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Original research

Predictors of in-hospital mortality amongst octogenarians undergoing emergency general surgery: A retrospective cohort study

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HIGHLIGHTS

- Emergency general surgery in octogenarians is generally high risk.
- Patients should be judged on physiological fitness for surgery rather than by age.
- COPD & increasing ASA score are significant & independent predictors of mortality.

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ABSTRACT

Introduction: Elderly patients are often judged to be fit for emergency surgery based on age alone. This study identified risk factors predictive of in-hospital mortality amongst octogenarians undergoing emergency general surgery. **Methods**: A retrospective review of octogenarians undergoing emergency general surgery over 3 years was performed. Parametric survival analysis using Cox multivariate regression model was used to identify risk factors predictive of in-hospital mortality. Hazard ratios (HR) and corresponding 95% confidence interval were calculated. **Results**: Seventy-three patients with a median age of 84 years were identified. Twenty-eight (38%) patients died post-operatively. Multivariate analysis identified ASA grade (ASA 5 HR 23.4 95% CI 2.38–230, $p = 0.007$) and chronic obstructive pulmonary disease (COPD) (HR 3.35 95% CI 1.15–9.69, $p = 0.026$) to be the only significant predictors of in-hospital mortality. **Conclusions**: Identification of high risk surgical patients should be based on physiological fitness for surgery rather than chronological age.

1. Introduction

Many countries around the world have an ageing population that is rapidly expanding. There are at least 2.6 million people aged 80 years and over in England and Wales and this number is expected to double in the next 25 years [1]. As life expectancy is increasing the surgeon will encounter an ever increasing number of elderly patients with surgical problems. The increase in this surgical caseload will be observed both for elective and emergency work but as elderly patients are more likely to be admitted for emergency surgery it is likely that this will have the largest impact in the acute setting [2].

As people get older they are more likely to have increasing co morbidities. Multiple studies have shown that the primary pre-operative risk factor for poor surgical outcome in the elderly is co-morbidity rather than chronological age [3]. Although the rate of surgical complications in older patients is comparable with that of younger patients, their rate of medical complications is higher [4]. Chronic cardiac and respiratory disease and functional reserve of the patient are consistently implicated [3]. The occurrence of post-operative complication has been shown to be more important than pre operative and intra operative risk factors in determining post-operative survival [5]. Predictably emergency surgery in the elderly carries a much higher mortality rate [6].

The goal in emergency surgery in an ageing population is to objectively assess a patient by their physiological age and co-existing co morbidities rather than by their chronological age. Unlike elective surgery there is great variation of pathology and a very limited time period in which to optimize existing co morbidities. The emergent nature of surgery also limits access to investigations that stratify risk of surgery, such as cardio-pulmonary exercise testing (CPEX) and metabolic equivalents (MET) [7,8]. The challenge for the emergency surgeon is to be able to quickly and

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reliably identify individuals prior to surgery who are high risk so that appropriate arrangements for perioperative critical care and post-operative support can be planned.

There are established care pathways for treatment of elderly patients with fractured neck of femur to try and improve prognosis and outcome. Similarly high risk patients admitted for elective general surgical procedures have enhanced recovery pathways and models such as Proactive care of Older People undergoing Surgery (POPS) in place to provide them with an extensive package of perioperative care and appropriate discharge planning [9]. Although emergency laparotomy is the second most common operation undertaken after femoral neck fractures in this population, there are currently not the same infra structures in place to provide similar standards of peri- and post-operative care.

The aims of our paper were to identify risk factors that predict in-hospital morbidity and mortality amongst octogenarians undergoing emergency general surgery. We hoped that this would give us a better understanding of prognosis and enable us to make informed decisions with the patient and their relatives about best emergency treatment.

2. Methods

We undertook a retrospective notes review of all patients aged 80 years of age or over who underwent an emergency laparotomy at Medway Maritime Hospital between July 2008 and June 2011. Vascular surgery procedures were excluded. Patients were identified using Crystal Reports. Patient demographics including age, gender and medical co-morbidities were documented. The co-morbidities analysed included a prior diagnosis of ischaemic heart disease (IHD), diabetes mellitus (DM), cerebrovascular accident (CVA), chronic obstructive pulmonary disease (COPD) and any cancer. Regular medications (including steroid use and anti-coagulation with warfarin), pre-morbid functional status (as determined by the American Society of Anaesthesia (ASA) grade on presentation) and time of surgery were recorded. Time from decision to operate to surgery and post-operative intensive care unit (ICU) admission were also noted.

Post-operative morbidity and in-hospital mortality data were collected, including return to theatre and re-admission within 30 days of surgery. Any respiratory, cardiac, infectious, renal, neurological and bleeding complications were recorded. Cause(s) of death, both as an inpatient and within 12 months of laparotomy were documented.

Statistical analysis was conducted using Stata© SE 10.1 for Macintosh (StataCorp, College Station, Texas, USA). Continuous data are presented as median value and range. Kaplan–Meier life-table analysis was used to calculate the cumulative incidence of in-hospital mortality following unplanned laparotomy. Univariate survival analysis based on the Cox proportional hazards regression methodology was applied to identify individual risk factors predictive of in-hospital mortality. Variables with a univariate p value less than 0.25 were evaluated by multivariate analysis. Hazard ratios (HR) and corresponding 95% confidence intervals were calculated for each variable. Relative risk was calculated and proportions compared using Mann–Whitney U-test. All statistical tests performed were two-sided with significance assumed at p less than 0.05.

3. Results

3.1. Patient demographics

A total of 73 patients (50 females) with median age of 84 (80–98) years underwent an emergency laparotomy over the study period. Table 1 lists the demographics of this group and the procedure performed at laparotomy.

3.2. Morbidity and mortality

Over a median length of stay of 23 (2–71) days there were 28 (38%) in-hospital mortalities. Of the in-hospital mortalities 5 patients had an ASA grade of 2, 13 had an ASA grade of 3, 7 had an ASA grade of 4 and 3 were ASA score 5 (Table 2). Fifty-one (70%) patients had one or more documented post-operative complication. The majority of complications were respiratory, cardiac, renal or infective (including wound infection). The causes of mortality and post-operative morbidities are shown in Table 1. Post-operative morbidity was observed in 24 of the 28 patients who died within 30 days of surgery. Patients who developed any post-operative morbidity were three times more likely to undergo subsequent in-hospital mortality (risk ratio 2.8 95% CI 1.06–7.43, $p = 0.021$) (Table 3).

3.3. Cox analysis of variables predicting in-hospital mortality following emergency laparotomy

Multivariate analysis identified ASA grade (ASA 5 HR 23.4 95% CI 2.38–230, $p = 0.007$) and COPD (HR 3.35 95% CI 1.15–9.69, $p = 0.026$) to be the only significant and independent predictors of in-hospital mortality (Table 4). Prior CVA, AF, COPD, functional status, and post-operative ICU stay and return to theatre, were predictive of mortality in univariate analysis only Figs. 1 and 2 show the influence of ASA grade and diagnosis of COPD on in-hospital mortality rate.

4. Discussion

Emergency laparotomy in elderly patients is high risk. Studies report mortality rates of 24%–38% and morbidity rates of 24%–64% [6,10,11]. These figures have remained largely unchanged over several decades. Despite advances in surgical and perioperative care, little seems to have improved the prognosis of the elderly patient undergoing emergency laparotomy.

Table 1
Patient demographics, post-operative morbidity and in-hospital mortality within 30 days.

Number of patients	73
Median (range) age (years)	84 (80–98)
Male:Female	23:50
Median (range) number of medications	5 (0–11)
Type of surgery performed:	
Small bowel obstruction	18 (25%)
Colonic surgery	25 (35%)
Peptic ulcer repair	5 (7%)
Surgery for hernia	6 (8%)
Other(s)	19 (26%)
Post-operative morbidity	**Number of patients (%)**
Respiratory complications	30 (40%)
Cardiac complications	23 (30%)
Infective complications	24 (32%)
Renal impairment	22 (30%)
Post-operative confusion	6 (8%)
Neurological complications	3 (4%)
Return to theatre within 30 days	7 (10%)
Readmission within 30 days of discharge	7 (10%)
In-hospital mortality/cause of death	
Bowel ischaemia	7 (25%)
Multiorgan failure/sepsis	7 (25%)
Metastatic disease	4 (14%)
Others (MI, PE, aspiration)	6 (22%)
Unknown	4 (14%)