Review

Emergency general surgery in the geriatric patient

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Background: **Emergency general surgery in the elderly is a particular challenge to the surgeon in charge of their care. The aim was to review contemporary aspects of managing elderly patients needing emergency general surgery and possible alterations to their pathways of care.**

Methods: **This was a narrative review based on a PubMed/MEDLINE literature search up until 15 September 2015 for publications relevant to emergency general surgery in the geriatric patient.**

Results: **The number of patients presenting as an emergency with a general surgical condition increases with age. Up to one-quarter of all emergency admissions to hospital may be for general surgical conditions. Elderly patients are a particular challenge owing to added co-morbidity, use of drugs and risk of poor outcome. Frailty is an important potential risk factor, but difficult to monitor or manage in the emergency setting. Risk scores are not available universally. Outcomes are usually severalfold worse than after elective surgery, in terms of both higher morbidity and increased mortality. A care bundle including early diagnosis, resuscitation and organ system monitoring may benefit the elderly in particular. Communication with the patient and relatives throughout the care pathway is essential, as indications for surgery, level of care and likely outcomes may evolve. Ethical issues should also be addressed at every step on the pathway of care.**

Conclusion: **Emergency general surgery in the geriatric patient needs a tailored approach to improve outcomes and avoid futile care. Although some high-quality studies exist in related fields, the overall evidence base informing perioperative acute care for the elderly remains limited.**

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Introduction

Emergency surgery represents a considerable workload in most healthcare systems[1]. In contrast to elective surgery, emergency conditions present at inconvenient hours, often without a diagnosis, with limited background information, and frequently with little time for planning. Outcomes are usually severalfold worse than after elective surgery, in terms of both morbidity and mortality[2]. In addition, costs are considerable across the entire care pathway[3–5], with increases projected for the next few decades[6]. In particular, the elderly are at higher risk of adverse outcomes as they have known, and often unknown, co-morbidity that adds complexity to their care. Improving outcomes in emergency surgery is particularly challenging in the elderly patient[7]. Indeed, the growing geriatric population is a worldwide challenge, for both developed and developing countries[8–12]. Surgical conditions that produce a high surgical workload, as well as high mortality, include: hip fracture surgery, ruptured abdominal aortic aneurysm (AAA) surgery and emergency laparotomy[13]. The aim of this review is to give a current overview of the challenges and issues to consider in emergency surgery for the geriatric patient.

Methods

Available PubMed/MEDLINE literature was searched up until 15 September 2015 using the terms 'emergency surgery' and 'geriatric', 'elderly', 'old', 'abdominal emergency'. Titles and abstracts were screened, and reference lists checked for relevant articles. Topics related to cardiothoracic, transplant, orthopaedic, trauma and neurosurgery were not included, unless describing novel or unique principles not covered in general surgery. Emphasis was placed on observational studies from the past 5 years, when available. Relevant topics beyond the detailed scope of this

narrative review were referenced by recent comprehensive reviews, systematic reviews, opinion papers or guidelines, where applicable.

Burden of emergency surgery conditions in the elderly

Emergency general surgery makes up 8–26 per cent of all hospital admissions[14,15]. Admissions are increasing annually in developed countries, with the elderly population making a definite contribution to the overall increase in admissions and procedures done[14]. Notably, the need for emergency surgery increases with age, as does the rate of complications and mortality[16]. As the average age of admitted patients increases, so the effect of physiological decline has a more prominent effect on outcomes. Thus, several emergency conditions carry a much higher age-adjusted incidence for each age decade above 60 years, including bone fractures[17], perforated gastroduodenal ulcer[18], emergency hernia repair[19] and ruptured AAA[20]. Mortality after emergency surgery increases by each decade, with a notable increase above 75 years of age in injured patients[21]. The overall risk of cancer also increases with age, and consequently emergency presentation with malignant disease does too. The prevalence of other medical conditions increases with age, as does the number of drugs used to treat co-morbidity. Together, the expected increase in the elderly population, the higher rate of emergency presentation and the added risks of unplanned surgery pose an enormous challenge to healthcare systems, and to surgical services in particular.

Mortality after emergency general surgery in the elderly

The mortality rate after emergency surgery is considerably higher in the elderly, even for conditions usually regarded as having low mortality. For example, in acute appendicitis the reported mortality rate in patients aged over 70 years is six to seven times higher than in those aged 20–49 years[22]. Perioperative mortality after emergency abdominal surgery is usually reported to be about 15–20 per cent[23–28], depending on age and diagnosis. Mortality increases with every decade of age beyond 50 years, reaching 40–50 per cent in those aged 80 years and above[25,29]. In a global assessment of mortality in emergency surgical conditions[1], the most common cause of death was complicated peptic ulcer disease, followed by AAA, bowel obstruction, biliary disease, mesenteric ischaemia, peripheral vascular disease, abscess and soft tissue infections, and appendicitis. Notably, the death rate per 100 000 inhabitants was twice as high in high-income countries compared with low- and middle-income countries (LMICs), although the overall number of deaths is higher in LMICs[1]. Beyond 30 days, higher mortality is reported up for to 1 year after surgery, usually 30–40 per cent[24]. This underscores the role of preoperative frailty in the elderly.

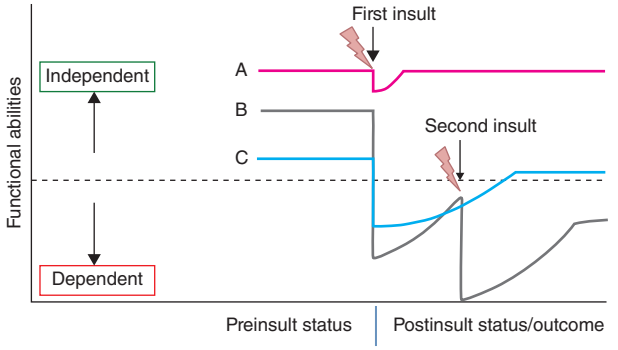

Fig. 1 Role of frailty on outcomes after a physiological insult. Patients may differ in physiological reserve and preinsult living status. Pathway **A** depicts independent living and a minor response to an insult (such as urinary tract infection or mild appendicitis), from which the patient recovers quickly to preinsult status and the same physiological reserve. In pathway **B**, the degree of independence is reduced, and the insult (for example, surgery for strangulated small bowel, or perforated peptic ulcer with abdominal sepsis) more severe, leading to dependence; if a second insult follows (such as postoperative pneumonia, cardiac event or anastomotic leak), the chance of returning to the same preoperative level of function is decreased, and in the very frail may result in death. In pathway **C**, the return to independent existence is possible after an uneventful recovery (for example from emergency surgery for colonic cancer), with no effect on long-term independence. Illustration modified from Clegg and colleagues[30]

Screening, and assessment of frailty

Frailty has been described as 'a state of vulnerability to poor resolution of homeostasis after a stressor event and is a consequence of cumulative decline in many physiological systems during a lifetime'[30]. Frailty results in a lack of resilience to any physiological insult (*Fig. 1*) that prevents recovery or achievement of the same functional level after the insult. The five indicators of frailty (weight loss, self-reported exhaustion, low energy expenditure, slow gait speed and weak grip strength)[30] may be measured easily in an elective setting, but are difficult to assess reliably in a patient with acute disease. Several scores exist to monitor frailty in the elective setting, but none is reliable in emergency patients. Some studies, however, have described

promising results for further development pending validation in other cohorts.

Among these are recent studies[31,32] that compared a number of available frailty scores. In one study[31], the diagnostic accuracy of six screening instruments for frailty was evaluated. The investigators compared the ability to predict outcome after emergency abdominal surgery. The screening instruments were all developed for elective surgery, except for the Triage Risk Screening Tool, which was developed for medical patients in the emergency room. The prevalence of frailty as determined by the screening tools varied from 50 to 80 per cent; their ability to predict postoperative morbidity and mortality also varied, with sensitivity for mortality ranging from 52 to 85 per cent. The Vulnerable Elderly Survey (VES-13) appeared to be accurate. Four of the six screening tests independently predicted postoperative mortality[31].

A second study[32] used scoring systems developed for intensive care medicine and elective surgery, and analysed whether they could predict mortality in the frail elderly patient needing emergency surgery. The scoring systems varied in terms of sensitivity and estimated mortality, but the Acute Physiology And Chronic Health Evaluation (APACHE) II system had a sensitivity of 96 per cent in estimating postoperative mortality. Notably, the APACHE II risk score is used mainly in North America; it is frequently used for research purposes, and is a very comprehensive and labour-intensive tool to apply in clinical practice.

The Charlson Age–Co-morbidity Index (CACI) was developed from the Charlson Co-morbidity Index (CCI) to facilitate classification of co-morbidities in longitudinal studies[33]. The CACI weighs different medical conditions on a scale from 1 to 6; age is weighted +1 for every decade after 40 years. The CACI has been validated in several settings, including as a predictor of perioperative outcomes after acute surgical care[33]. In a study of acute surgical care[33], but with most patients aged less than 65 years (i.q.r. 30–66 years), the authors showed that a higher CACI predicted both 30-day mortality and critical care admission. Whether this is applicable to the geriatric population is not yet proven.

One study[34] assessed a modified version of the Canadian Study of Health and Aging Frailty Index and investigated the effect of increasing frailty on multiple outcomes, including wound infection, any infection and mortality. The Frailty Index was a strong and independent predictor of both morbidity and mortality. It was thought to be a useful preoperative screening tool for emergency patients aged over 60 years[34].

Although acute abdominal surgery in elderly patients is becoming increasingly common, the literature on prognostic factors for morbidity and mortality in these patients lags behind[35]. Further research is needed to help guide patient care and potentially improve outcomes.

Predictors of mortality or futility

Although age is related strongly to mortality, the presence of organ failure, including pulmonary disease, congestive cardiac failure, hypertension and renal failure, is an even stronger predictor of death[22,36]. This reflects the role of ageing in accumulating co-morbidity, as expressed in one study[33] where the CACI was a good predictor of 30-day mortality after emergency general surgery[33]. The CCI has also been validated as a useful tool in morbidity and mortality prediction for the elderly with acute conditions[37].

Several scores have been assessed that might predict poor outcome after emergency surgery. Many risk scores attempt to be too generic, and others are too disease-specific. Thus they either fail to take into account the complexity of the disease or fail to achieve good predictive values across variable populations[38]. For perforated gastroduodenal ulcer, which is a high-incidence, high-risk surgical disease in the elderly[39], there are more than ten suggested scores[40], but none gives a robust prediction across studies[27]. The plethora of available scores testifies to the difficulty in achieving a unified approach. Indeed, the effect of chronological age and the presence of co-morbidity has not been associated consistently with poor outcomes across all studies[41].

Several investigators have tried to combine a few risk factors to predict outcome. Among these factors are the American Society of Anesthesiologists (ASA) fitness grade and the nature of the procedure (elective, urgent or emergency)[42]. In addition, more than one co-morbidity and new-onset organ failure are single risk factors predicting poor outcomes[43].

In an observational study[44], mortality rose with increasing age for emergency surgery, high ASA grade (over III), in patients with anaemia or those with a high white blood cell count, and in those who underwent a palliative cancer procedure. The study showed a twofold to fourfold higher odds ratio for mortality after simple procedures such as appendicectomy and cholecystectomy.

When a large number of risk factors occur, such as high age, high ASA grade, presence of septic shock and preadmission dependent living, the perioperative mortality rate is very high. In this circumstance, one study[45] demonstrated that the chance of survival was less than 50 per cent in patients aged over 70 years, and below 10 per cent for those aged over 90 years. In the absence of any agreed and

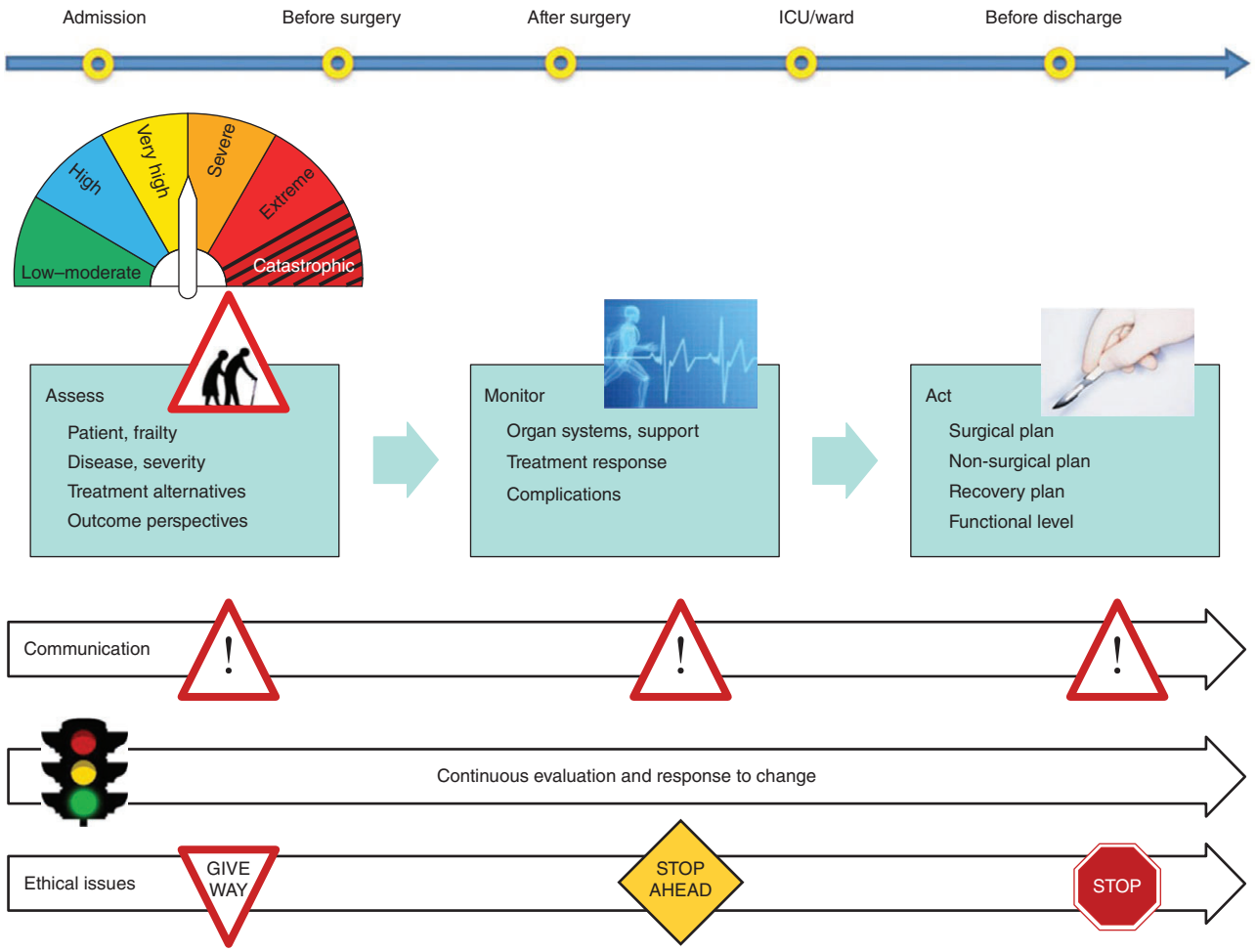

Fig. 2 Creating a road map in the pathway of care. Caring for the geriatric patient with a surgical emergency is complex and needs to be tailored to the individual based on associated co-morbidity and frailty, disease severity, treatment alternatives and the wishes of the patient. Continued assessment of interventions and effect, timely and repeated communication, and cautious reflection on aspects of care should be incorporated into decision-making. ICU, intensive care unit

reliable score, these factors could be used to inform patients and their families of the risks of surgery, and could result in a decision for palliative care alone.

A care plan from admission to discharge

In caring for the elderly patient who needs emergency surgery, there are a number of considerations to implement in the decision-making process (*Fig. 2*). First, the correct diagnosis may be difficult owing to the altered physical and mental status of the patient, as well as other conditions or medications masking symptoms or severity. Second, the choice of treatment may not always be as straightforward as for younger, fitter patients. Third, although age itself is no contraindication to surgery, the potential outcomes may be different. In a geriatric patient the ability to live an independent life with minimal loss of function (but perhaps no cure of the disease) may take precedence over heroic life-extending therapeutic interventions. Although the elderly patient may tolerate an operation, they may not tolerate any subsequent complications, so tailoring the procedure by using a different risk–benefit ratio is necessary. This is a clinical setting where truly personalized medicine should come of age. Furthermore, as the prognosis may be unpredictable, ethical issues of care may emerge[46]. It is important to set realistic goals with both patient, caregivers and, if available, the next of kin[47]. The latter is prudent to avoid unnecessary or futile treatments, and to prevent prolonged suffering and unnecessary procedures at the end of life.

Clinical assessment and preoperative optimization

The acute abdomen remains a clinical challenge in the elderly patient. To distinguish which patients need surgery from non-surgical abdominal illnesses can be difficult. Less severe conditions can mimic major diagnoses requiring early intervention. Early diagnosis is essential, as delayed treatment can worsen outcome, as demonstrated for perforated peptic ulcer[48]. Use of urgent imaging (such as CT) should be liberal as the long-term side-effect of radiation is less of a concern in the elderly. Efforts to explain to the patient the range of therapeutic alternatives, risks and possible outcomes should precede final decision-making. The objective in all patients should be to avoid unnecessary and non-beneficial treatment, and to maintain quality of life[46,49,50]. Optimal perioperative care improves the chance of patients returning to their place of residence after surgery. Furthermore, as in any urgent presentation, early resuscitation, treatment of sepsis and appropriate monitoring is of the essence[51,52].

In the emergency situation, opportunities for preoperative optimization may be limited. A few considerations may still be prudent. Because elderly patients tolerate hypovolaemia poorly, it is wise to consider shock and hypoperfusion early. As learned from patients with traumatic injury, the systolic BP threshold suggesting shock may begin at 110 mmHg in the elderly, rather than the usual 90 mmHg[53]. As the elderly have reduced cardiovascular reserve, occult heart failure should not be forgotten; some drugs may affect heart rate, and it may be necessary to correct reduced contractility or afterload by means of vasopressors[54]. This is best done by invasive monitoring and echocardiography in critical care, and should be prioritized early during resuscitation and preparation for surgery. Elderly patients also have a higher prevalence of reduced pulmonary function, owing to ageing effects on the thoracic muscles and lung tissues, but also as a result of underlying disease such as chronic obstructive pulmonary disease, asthma, pulmonary fibrosis or congestive heart failure[55]. They may be at risk of pneumonia because of a reduced immune system and have a higher risk of aspiration, either from an obstructed gastrointestinal tract, or from cerebrovascular or neurological disease. Early considerations should include ensuring a patent airway and relieving gastric contents by means of a nasogastric tube. Renal insufficiency is also more prevalent with age, and is worsened by underlying diabetes, hypertension and drugs (including non-steroidal anti-inflammatory drugs)[56]. Hypovolaemia and decreased cardiac output may trigger or worsen renal insufficiency, and even cause renal failure in the acute setting. Ensuring proper hydration, attention to drugs (types and doses), proper monitoring of urinary output and an adequate BP are crucial. For patients in critical care, a mean arterial BP over 60 mmHg is recommended to ensure renal perfusion[57]. A multidisciplinary approach involving surgeons, geriatricians, radiologists, anaesthetists and other relevant specialties is important to agree treatment goals, optimize care and evaluate the response through the pathway of care (*Fig. 2*). It is recommended that this is an early priority during hospitalization[49,58,59].

Range of treatment alternatives

Elderly patients should be assumed to have the mental capacity to make decisions about their treatment, until proven otherwise. Where patients obviously lack the cognitive capacity for informed decision-making, their relatives and carers must be involved to determine what treatment, if any, is in the patient's best interests.

Surgery should not be denied based on age alone. Indeed, studies have shown that selected elderly patients may tolerate major emergency surgery and recover well. Damage control surgery or abbreviated laparotomy to restore challenged physiology is a method learned from trauma that is now employed in emergency general surgery[60]. A small study[61] including elderly patients (aged over 65 years) who had damage control surgery for non-trauma conditions found similar survival in elderly compared with younger patients.

Emergency surgery may be life-saving where death is likely without operation, such as for hollow viscus perforation or major bleeding. In other situations, where surgical treatment is the obvious option of choice in younger patients, less invasive alternatives may be discussed in the fragile elderly patient. Reports about various emergency conditions support this tailored approach. For example, in acute cholecystitis, urgent cholecystectomy may still be the preferred choice even in elderly patients. However, percutaneous drainage may be just as efficient in relieving symptoms in the high-risk elderly patient, and may represent a definite treatment[62].

Minimally invasive techniques and surgery under local anaesthesia make fewer demands on physiology; given that co-morbidity is a stronger predictor of outcome after surgery than age, this is a significant consideration in the elderly[63]. The risk–benefit balance between open surgery and minimally invasive approaches should be considered individually. As an example, mortality from a bleeding peptic ulcer has decreased considerably with the advent of endoscopic options, and transarterial angiography and embolization techniques to control bleeding[64], whereas surgery for a bleeding ulcer in the elderly, frail and shocked

Table 1 Ethical considerations in the geriatric patient with an emergency condition

	Considerations	Complexities
Patient's will and level of care	Oral or written will Consult relatives or guardian	Mental awareness Non-documented will Proxy will
Do-not-resuscitate decisions	Patient's will Physician/surgeon experience Expectations	Communication Expected outcomes Preinsult level of function Frailty assessment
Withholding life support	Still hope to get through Is there a limitation in the care to be provided? Organ system reserve limitations Ward care: intravenous fluids, medications, antibiotics, nutrition High-dependency unit: ventilation and pressure support Intensive care unit: no indication for invasive respiratory support if weaning will be impossible or unlikely?	Caregivers' expectations *versus* patient's expectations *versus* relatives' and carers' expectations Frailty assessment
Withdrawing life support	Poor prognosis Non-responsive to ongoing treatment and no indication to step up	Feeling of 'giving up' Difficult to stop when started Patient's wishes Relatives' and carers' expectations and wishes Caregiver perspectives
End-of-life decisions	Is the available treatment likely to be futile? Too advanced disease Focus on palliation rather than unfruitful intervention?	No firm endpoints or few objective measures Caregiver unwillingness Patient, relative and carer unwillingness False hopes False expectations Experience *versus* objective criteria

patient carried a very high risk of death in the past. In contrast, treatment of perforated peptic ulcer has seen fewer advances over the same interval[39]; it is still associated with a high mortality rate, particularly in the elderly. Non-surgical options have been described, but results were particularly poor in patients aged over 70 years[65]. Some authors still suggest this as an alternative in the elderly, but it remains poorly documented[39]. Where surgical and non-surgical treatment options are not balanced equally in terms of risk and benefit, management should be tailored to the individual patient and the underlying disease. The need for early reoperation is associated with prolonged hospital stay and very poor outcomes; the first surgical procedure should focus on functional solutions with the lowest risk of complication or reoperation.

Complications after surgery

Perioperative complications are a very strong predictor of poor outcomes in geriatric surgery[16,41,66–68]. When complications follow emergency laparotomy, the mortality rate is increased over threefold[41,69,70]. This should be explained to patients and their families, and included in decision-making for further intervention or advanced care. Optimal surgical technique, avoiding large incisions, minimal tissue handling and shorter operations are hallmarks of successful surgery[43].

Postoperative care

Postoperative delirium is common, but underdiagnosed, in elderly surgical patients, and delays rehabilitation[49,71,72]. It occurs in 7–13 per cent of patients after elective surgery, and up to 18 per cent after emergency surgery[26,71]. Older age and emergency surgery are two of 11 risk factors for development of postoperative delirium in intensive care[72].

The American Geriatrics Society's Geriatrics for Specialists Initiative[73] recently suggested guidelines to improve prevention and treatment of delirium[73]. There were eight recommendations with strong evidence, including the use of interdisciplinary teams, early mobility and walking, avoiding restraints, sleep hygiene, and adequate nutrition, fluids and oxygen. Postoperative pain control, preferably without opioids, was also important. Perioperative pain is common and underappreciated in elderly surgical patients, particularly in those with cognitive impairment. The suggestions are supported by similar guidelines issued by other specialties[49].

Long-term outcomes after emergency surgery

Elderly patients who undergo emergency surgery may survive the initial treatment, but often suffer from complications due to co-morbidity, and with increased

long-term mortality[74,75]. A holistic focus with interdisciplinary assessment and care can reduce duration of hospital stay, intensive care admission, hospital readmission, mortality and costs[58,59,76–79]. The multidisciplinary care concept has yet to gain full acceptance in general surgery. Positive benefits can be extrapolated from orthopaedics, trauma surgery and, lately, acute care surgery services[58,59,76–79]. Involvement of nutritionists to optimize feeding and starting early mobilization are contributory. As many as 80 per cent of older hospitalized patients are either malnourished, or at risk of malnourishment[80]. Mobilization and physiotherapy can improve bowel function and reduce postoperative complications such as deep vein thrombosis and chest infection.

Palliation and end-of-life decisions

Emergency surgical conditions in the elderly and frail patient bring a number of ethical issues (*Table 1*) that need to be monitored continuously through the pathway of care (*Fig. 2*)[50,81–83]. Although beyond the scope of this review, the explicit points of universal application have been addressed in several recent overviews[46,50,84].

Research and future considerations

Research in the emergency setting is difficult for several reasons, including the unplanned nature of presentation, the obstacles concerning informed consent, and the immediacy or urgency for intervention in many patients[85]. Elderly patients are grossly under-represented in clinical trials[86], particularly in surgery. Like ethnic minorities and children, geriatric patients are less likely to be enrolled in acute care clinical research than middle-aged white people[87,88]. Some attempts have been made with success, in particular recruiting patients with hip fractures[89]. The experience needs to be expanded to a larger range of emergency conditions in order to provide the elderly with the best knowledge, respect and service possible.

Disclosure

The authors declare no conflict of interest.

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Editor's comments

Emergency abdominal surgery in the aged. R. Black and J. Lynn. *Br J Surg* 1976; **63:** 957–960.
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This 40-year-old paper from BJS highlights what is still a challenge: emergency surgery in people aged 75 years and above. As today, mortality increases with each decade of life. Some of the presentations are still very frequent, such as incarcerated hernia, strangulated small bowel, intestinal obstruction and acute mesenteric ischaemia. The very high mortality rate in the latter (66 per cent) is recognizable even today. Also, the high mortality from appendicitis (over 10 per cent) and acute biliary disease (at 20 per cent) in this age cohort should be noted. Such figures may be true even today in the very elderly presenting with an acute surgical emergency.

K. Søreide
BJS Editor

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