominal malignancy	25 out of 121 (20.7%)	23 out of 121 (19.0%)	65 out of 121 (53.7%)
No malignancy	89 out of 402 (22.1%)	95 out of 402 (23.6%)	145 out of 402 (36.1%)

1.36; 95% CI 0.89, 2.06; $P = 0.150$), bowel resection (OR, 1.12; 95% CI 0.73–1.71; $P = 0.60$), or malignancy (OR, 0.92; 95% CI 0.55–1.51; $P = 0.73$) as predictors of 30-day postoperative mortality.

In-hospital mortality Binary logistic regression analysis identified ASA status (OR, 2.63; 95% CI 1.93–3.59; $P < 0.0001$) and peritoneal contamination (OR, 2.15; 95% CI 1.40–3.28; $P = 0.001$) as predictors of in-hospital mortality. The analyses did not identify sex (OR, 1.48; 95% CI 0.98, 2.24; $P = 0.06$), bowel resection (OR, 1.26; 95% CI 0.83–1.93; $P = 0.28$), or malignancy (OR, 0.76; 95% CI 0.46–1.26; $P = 0.28$) as predictors of in-hospital mortality.

1-year mortality Binary logistic regression analysis identified ASA status (OR, 1.92; 95% CI 1.50–2.46; $P < 0.0001$), peritoneal contamination (OR, 1.57; 95% CI 1.07–2.48; $P = 0.020$), and malignancy (OR, 2.06; 95% CI 1.36–3.10; $P = 0.001$) as predictors of 1-year mortality. The analyses did not identify sex (OR, 1.28; 95% CI 0.89, 1.82; $P = 0.171$) and bowel resection (OR, 1.20; 95% CI 0.84–1.72; $P = 0.32$) as predictors of 1-year mortality.

Cox proportional-hazards regression analysis

Cox proportional-hazards regression analysis taking ASA status, intraperitoneal contamination, and malignancy as covariates showed that the probability of survival 30 days postoperatively was 78.3% and identified ASA status as predictor of 30-day mortality ($P = 0.0125$).

Kaplan–Meier survival analysis (Fig. 2)

ASA-stratified survival The 30-day postoperative survival was 100% in patients with ASA 1 status, 92.8% (95% CI 85.7–97.0%) in patients with ASA 2 status, 81.9% (95% CI 76.6–86.5%) in patients with ASA 3 status, 65.6% (95% CI 57.8–72.9%) in patients with ASA 4 status, and 45.5% (95% CI

Table 4 Results of binary logistic regression analysis

Independent variables	Dependent variables					
	30-day mortality		In-hospital mortality		1-year mortality	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Sex	1.36 (0.89, 2.06)	0.150	1.48 (0.98, 2.24)	0.06	1.28 (0.89, 1.82)	0.171
ASA status	2.49 (1.82–3.38)	< 0.0001	2.63 (1.93–3.59)	< 0.0001	1.92 (1.50–2.46)	< 0.0001
Peritoneal contamination	2.00 (1.30–3.08)	0.002	2.15 (1.40–3.28)	0.001	1.57 (1.07–2.48)	0.02
Bowel resection	1.12 (0.73–1.71)	0.6	1.26 (0.83–1.93)	0.28	1.20 (0.84–1.72)	0.32
Abdominal malignancy	0.92 (0.55–1.51)	0.73	0.76 (0.46–1.26)	0.28	2.06 (1.36–3.10)	0.001

ASA, American Society of Anaesthesiologists; *OR*, odds ratio; *CI*, confidence interval

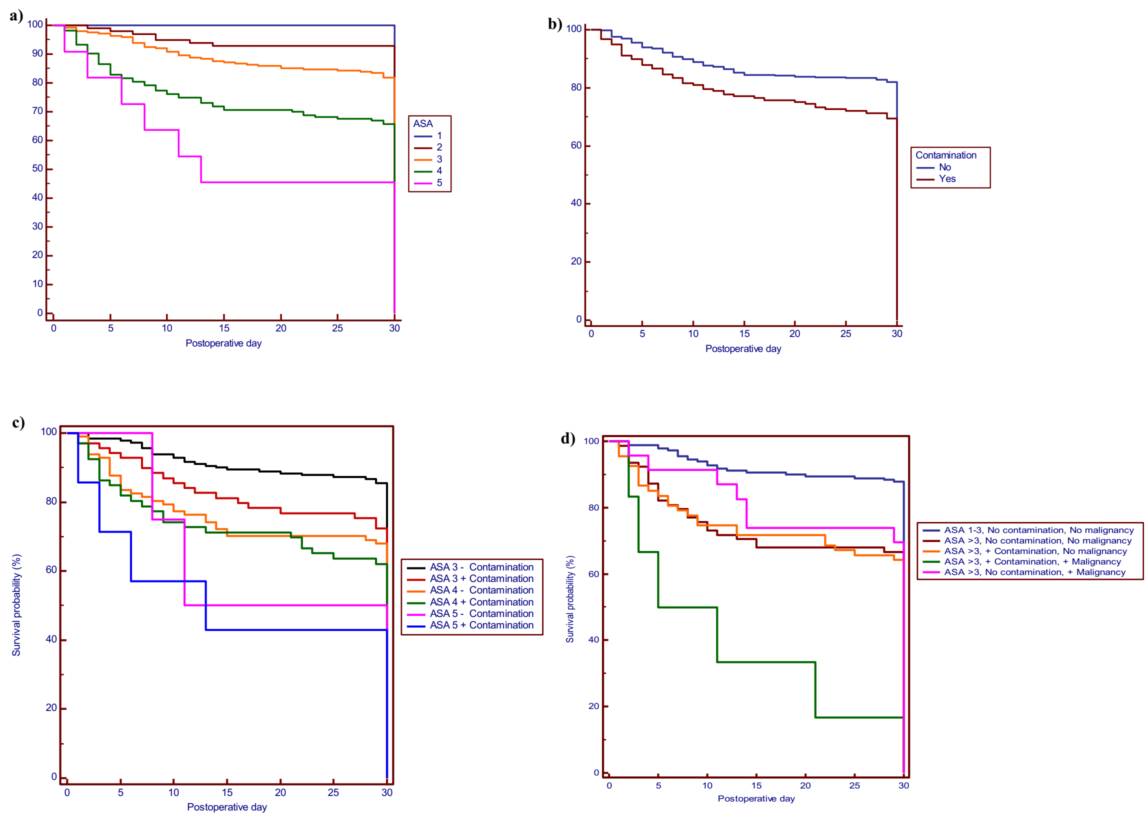

Fig. 2 Kaplan–Meier survival analysis. **a** ASA-stratified 30-day survival. **b** Peritoneal contamination-stratified 30 day survival. **c** ASA and peritoneal contamination-stratified 30-day survival. **d** ASA, peritoneal contamination, malignancy-stratified 30-day survival

16.7–76.6%) in patients with ASA 5 status. Log-rank test showed significant difference in postoperative survival among patients with different ASA status ($P < 0.0001$).

Peritoneal contamination-stratified survival The 30-day postoperative survival was 69.4% (95% CI 61.6–76.5%) in patients with peritoneal contamination and 82.0% (95% CI 77.6–85.8%) in patients without peritoneal contamination. Log-rank test showed significant difference in postoperative survival between patients with and without peritoneal contamination ($P = 0.0011$).

ASA and peritoneal contamination-stratified survival The 30-day postoperative survival was 85.6% (95% CI 79.6–90.3%) in patients with ASA 3 status without peritoneal contamination, 72.5% (95% CI 60.4–82.5%) in patients with ASA 3 status with peritoneal contamination, 68.0% (95% CI 57.8–77.1%) in patients with ASA 4 status without peritoneal contamination, 62.1% (95% CI 49.3–73.7%) in patients with ASA 4 status with peritoneal contamination, 50.0% (95% CI 6.8–93.2%) in patients with ASA 5 status without peritoneal contamination, and 42.9% (95% CI 9.9–81.6%) in patients with ASA 5 status with peritoneal contamination. Log-rank test showed significant difference in postoperative survival among patients with different ASA and peritoneal contamination status ($P < 0.0001$).

ASA, peritoneal contamination, and malignancy-stratified survival The 30-day postoperative survival was 87.8% (95% CI 82.1–92.2%) in patients with ASA 1–3 status without peritoneal contamination and without malignancy, 66.7% (95% CI 55.1–76.9%) in patients with ASA status > 3 without peritoneal contamination and without malignancy, 64.2% (95% CI 51.5–97.5%) in patients with ASA status > 3 with peritoneal contamination and without malignancy, 69.6% (95% CI 47.1–86.8%) in patients without ASA status > 3 without peritoneal contamination and with malignancy, and 16.7% (95% CI 0.4–64.1%) in patients with ASA status > 3 with peritoneal contamination and with malignancy. Log-rank test showed significant difference in postoperative survival among patients with different ASA > 3, peritoneal contamination, and malignancy ($P < 0.0001$).

Discussion

We conducted a multicentre cohort study to evaluate the risk of postoperative mortality in octogenarians undergoing emergency laparotomy. Analysis of 523 patients suggested that the risks of in-hospital mortality, 30-day postoperative mortality, and 1-year mortality in octogenarians undergoing emergency laparotomy are high. The ASA status and presence of peritoneal contamination were identified as significant predictors of in-hospital and 30-day postoperative mortality. In addition to ASA status and peritoneal contamination, the presence of abdominal malignancy was identified as significant predictor of 1-year mortality.

To the best of our knowledge, the current study is the largest cohort study in literature that evaluates the risk of mortality following emergency laparotomy specifically in octogenarians. Our findings are consistent with the findings of other studies.[8–13] Various factors may explain the relatively high risk of postoperative mortality in octogenarians undergoing emergency laparotomy. Firstly, compared with younger patients, octogenarians are likely to have higher baseline ASA status and more comorbidities, and as demonstrated in this study and in other studies, the ASA status and comorbid burden are strong predictors of postoperative mortality and morbidity.[14, 15] Moreover, octogenarians are more likely to have sarcopenia, age-related loss of skeletal muscle mass, which is a strong predictor of mortality in emergency general surgery and other settings.[3, 4] In addition to the above factors, the reduced physiological reserve and the negative effect of underlying acute abdominal pathology may explain the high risk of postoperative mortality in this group of patients.

The underlying pathology that warrants an emergency laparotomy is likely to be associated with risks of intraperitoneal contamination and need for bowel resection. Our results suggest that peritoneal contamination is a predictor of postoperative mortality in octogenarians undergoing emergency laparotomy. This is consistent with our knowledge about prognostic significance of peritoneal contamination in patients with acute abdominal pathology.[16] The extent of intraperitoneal contamination is taken into account by most of the preoperative prognostic scoring tools; however, the knowledge about the extent of contamination is only available intraoperatively, limiting the predictive value of preoperative prognostic scoring tools. Recently, intraperitoneal contamination index (Hajibandeh index) derived from combined preoperative levels of C-reactive protein, lactate, neutrophils, lymphocytes, and albumin was found to be promising in predicting the extent of intraperitoneal contamination in patients with acute abdominal pathology.[16]

It is crucial to identify the elderly patients with acute abdominal pathology who are likely or unlikely to benefit from emergency laparotomy. In order to improve outcomes in patients undergoing emergency laparotomy, many efforts have been made. These include accurate preoperative mortality and morbidity risk assessment, prediction of the need for perioperative supportive treatment in a high dependency or intensive care unit, and application of enhanced recovery protocols following emergency surgery.[17, 18] The results of our study suggests that an emergency laparotomy in a patient older than 80 with ASA status more than 3 in the presence of peritoneal contamination carries a high mortality risk. Nevertheless, such risks may not be accurately reflected by current risk predictive tools as the most commonly used preoperative mortality risk assessment tools do not take into account important predictors including advanced age, specifically being an octogenarian, frailty, and sarcopenia.[19]

The current study could potentially facilitate decision-making in the management of patients aged over 80 undergoing emergency laparotomy by providing objective information for patients, their relatives, and healthcare professionals involved in the management of such patients. Decision for operation depends on many factors including patient's wish, underlying pathology, type of procedure, and patient's baseline performance status and should be made via a multidisciplinary approach. In order to give a valid consent for a potentially life-threatening operation, patients and their relatives have a right to be informed about the estimated risk of mortality associated with the procedure. On the other hand, the healthcare professionals who are involved in the management of patients should be aware of the prognosis associated with the treatment that they offer. Therefore, all of the aforementioned factors should be taken into account when making a decision for operation in high-risk patients. Based on ethical principles, while patient's wish should be respected (autonomy), the operation should be offered to a patient who can benefit from the operation (beneficence), and when the operation is associated with a significantly high risk of mortality, it should be avoided (non-maleficence).

We are fairly confident about the robustness of the results of the current study as indicated by adequate statistical power, systematic and objective methodology, and comparable findings with other studies. However, the reported outcomes of this study should be viewed and interpreted in the context of inherent limitations. The retrospective nature of current study would subject our results to inevitable selection bias.

Directions for future research

The results of current study highlights the need for dedicated geriatric surgery pathways in the management of patients aged over 80 who need emergency laparotomy. Such pathways should follow an evidence-based multidisciplinary model of care comprising comprehensive preoperative multi-domain (medical, functional, psychological, and social) geriatric assessment and optimisation. Future studies should investigate whether the implementation of dedicated geriatric surgery pathways could improve perioperative outcomes in octogenarians undergoing emergency laparotomy. Moreover, future studies should focus on outcomes of operative versus non-operative management of patients aged over 80 who are considered to be at significantly high risk of mortality.

Conclusions

Emergency laparotomies in patients older than 80 years with ASA status more than 3 in the presence of peritoneal contamination carry a high risk of immediate postoperative and 1-year mortality. This should be taken into account in communications with patients and their relatives, consent process, and multidisciplinary decision-making process for operative or non-operative management of such patients.

Author contribution Conception and design: Shahab H; data collection: Shahab H, Shahin H, JS, JM, MA, and SM; analysis and interpretation: Shahab H and Shahin H; writing the article: Shahab H and Shahin H; critical revision of the article: all authors; final approval of the article: all authors.

Declarations

Ethics approval and consent to participate Considering the nature of this study, which was a retrospective cohort study involving non-identifiable data from hospital databases, approval by the research ethics committees was not required; however, the study was conducted in accordance with the institutions' policies and internal arrangements approved by local clinical governance units, and all authors declared compliance with the policies before being granted access to local hospital database. Considering the nature of this study, which was a retrospective cohort study involving non-identifiable data from hospital databases, there was no direct involvement of patients during the study; informed consent was not required.

Human and animal rights This study was a retrospective cohort study involving non-identifiable data from hospital databases, and there was no direct involvement of patients during the study; nevertheless, the study was conducted in compliance with the Helsinki ethical principles for medical research involving human subjects.

Conflict of interest The authors declare no competing interests.

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