Royal College of Surgeons

ADVANCING SURGICAL CARE

The High-Risk General Surgical Patient: Raising the Standard

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Approving Organisations

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- The Royal College of Surgeons of England
- Association of Surgeons of Great Britain and Ireland
- Association of Upper Gastrointestinal Surgeons
- Association of Coloproctology of Great Britain and Ireland
- Royal College of Anaesthetists
- Age Anaesthesia Association
- British Geriatrics Society
- Faculty of Intensive Care Medicine
- Intensive Care Society
- Clinical Radiology Faculty of The Royal College of Radiologists
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- British Society of Gastrointestinal and Abdominal Radiology
- National Emergency Laparotomy Audit
- Emergency Laparoscopic and Laparotomy Scottish Audit
- National Acute Surgery Forum

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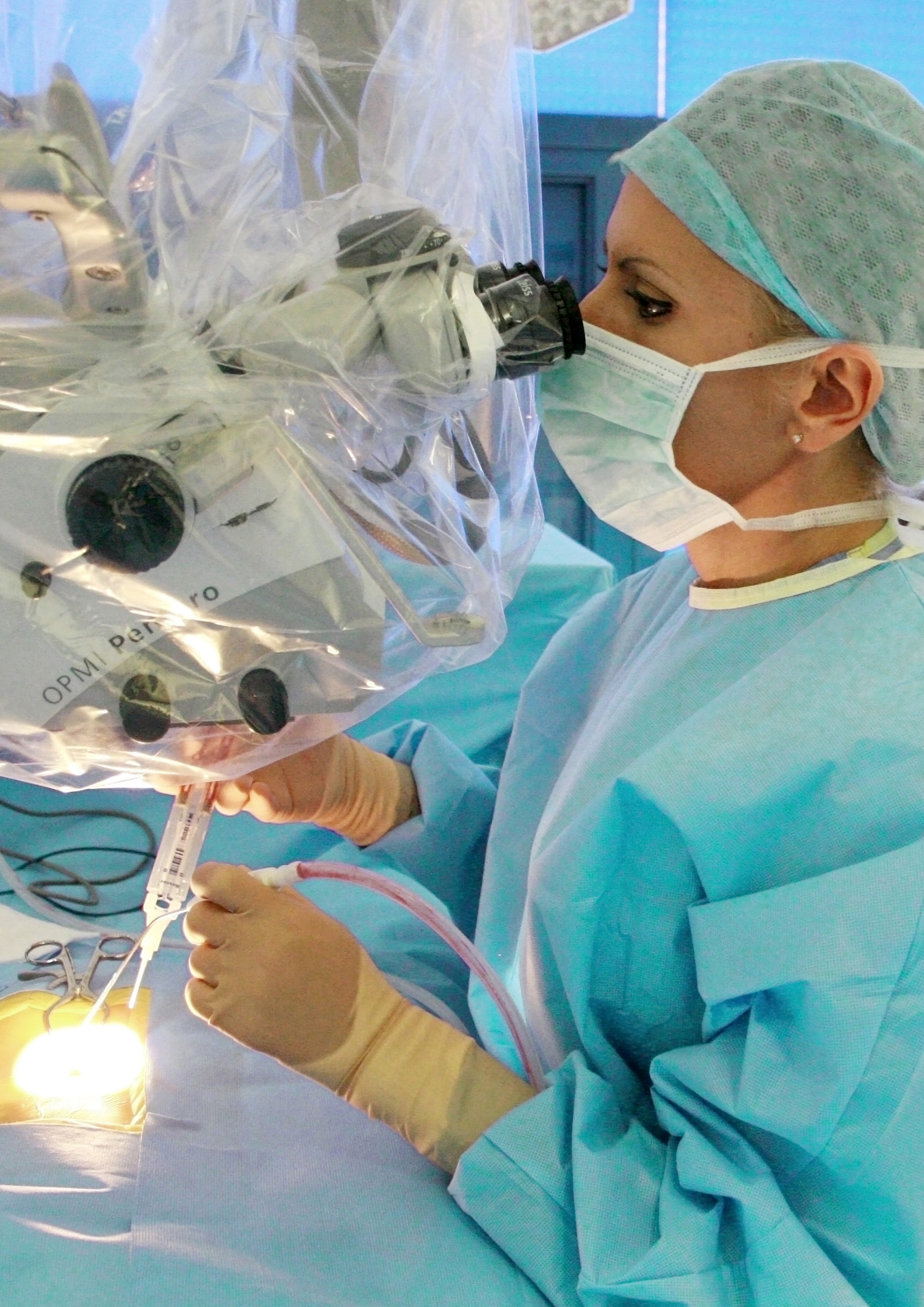
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Summary

The Royal College of Surgeons of England published the *Higher Risk General Surgical Patient* in 2011. The document drew attention to the high rate of mortality that was previously unappreciated in a readily recognisable group of adult patients undergoing high-risk elective or emergency abdominal surgery for a broad range of conditions seen in every acute NHS hospital; for example, bowel cancer, strangulated hernia and peritonitis. It described key issues and standards and made recommendations expected to make an appreciable difference to outcomes for a group that accounts for more deaths and admissions to critical care than any other surgical patients.

Perioperative processes and outcomes have improved significantly since 2011, notably for some patients undergoing emergency laparotomy, who now benefit from greater consultant involvement and increased access to critical care beds. However, current evidence indicates that many patients, particularly those presenting as an emergency with an abdominal condition, still receive surgical care that is unreliable with respect to diagnosis, recognition of deterioration and provision of high-quality treatment. Some are still suffering avoidable harm and on occasion dying, waiting for antibiotics, scans, procedures, operations or critical care beds because care is not focused enough on their life-threatening conditions. There is evidence that finite resources, such as consultant staff and theatre availability, are still systematically targeted at lower-risk patients having planned procedures, discriminating against sicker patients who need emergency abdominal surgical care.

This document is an update on the 2011 position. It reviews the progress made and identifies persisting and newly recognised issues. It describes revised and new standards for the management of high-risk patients, defined as those with a risk of dying of ≥ 5%, who should universally receive prompt multidisciplinary consultant-delivered care and perioperative critical care admission. It also details the improvements urgently needed for the large numbers of frail patients presenting with an abdominal surgical emergency. We recognise that a predicted mortality of ≥ 5% is a relatively high threshold for defining a ‘high-risk’ patient. However, given the existing shortfall in resources we have sought to focus on those patients with the greatest unmet need.

Where previous standards have not been revised, they remain recommended. The *actions* now required are clearly shown. Furthermore, it is the opinion of this expert group that implementation of the new *key recommendations* should be mandatory in all acute hospitals with adult general surgical services and that doing so would save lives and make further appreciable differences to patient outcomes. Many could be delivered within two years.

Key Recommendations

1. Adult patients admitted or transferred under the care of a general surgeon, for operative or non-operative management, should be managed in accordance with a unit protocol led by general surgery and agreed by emergency medicine, acute medicine, radiology, anaesthesia, critical care and, for patients aged over 65 years, care of the elderly. This protocol should include the following key components: administration of appropriate antimicrobials within one hour when indicated; availability of a radiologist's report within one hour when emergency abdominal computed tomography is performed; assessment of risk and provision of an appropriate response at key points within the patient pathway and of escalation pathways in the event of patient deterioration, in both perioperative and non-operative periods.

2. Patients aged over 65 years and other patients who appear frail for their age should have their level of frailty assessed and recorded within four hours of admission or transfer, using a recognised assessment tool. In addition, these patients should be screened preoperatively for risk of perioperative neurocognitive disorders. Evidence-based approaches should be instituted to reduce the incidence of acute postoperative delirium, to minimise its severity and to reduce the risk of longer-term consequences.

3. Patients should have their risk of morbidity and mortality assessed and recorded in the medical records by a senior surgeon (Specialty Trainee Year 3, ST3 and above) within four hours of admission/transfer, using appropriate risk prediction tools and clinical judgement. Frailty, the likelihood of perioperative neurocognitive disorders and surgical diagnosis should be taken into account during this assessment, as these may not be adequately reflected in existing risk prediction tools. The risk should be reassessed and recorded again after operative interventions and after any material deterioration. Any change should prompt an appropriate adjustment in patient care. The predicted mortality should be used as part of the global assessment of a patient and should help to inform the allocation of care resources. It should also be used to communicate reliably within the multidisciplinary team and in discussion with patients and their supporters.

4. High-risk patients are defined by a predicted hospital mortality of ≥ 5%. Where any of the recognised appropriate risk prediction tools, frailty assessment or clinical judgement results in an assessment of predicted hospital mortality of ≥ 5%, the patient should be treated as high risk. In the absence of a recorded assessment of risk, the patient should be treated as high risk.

5. All patients admitted or transferred under the care (or joint care) of a general surgeon should be screened and monitored for sepsis using the National Early Warning Score (NEWS) 2 score. For high-risk patients, the outcome of this screening should be documented, even if negative.

6. When general surgery patients undergo emergency abdominal CT for non-traumatic abdominal pain, the incidence of significant discrepancies should be less than 5%. For high-risk general surgery patients being considered for major surgery, there should be joint preoperative discussion between senior surgeon (ST3 and above) and senior radiologist (ST3 and above), either in person or by telephone, followed by postoperative comparison of imaging and operative findings. Best care includes preoperative discussion between a consultant surgeon and an in-house consultant radiologist.

7. Image-guided drainage by radiology should be available in all centres admitting elective and emergency general surgical patients, with procedures being performed by suitably experienced radiologists or dedicated interventional radiologists. Comprehensive interventional radiology services are required for more complex procedures, ideally on site or through a defined and effective network arrangement. The choice between operative and radiologically guided intervention for source control in patients with sepsis should be an active process that weighs respective risks and benefits and is informed by robust information about availability of those options.

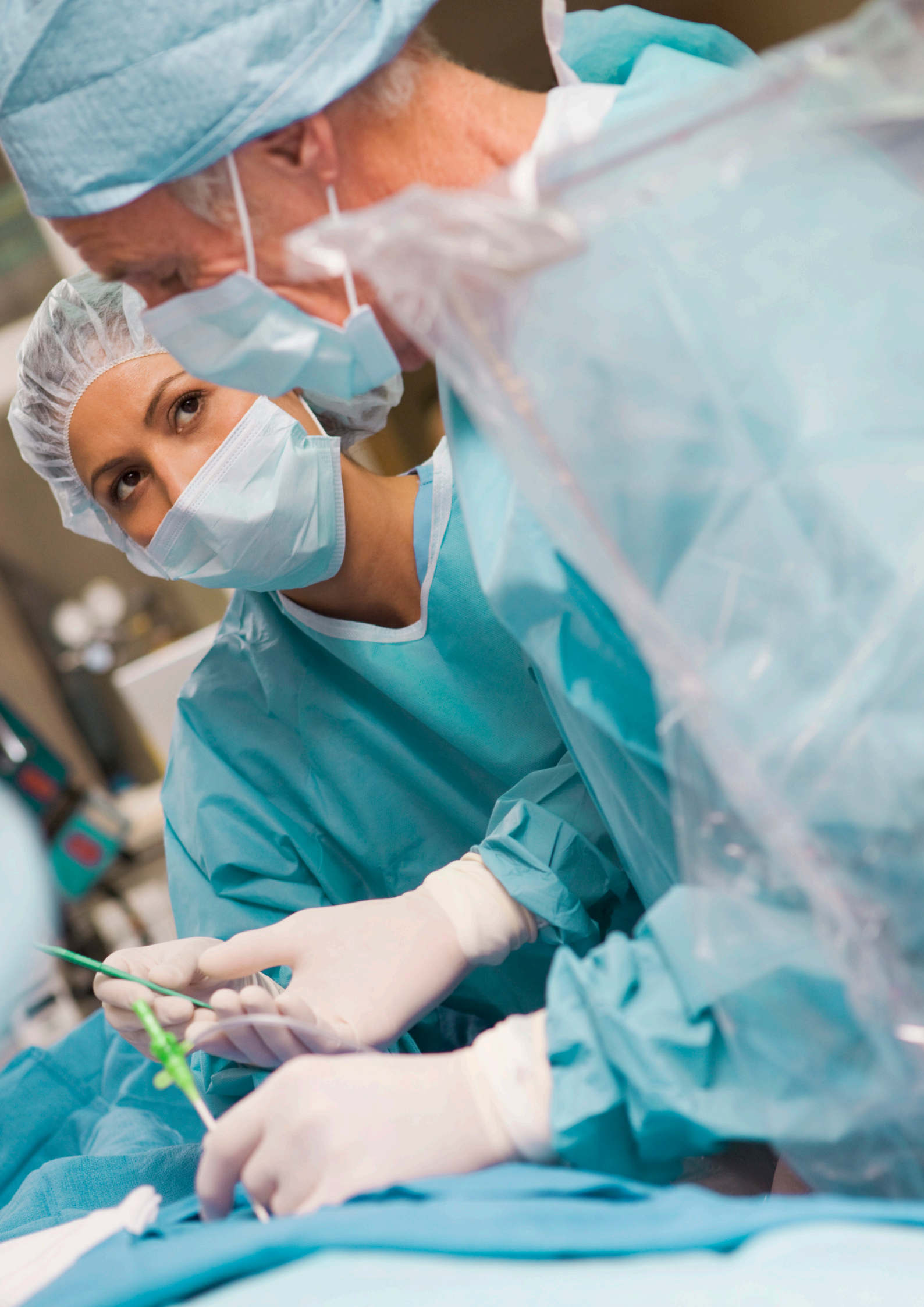
8. Unit protocols for high-risk patients undergoing surgery should include the following key pathway components: a time-compliant operation that, for a patient with septic shock or sepsis requiring operative source control, is underway within a maximum of three hours or six hours, respectively, surgery conducted in the presence of a consultant surgeon and consultant anaesthetist, and immediate postoperative admission to critical care. Compliance with these standards should be continuously audited and breaches of these key components of this high-risk operative care bundle should be considered suboptimal care and should undergo structured review by the unit.

9. Unit protocols for high-risk non-operative patients should include the following key pathway components: consideration of admission to critical care with the decision and rationale recorded in the medical records by a senior doctor (ST3 and above) within four hours of admission or transfer; consideration of advance care planning and ceilings of care.

10. Commissioners and hospital service managers should incentivise delivery of care for high-risk general surgical patients that complies with these key pathway components.

11. Units should review the number and complexity of both high-risk general surgical patients and general surgical patients overall. Taking note of the detailed guidance given here and elsewhere, units should formally consider, at least annually, the resources required for safe general surgical care. They should put in place systems to track, detect and respond to an acutely increased risk of harm to general surgical patients caused by individual or collective patient demand on staff, equipment or estate that exceeds the capacity for safe care. This should include encouraging and empowering staff to raise concerns when they believe that emergency general surgical patients are endangered and should specify how and when escalation will trigger deployment of more staff and prioritised access to hospital facilities, including diagnostics, theatre and critical care. This should be supported by a standard operating policy.

12. Units should adopt a programme of continuous quality assurance and quality improvement for the care of high-risk general surgical patients that embeds a bundle of high impact interventions into daily practice. The programme should be multidisciplinary and should be led by a named clinician with time allocated in their job plan. Data should be collected on a range of outcomes, including risk-adjusted mortality, morbidity and patient-reported outcome and experience measures for both operative and non-operative care. Mortality and morbidity reviews should follow a structured format. Key performance indicators, including breaches of compliance with the high-risk operative care bundle should be reported monthly to the board and to relevant hospital departments as part of that process.



The High-Risk General Surgical Patient: Raising the Standard

Background

Introduction

In 2011, an expert group published *The Higher Risk General Surgery Patient. Towards Improved Care For A Forgotten Group*[1] on behalf of the Royal College of Surgeons of England and the Department of Health. The document was prompted by growing concern over the quality and reliability of care received by adult patients undergoing major general surgery in the UK. Then, as now, major general surgery took place in every acute hospital, involved a broad variety of different conditions and frequently took place on an emergency basis. In comparison with cardiac surgery and many other complex surgical procedures, mortality and complications rates were often high, yet care pathways were frequently unstructured and involved limited use of critical care. National audit was largely confined to a few specific conditions, mainly treated on an elective basis, such as colorectal cancer.[2]

It was already known that an easily identified group of predictably high-risk non-cardiac surgical patients accounted for most postoperative deaths.[3] Many of these patients were emergency general surgical patients and the variation in care received by patients undergoing emergency gastrointestinal (GI) surgery was a particular cause for concern. However, similar issues also impact on the care of patients suffering serious complications after major elective GI surgery. Delays in assessment, decision making and treatment, deficiencies in access to radiology, theatre and critical care, suboptimal supervision of juniors and unreliable administration of antibiotics and venous thromboembolism prophylaxis have all been implicated in deaths and/or other avoidable harm, highlighted in the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reports.[4–6]

The Higher Risk General Surgery Patient. Towards Improved Care For A Forgotten Group described the nature of these shortcomings and how they impacted on outcomes for this group of patients.[1] The expert group identified opportunities to reduce the incidence and/or severity of complications before, during and after surgery, described standards and made a series of recommendations expected to make an appreciable difference to outcomes. The Royal College of Surgeons of England also published *Emergency Surgery: Standards for Unscheduled Care*,[7] which made further complementary recommendations for emergency surgery in general.

Since the publication of these documents much has happened. There have been important clinical developments; recognition of the importance of estimating perioperative risk,[6] changes to the recommended approach to sepsis,[8,9] and a deeper understanding of the impact of frailty and of perioperative neurocognitive disorders. There has also been a focus on improving pathways of care and demonstration that even in patients with multimorbidity who undergo emergency general surgery, perioperative mortality can be reduced through the use of new models of care.[10]

Since publication of the previous report, there has also been an increased emphasis within healthcare generally on both evidence-based practice and patient safety. The NHS Constitution,[11] commits to 'innovation and to the promotion, conduct and use of research to improve the current and future health and care of the population'. The Francis report[12] and the subsequent report by the National Advisory Group on the Safety of Patients in England led by Dr Don Berwick, *A Promise to Learn – A Commitment to Act*[13] place the quality of patient care, especially patient safety, above all other aims. The *Getting it Right First Time (GIRFT) Programme National Specialty Report for General Surgery* has been published.[14] It recommends the definition of optimal care pathways in national guidance that can be implemented locally with minimal, if any, variation.

There has been demonstrable improvement in the care of some patients undergoing general surgery since 2011, particularly those undergoing emergency laparotomy.[15] However, extensive evidence has emerged that confirms ongoing variation in care within and between units in the UK and when compared internationally. Furthermore, while patients undergoing emergency laparotomy have been the subject of considerable scrutiny and action, other high-risk general surgical patients, such as those undergoing emergency operations other than a laparotomy (e.g. strangulated hernia repair), non-operative emergency general surgical patients and patients deteriorating after major elective GI surgery have received rather less attention. Furthermore, implementation of emergency surgical care pathways has remained difficult in the context of workforce issues, with some specialties dogged by high vacancy rates[16] and others struggling to balance the competing needs for subspecialists and generalists.[17]

There is now a growing realisation that adverse outcomes are not inevitable for high-risk general surgery patients. Unacceptable variation in the care of this group is tantamount to avoidable serious harm and requires changes to systems to address the issues. Accordingly, the Royal College of Surgeons of England invited this expert group to review the *Higher Risk General Surgery Patient* 2011 document, taking note of developments in practice, to provide updated recommendations where appropriate.

Setting the standard

Drivers for improved healthcare include the publication of outcome data and audits[15,18–22] and commissioning incentives such as Commissioning for Quality and Innovation (CQUIN) measures[23] and Best Practice Tariffs.[24] It is our opinion and intention that raising the standards recommended for patient care will also act as a driver for improvement. Standards inform audits and can be used in commissioning incentives.

It was thought that the standards recommended in 2011 were deliverable within two years in all acute hospitals.[1] One of the key recommendations was the setting up of a national audit of outcomes for adults undergoing emergency general surgery. Following a report from the Emergency Laparotomy Network,[18] the National Emergency Laparotomy Audit (NELA) was commissioned in 2011. An organisational audit was undertaken in 2012 and individual patient data collection began in December 2013 in England and Wales.

NELA has shown significant improvement against the existing recommended standards, although there remains some variation in compliance. The 2017 NELA report[15] showed that estimation and documentation of the expected risk of death had risen from 56% of patients in 2013–14 to 71% in 2015–16. Emergency laparotomies were conducted within the timescale judged necessary in 78% of cases in 2013–14, rising to 83% in 2015–16. Improvements in processes such as these have translated into better outcomes. The 30-day mortality for patients undergoing emergency laparotomy fell from 11.8% to 10.6% over the same period.

Units have approached improving their compliance with the 2011 standards in several ways. Some have adopted a pathway for high-risk patients using their existing resources, driving up compliance using quality improvement methodology[10] and/or redesigning ways of working, particularly around emergency care. Exemplar vignettes are readily available.[14,15] Others have concluded that compliance requires more fundamental reconfiguration of general surgical services within or between organisations, sometimes as part of sustainability and transformation plans;[25] an approach that almost inevitably takes longer to implement and has been the subject of limited research.

In 2011 pragmatic standards were set, mindful of the ease of early adoption. It is our opinion that some of the existing standards do not now go far enough. For example, it would be possible within the existing standards for patients with a predicted mortality of ≥ 10% to have their operation delegated to a junior surgeon or anaesthetist if the responsible consultants were satisfied regarding their competency and experience. Patients with an estimated risk of death of almost 10% could be managed postoperatively without critical care admission.

In reviewing the standards expected in the care of high-risk general surgical patients we have sought to take account of evidence, recognising its limitations. There are many observational cohort and quality improvement studies for critically ill high-risk surgical patients but no randomised trials comparing the results of different standards of care, such as the timeliness of operative source control for sepsis. We have tried to strike a balance between modest changes that could be implemented within existing resources and more ambitious standards that should drive a step change in the care of high-risk general surgical patients.

We have also focused on reducing unwarranted variation in the processes of care and have drawn on available standards accepted as the norm for other patients undergoing elective major general surgical procedures. It is notable that a patient admitted electively for surgery for colorectal cancer has an average 90-day mortality of 1.8%.[20] Such a patient undergoes preoperative diagnosis in accordance with clear professional guidance[26] and within a timescale that is rightly protected by the NHS Constitution.[11] They have computed tomography (CT) reported by a consultant radiologist that is reviewed preoperatively jointly by a consultant surgeon and consultant radiologist. Decision making is shared between the patient and a multidisciplinary team with a core consultant quorum. Preoperative assessment is driven by protocols to ensure reliability. The operation is conducted by a consultant surgeon who is a core member of that multidisciplinary team and who performs the operation a defined minimum number of times per year. It is undertaken within a defined timescale, actively tracked and facilitated by hospital service managers. If there is a breach in that timescale, the unit's managers undertake a root cause analysis to reduce the risk of repetition and the organisation faces potential financial penalties. The radiological, operative and pathological findings are routinely reviewed by the multidisciplinary team to plan postoperative care and to promote continuous medical education. Outcomes are published at both surgeon[27] and unit[20] levels.

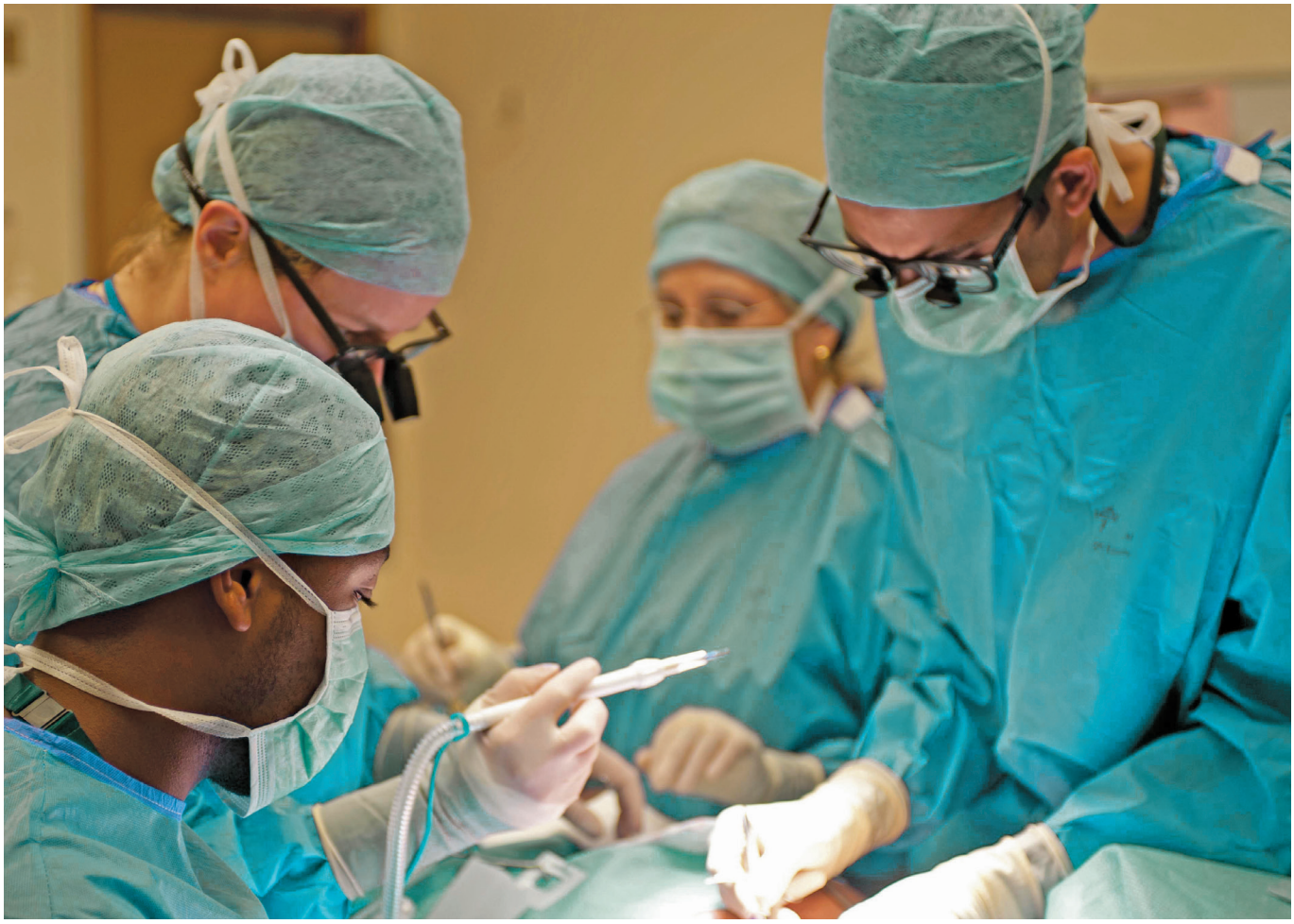
In contrast, previous studies have shown mortality rates following emergency laparotomy of 13–18% at 30 days[18,28,29] (i.e. approximately eight times higher than for a patient having an elective colon cancer resection).[20] The protections afforded an elective patient are not made available to emergency patients despite their illness being far more dangerous. The preoperative diagnostic pathway for an emergency surgical patient remains haphazard and prone to delay.[1] One-fifth of CT scans are not reported by a consultant radiologist preoperatively.[15] Where scans are reported by a consultant radiologist it is often through an outsourcing arrangement[30] and joint review of CT scans by a consultant surgeon and a consultant radiologist before surgery often does not happen. Treatment options are frequently determined by surgeons alone and in more than one-fifth of cases decisions to operate are made without the patient first being seen by a consultant surgeon.[15] One in ten emergency laparotomies, in patients with a predicted mortality of 5–10%, is conducted without a consultant surgeon being present.[15] One in six patients experiences an unacceptable delay in their transfer to the operating theatre.[15] When delays occur, they are not subjected to organisational review, nor is there a direct financial consequence. Multidisciplinary review of the case is rare. Unit-level outcome metrics are published for emergency laparotomies[15] but not for other high-risk emergency operations and conditions.

There is significant variation between units in both processes and outcomes. In some hospitals, the omission of preoperative review by a consultant surgeon, absence of a consultant surgeon at operation or undesirable delay before emergency laparotomy are double the NHS average. The adjusted 30-day mortality in units reporting at least 50 cases varied between 4% and 22% in 2015–16.[15] Within units, variation in processes and outcomes at different times of the week is known to occur.

It is an inescapable conclusion that some high-risk patients are systematically discriminated against by the way services are designed within and between units, receiving a lesser standard of care if they happen to present as an emergency rather than electively or at the ‘wrong’ time or place. This is at odds with the principles described in the NHS Constitution,[11] which include: ‘The patient will be at the heart of everything the NHS does’, ‘The NHS aspires to the highest standards of excellence and professionalism – in the provision of high-quality care that is safe, effective and focused on patient experience’ and ‘The NHS works across organisational boundaries and in partnership with other organisations in the interest of patients, local communities and the wider population’. The Berwick report observed that, ‘incorrect priorities do damage: other goals are important, but the central focus must always be on patients’.[13] In revising these standards we have sought to provide justification and a means of correcting such discrimination against high-risk emergency patients in the allocation of resources.

We have taken account of the resources made available to patients admitted for major surgery under specialties other than general surgery. Notably, there are similar numbers of adult cardiac operations and emergency laparotomy operations performed in the UK each year.[15,22] Patients undergoing isolated first-time coronary artery bypass graft surgery in the UK had a 1.05% in-hospital mortality rate in 2015.[22] It would be unthinkable for any patient in this group to have surgery delivered by non-consultant staff or to receive immediate postoperative care on an ordinary general ward providing less than four-hourly observations. Yet that is what happens to many general surgical patients who suffer from much more dangerous illnesses.

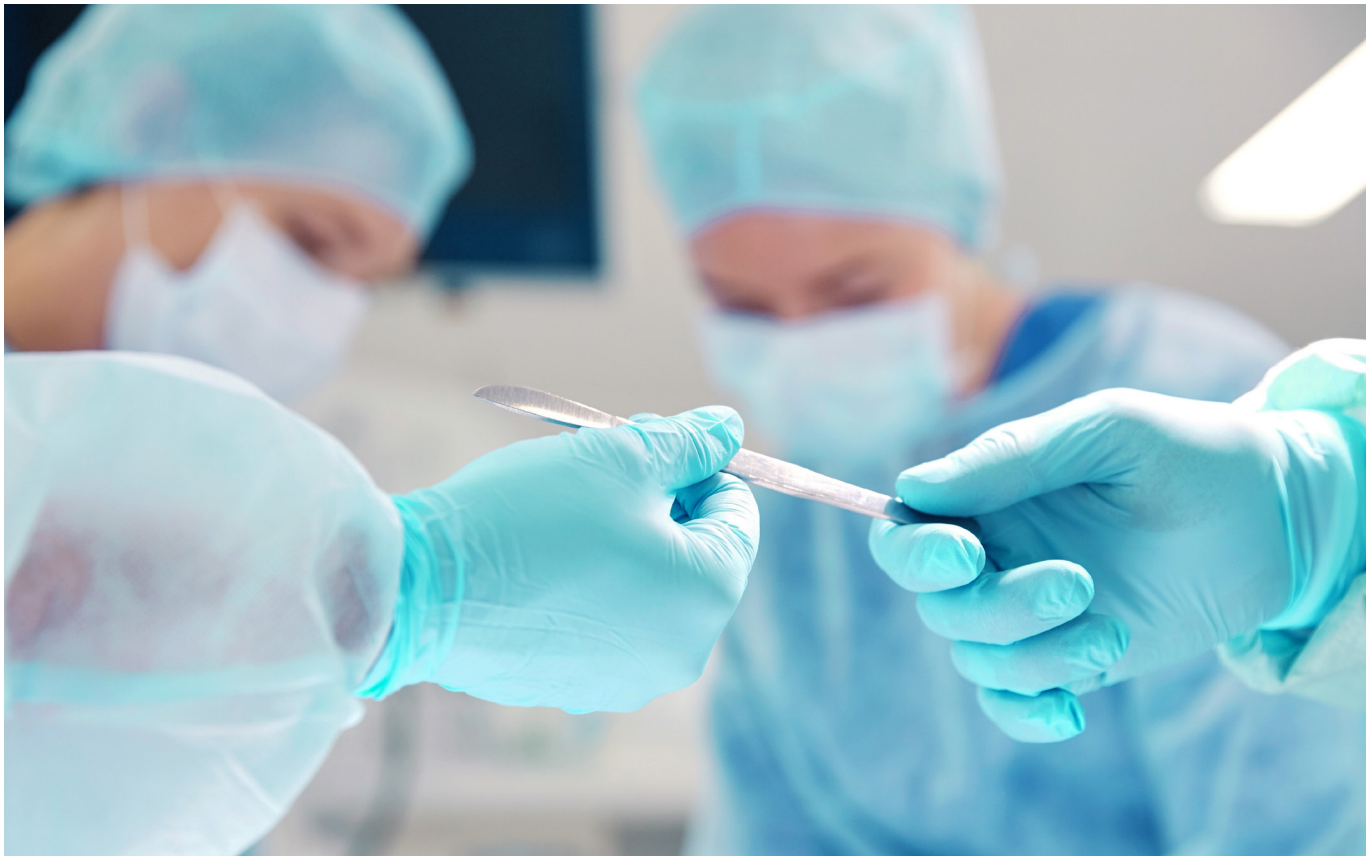
It is illogical that standards are more exacting for patients undergoing specific non-general surgical procedures in a modest number of specialist centres than they are for high-risk general surgery undertaken in almost every NHS hospital. In major trauma, significant reductions in mortality have been achieved through hospitals working as a network across traditional organisational boundaries.[31] Improvements since 2011 for high-risk general surgery patients have largely been achieved by developments within existing unit footprints and, in some localities, exacting standards have been delivered with that approach. However, where a higher standard of care can be delivered by cross-organisational working, standards should not be dumbed down simply to avoid such change.



Defining ‘High Risk’

High-risk patients are defined by a predicted hospital mortality of ≥ 5%.[1] The purpose of defining ‘high risk’ is to enable ready identification of a group of patients liable to experience an adverse outcome[3] and to optimise their care. The definition of high-risk and the resulting interventions should apply to patients irrespective of whether they present electively or as an emergency. The greatest shortfall is in emergency care.

Patients with a predicted hospital mortality lower than 5% are not to be viewed as ‘low risk’. Many patients told they have a 2% risk of dying with a proposed operation would consider that risk to be concerning, and understandably so. Furthermore, we recognise that the performance of risk prediction tools is not perfect, and it is explicitly not our recommendation that when hospital mortality is estimated to be lower than 5% it should be taken as reassurance that a patient can safely be managed without input from senior clinicians nor benefit from enhanced levels of monitoring. Many patients with a predicted hospital mortality lower than 5% would probably also benefit from similar interventions. Indeed, our assumption, based on data, is that most patients undergoing major general surgery will be at high risk of adverse postoperative outcomes and that therefore categorisation of major surgical patients as low risk should be an active decision made by senior clinicians and should be guided by an objective assessment of risk.



Risk Assessment

There are a number of ways of estimating risk for a general surgical patient. For patients undergoing an operation they include several universal or disease-specific risk prediction tools.[32–37] However, some, such as the Portsmouth Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (P-POSSUM)[32], were developed many years ago for retrospective comparison of observed and expected outcomes, when the values of all variables are known. There is concern about their widespread misuse for individualised preoperative 'prediction' of outcomes. Perioperative risk in an elective patient can be further assessed by measurement of physiological reserve. Cardiopulmonary exercise testing can be used to identify comorbidities amenable to optimisation, inform shared decision making and direct patients to particular levels of postoperative care.[38]

In the emergency setting, the NELA risk model has been validated for patients undergoing an emergency laparotomy.[15,39,40] Like P-POSSUM, it requires some values to be estimated when it is used preoperatively. The correlation between the risks estimated by P-POSSUM and NELA is relatively modest but the NELA model more consistently predicts the actual risk of emergency laparotomy for high-risk patients, as one would expect-given that it was developed from the actual NELA patient cohort.[15] The model benefits therefore from being both modern and relevant to such a population.

Risk prediction models developed from large populations of patients take little or no account of the actual surgical diagnosis and may over- or underestimate the risk for an individual patient. On occasion, the estimate obtained using NELA or other models may differ significantly from an estimate of perioperative death made by experienced clinicians using their judgement alone. However, clinicians' judgement in emergency situations may be impaired by the limited time for preoperative assessment and reflection and the potential for information pertinent to risk assessment to go unnoticed. The American College of Surgeons National Surgical Quality Improvement Program risk prediction tool enables surgeons to use their judgement to adjust the default estimated risk by one or two standard deviations to reflect the fact that it does not adjust for all potential comorbidities and other variables.[35] Risk prediction accuracy appears to differ for emergency and elective patients.[41] Assessors should also consider that there are certain clinical situations, such as bowel infarction, where relatively normal physiology early in the disease process can lead to overly optimistic risk prediction scores. On the other hand, in some conditions, including upper GI perforation, patients may be extremely acutely unwell and have very high risk scores, yet timely surgery can be life-saving.

When applying clinical judgement to estimate 30-day mortality after emergency laparotomy it may be helpful to keep a series of baseline risks in mind. NELA analysis from 2015-16 shows that average mortality for emergency laparotomy is approximately 10%;[15] for all of the 10 most common procedures performed, in patients with an American Society of Anesthesiologists (ASA) score of ≥ 3 or who are over 50 years of age, it is at least 5%. Approximately 60% of patients undergoing emergency laparotomy in the UK have a P-POSSUM predicted mortality of ≥ 5%,[15] although it should be noted that current practice probably does not involve estimating risk by multiple means, including clinical judgement. These data complement previously published findings on those patient groups that have a predicted mortality ≥ 5% after major GI surgery.[3]

Frailty

The frail patient presents a particular challenge in high-risk surgery. Frailty is a term widely used to convey a patient's vulnerability. It is a complex concept, which has many definitions, including: 'a medical syndrome with multiple causes and contributors that is characterised by diminished strength, endurance and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death.[42] Although the frailty syndrome is not limited to the older population, it is positively associated with ageing. Much of the published research has been conducted in patients aged over 65 years, but the incidence of frailty is higher above the age of 70 years. This is particularly important given that the over 70s represent 60% of the elective colorectal surgical and 45% of the emergency laparotomy population.[15] Indeed, recent studies confirm that frailty is present in 25% of older adults presenting as a surgical emergency and is associated with poorer outcomes across elective and emergency surgery, including prolonged length of stay, increased level of dependency after surgery and increased morbidity and mortality, irrespective of whether surgery is performed.[43–46]

There are many frailty scoring systems available for screening and for diagnosis. One of the simplest is the seven-point Clinical Frailty Scale derived from the Canadian Study of Health and Ageing.[47] This scale estimates the degree of frailty through observation of the patient and their current medical records with patients classified as frail if they score five or above. It provides useful predictive information on the medium-term risk of death or admission to an institution.[48] It has been used widely in the emergency setting, although some patients who are not frail can appear to be so because of their acute illness. Another tool widely used in surgical settings is the Edmonton Frail Scale.[49] In the UK, the electronic Frailty Index[50] is being validated and is likely to become a routinely used screening tool, although experience of its use to date is predominantly in primary care.

Recognition of the association between frailty and adverse postoperative outcomes has led to the establishment of collaborative models of care to improve patient, clinician and process reported outcomes. Joint management between surgeons and care of the elderly physicians has become routine practice in hip fracture[51] and there is emerging evidence to support the involvement of services such as the Proactive Care of Older People undergoing Surgery (POPS) service in high-risk elective surgery.[52]

It should be noted that frailty does not feature in the commonly used risk prediction tools[32,35,39] and this is an area that is ripe for development. However, recognition of frailty already guides decision making in many high-risk elective general surgical practices, one example being of a frail patient with rectal cancer supported through shared decision making to choose between a restorative rectal resection, a rectal resection and stoma, endoluminal excision, non-operative treatment with radiotherapy or supportive care limited to symptom palliation.

In contrast, the awareness and understanding of frailty and its impact in emergency surgical patients is in evolution. The Emergency Laparotomy and Frailty UK study is likely to add to our understanding of how preoperative frailty assessment can be used as a prognostic tool for this group of patients.[53] Results are expected to be reported in late 2018. It should be noted that, while the risk of developing frailty increases with increasing age, it can be present in younger adults, making it a potentially useful tool for stratifying all emergency surgical patients.[54]

Action

Patients aged over 65 years and other patients who appear frail for their age admitted or transferred under the care (or joint care) of a general surgeon, whether for operative or non-operative management, should have their level of frailty assessed and recorded within four hours of admission or transfer, using a recognised assessment tool that is valid, reliable and easy to use, such as the Clinical Frailty Scale, Edmonton Frail Scale or electronic Frailty Index.

If frailty is present, the patient should be considered to be high-risk and this should trigger a more in-depth assessment and optimisation of modifiable factors. The frailty assessment should be used to inform shared decision making regarding surgical and non-surgical treatment options. This should involve a specialist in care of the elderly.

Perioperative neurocognitive disorders

Postoperative delirium and delayed postoperative neurocognitive recovery (now grouped together as perioperative neurocognitive disorders)[55] are among the most common complications following surgery in older people, with incidence increasing with age.[56] Postoperative delirium is the best defined and most studied of these disorders. It is often undiagnosed, however, especially if presenting as hypoactive delirium. The consequences of postoperative delirium are significant: a change in trajectory of underlying cognitive impairment, increased perioperative morbidity and mortality, longer length of stay and higher rates of institutionalisation. In specific surgical populations, for example in those presenting with hip fracture or undergoing cardiovascular surgery, the incidence can be as high as 50%.[56]

Simple preoperative cognitive screening can help identify patients at risk,[57] although it is not only patients with established cognitive impairment who are at risk of delirium. Predisposing factors also include uncontrolled pain, anxiety, depression, electrolyte disturbance and sub-optimally controlled thyroid disease. The AWOL tool is an example of a risk prediction tool which can be applied in emergency settings, taking less than two minutes to complete.[58] In a population of medical inpatients aged over 50 years, higher scores on admission were associated with higher rates of subsequent delirium, (2% in those scoring 0 points, 64% in those scoring 4 points). Another simple, quick to administer and widely used tool is the 4AT.[59] It is critical to identify patients at risk of delirium as there is clear evidence to support the use of interventions to reduce the incidence and severity of postoperative delirium. The literature is not yet as robust for other postoperative cognitive disorders, although this is the subject of continuing research.

Action

All patients aged over 65 years of age undergoing inpatient elective or emergency surgery should be screened preoperatively for the risk of perioperative neurocognitive disorders using a tool such as AWOL or AT.

Multimodal assessment of risk

When using numerous risk prediction tools, clinical judgement and an assessment of frailty, a worst-case scenario approach should be adopted, with a patient treated as high risk if the predicted hospital mortality is determined to be ≥ 5% by any method and at any time. Adopting this new approach will probably result in a greater proportion of patients being defined as high risk in the future. It might be argued that this approach gives the general surgical patient multiple opportunities to be assessed as high risk and thus to benefit from access to limited resources in preference to others. We contend that other groups with less dangerous conditions are already offered such care. The approach we advocate highlights the resources required to raise the care of the high-risk general surgical patient to an acceptable standard.

Failing to assess risk

Nearly one-third of patients having an emergency laparotomy in the UK do not have their risk documented preoperatively. The 30-day mortality for this undocumented group was found to be 7.1% in the 2017 NELA report.[15] Patients for whom risk was not determined were less likely to be assessed preoperatively by a consultant surgeon and were less likely to go to critical care postoperatively,[15] suggesting that the failure to assess risk results in some high-risk patients not receiving potentially protective interventions. Furthermore, a failure to assess risk may impair clinicians' ability to present information about risks, burdens and benefits of competing treatment options to patients and their supporters. In a 2017 audit of emergency laparotomy care in Western Australia, nearly one-third of patients were not risk-assessed prospectively and their mortality was both significantly higher than expected when risk-assessed retrospectively and significantly higher than in those patients where risk assessment was undertaken prospectively.[60] Accordingly, determining that a patient having an emergency laparotomy is not at high risk should be an active process, not an act of omission, and the evidence of that active process is its formal and contemporaneous documentation in the medical records. Use of a 'boarding card'[61] or other forcing function to drive compliance with risk assessment has been advocated.[15]

Reassessing risk

A patient's physiology is liable to change considerably over a short period of time before, during and after therapeutic interventions. For example, preoperative patients are vulnerable when awaiting control of a source of sepsis or haemorrhage. Intraoperatively, a clean operation can become contaminated, and in the early postoperative period respiratory function may be impaired by pain or reduced conscious level, or hypotension can prove to be more vasopressor dependent than previously anticipated. When a patient's clinical condition materially changes, other than in a palliative setting, their risk should be reassessed and appropriate adjustments should be made in the urgency and location of care delivered and in the seniority of staff involved. Warning signs include a deterioration manifest by a worsening in the early warning score, rising lactate, the development of suspected sepsis or a significant deviation from an expected perioperative course. Additionally, the predicted in-hospital mortality should be formally reassessed and documented as a matter of course as part of the end of surgery bundle.[1]

Assessing risk in patients whose disease is managed non-operatively

General surgical patients who will not (or may not) undergo surgery are a heterogeneous group that accounts for the majority of emergency general surgical admissions. This group includes patients with conditions that rarely require emergency surgery (e.g. pancreatitis), patients who may be treated surgically if non-operative treatment fails (e.g. adhesional small bowel obstruction) and patients whose comorbidities mean that non-operative treatment is undertaken for a condition that would otherwise often be treated surgically (e.g. spontaneous intraperitoneal GI perforation). In addition, there are also patients for whom surgery may be an appropriate option but they choose not to undergo it. Assessment of in-hospital mortality for this mixed group presents its own challenges.

The Charlson score can assist in predicting how comorbidities impact on 1- and 10-year survival rates.[62] However, it has been found to be a relatively poor predictor of hospital mortality in some critical care populations, for whom the Acute Physiology and Chronic Health Evaluation (APACHE II) calculator may be better.[63] Consideration of diagnostic groups and their average mortality may be a useful approach. Risk stratification scores are available for some specific general surgical conditions that are generally treated non-operatively (e.g. acute pancreatitis).[64] Those diagnoses associated with a 30-day in-hospital mortality of ≥ 5% in NHS emergency general surgery admissions have previously been identified.[19] In addition to diagnosis, increasing age, a Charlson score greater than 2 and social deprivation were associated with increased mortality. Most patients in these high-risk diagnostic groups do not undergo surgical treatment (Table 1).

Table 1: High-risk abdominal diagnostic categories

Condition	Type
Perforated gastrointestinal ulcer	Duodenal Gastrojejunal Other peptic
Hernia with obstruction or gangrene	Inguinal Femoral Ventral Diaphragmatic Other abdominal
Bowel obstruction	Adhesion Paralytic and other Ileus Intussusception Volvulus Gallstone ileus Other intestinal
Diverticular disease with perforation and abscess	Large intestine Small intestine
Peritonitis	
Haemoperitoneum	
Liver and biliary conditions	Infarction or central necrosis of liver Cholangitis Gallbladder obstruction or perforation
Miscellaneous	Acute dilatation of stomach Adult pyloric stenosis Duodenal obstruction Megacolon

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Actions

Patients admitted or transferred under the care (or joint care) of a general surgeon, whether for operative or non-operative management, should have their risk of morbidity and mortality assessed and recorded in the medical records by a senior surgeon (ST3 and above) within four hours of admission or transfer, using appropriate risk prediction tools, where available, and clinical judgement. Frailty, the likelihood of perioperative neurocognitive disorders and surgical diagnosis should be taken into account during this assessment, as these may not be adequately reflected in existing risk prediction tools. The risk should be reassessed and recorded again after operative interventions and after any material deterioration and any change should prompt an appropriate adjustment in patient care.

High-risk patients are defined by a predicted hospital mortality of ≥ 5%. Where any of the recognised appropriate risk prediction tools, frailty assessments or clinical judgement results in an assessment of predicted hospital mortality of ≥ 5%, the patient should be treated as being at high risk. In the absence of a recorded assessment of risk the patient should be treated as high risk.

Using risk assessment to aid shared decision making

In addition to directing appropriate resources to high-risk patients, estimation of risk is important in communication with patients and their supporters, helping them to make informed decisions about their care and preparing them for the possibility of adverse outcomes.[35] It is evident that some patients undergo major surgery in circumstances where it should be apparent that they are at very high risk of perioperative death, including the elderly with severe comorbidity, the frail and patients with severe life-limiting illnesses.[65] Forty percent of patients having an emergency laparotomy in the UK have a preoperative P-POSSUM predicted 30-day mortality greater than 10%; in approximately 20% the estimated risk is greater than 25%, and in approximately 10% it is greater than 50%.[15] Mortality within 90 days of emergency laparotomy is approximately 25% in the over 80s and over 60% for patients whose ASA score is 5.[15] When patients survive despite a very high preoperative predicted mortality, they often experience considerable morbidity and prolonged stays in critical care and in hospital. For some patients, surgery is predictably likely to be futile,[29,65] although it is important to recognise that a small group of patients can do very well despite very high predicted perioperative risk, for example in sepsis associated with GI perforation. It is not appropriate to withhold treatment (including surgery) based on a risk score alone.

Postoperative outcomes beyond 90 days with respect to mortality, morbidity and quality of life are poorly understood for this group. For some patients, quality of life may be more important than survival at all costs. Patient satisfaction with emergency abdominal surgery is associated with being given sufficient information about their treatment and explanation about the risks and benefits of surgery.[65,66] Challenges to communication for surgeons, patients and their supporters include uncertainty over the potential for a ‘quick operative fix’ for the acute condition in the context of chronic ill health, variable preparedness to discuss end of life issues and the time required for multidisciplinary discussions in an acute setting.[65] Successful communication can, however, radically alter the course of a patient’s final illness.

It is probable that particular groups of high-risk patients would benefit from greater shared decision making and more clarity over agreed ceilings of care. One-fifth of patients with disseminated cancer die after emergency abdominal surgery for bowel obstruction and one-third die following surgery for bowel perforation, with more survivors being discharged to institutions rather than to their home.[67] Emergency surgery and critical care admission can adversely impact on the qualities of life and of death in patients with advanced cancer.[66,68,69] Similar considerations apply for patients with life-limiting renal failure or dementia, those with 'do not attempt resuscitation' orders and nursing-home residents.[66] Hospice care can be associated with both longer survival and better quality of life than in-hospital care for some patients in these groups.[68,70] Patients may sometimes undergo emergency surgery without fully appreciating the postoperative interventions involved in striving for survival to hospital discharge.[71] Again, presenting options and aligning expectations openly, including postoperative ceilings of care for those who do choose to proceed with surgery is central to enabling patients to make well-informed decisions. Many patients with life-limiting diseases should consider in advance what they would want if they were to develop an acute surgical illness. When disease means that a patient is unfit for elective surgery, the opportunity exists to plan for the development of foreseeable complications of the same condition. Such approaches enable the patient, their supporters and key members of the multidisciplinary team to align their expectations and facilitate subsequent decision making in the event of a persisting or escalating dependency on critical care interventions. For example, requiring a breathing tube or feeding tube to live, being permanently incontinent or being constantly dependent on carers are each health states that many hospitalised patients may consider at least as undesirable as death.[72] Nevertheless, for some of these patients, carefully considered operative intervention remains an effective treatment, despite them having a notably high predicted in-hospital mortality.

Actions

The predicted mortality rate should be part of the global assessment of a patient and should help to inform the allocation of care resources. It should also be used to communicate reliably within the multidisciplinary team and in discussion with patients and their supporters.

When patients being considered for operative intervention have a predicted in-hospital mortality greater than 25% by any measure, including frailty, they should be assessed preoperatively in person by a consultant surgeon, consultant anaesthetist and critical care consultant to provide multidisciplinary advice to the patient about operative and non-operative treatment options and to discuss postoperative ceilings of care. This may require a wider discussion with other specialists, including specialists in care of the elderly.

Determining that a patient is at too high a risk to undergo lifesaving surgery should normally be a decision taken with multidisciplinary consultant involvement.

When high-risk patients are being considered for surgery in the setting of severe life-limiting disease or severely impaired quality of life, shared decision making should be supported by preoperative input from a multidisciplinary team that includes a consultant surgeon, consultant anaesthetist, critical care consultant and palliative care specialist, as well as disease-specific specialists or generalists (e.g. oncologists or geriatricians).

Interventions

Frailty

There is no single intervention for frailty, which is not surprising as it is a multidomain syndrome. Instead, comprehensive geriatric assessment (CGA)[73] is a methodology used by multidisciplinary teams led by geriatricians to ensure assessment and optimisation across medical, functional, social and psychological domains and to facilitate care plans to support the patient through pathways of care. In the elective setting, CGA has been used in complex older patients using the POPS model of care to improve perioperative outcomes,[74] as have prehabilitation strategies without formal CGA (lifestyle modification and exercise).[75] It is likely that the success of these initiatives lies in the multimodal collaborative approach leading to multiple small improvements in medical and functional status in combination with proactive postoperative medical management, rehabilitation and social care provision.[73,74,76] The integration of CGA methodology into service design is strongly supported by the *Silver Book* from the British Geriatrics Society.[77] The two-page summary provides a useful summary for all acute clinicians.

Although most clinical and research work examining the management of frailty using CGA has been performed in the elective setting and in hip fracture care, there are overlapping concepts that suggest transferability to the emergency general surgical setting. Some units have already adapted the elective POPS model to deliver CGA in the emergency general surgical population (e.g. Guy's and St Thomas', Salford, Derby and Darent Valley). These services use CGA to address medical issues and geriatric syndromes (frailty, cognitive and functional impairment) pre- and postoperatively and to direct rehabilitation and safe effective discharge. Such approaches have yet to be formally evaluated although local quality improvement data are promising.

Action

Comprehensive geriatric assessment methodology should be integrated early into surgical pathways of care for complex older patients and for frail patients, and should be used to direct medical management, rehabilitation and discharge planning.

Perioperative neurocognitive disorders

Preoperative assessment of cognition is critical in establishing a baseline against which to measure change. It also informs judgement of the capacity to consent, communication strategies to facilitate shared decision making and the assessment of risk of postoperative delirium.

In patients identified as being at risk of delirium, preventive strategies should be employed to reduce its incidence and severity. These preoperative interventions include correction of electrolytes, rationalisation of medication, management of pain and pre-emptive counselling and discussion regarding the risk of delirium with the patient and their carers. Intra- and postoperative management should also be modified to reduce the risk of delirium, including; consideration of anaesthesia technique and choice of anaesthetic drugs and dosing, avoidance of drugs associated with perioperative neurocognitive disorders, ensuring that patients are oriented as much as possible, for example by the early presence of family after surgery, and ensuring that glasses and hearing aids are used.

The hospital environment should be adapted with the presence of a clock, attention to day/night lighting and promotion of sleep. The Hospital Elder Life Program[56] has shown that it is possible to reduce the incidence of acute delirium in patients undergoing major abdominal surgery by as much as 40% if attention is paid to simple factors such as orienting communication, oral and nutritional assistance and early mobilisation.

In the postoperative period, patients at risk of delirium should be regularly screened for delirium using a tool such as the confusion assessment method.[78] Hypoactive delirium (with the patient appearing quiet and withdrawn) is significantly more common than the agitated confused type but is less well recognised and is associated with worse outcomes than hyperactive delirium. When delirium is identified, specific and correctable causes should be addressed and treated promptly. Common causes include newly initiated or withdrawn medication, electrolyte disturbance, thyroid dysfunction, alcohol withdrawal, poorly controlled pain, infection, intracranial disorders including stroke, urinary retention and constipation.[79,80] The American College of Surgeons has issued joint guidance with the American Society of Geriatrics on managing older patients undergoing surgery, which includes guidance on delirium prevention and management.[81] The Association of Anaesthetists of Great Britain and Ireland will shortly be publishing guidelines on managing dementia in the perioperative setting.

Action

Patients at risk of perioperative neurocognitive disorders, including delirium, should be informed of this risk and modifiable predisposing factors should be actively sought and addressed.

Patients should be regularly reviewed and assessed for the occurrence of delirium using a screening tool.

Patients with postoperative delirium should be reviewed by an appropriate clinician and should have treatable causes addressed to minimise the severity of the episode and reduce the risk of longer-term consequences.

Consultant-delivered care

Consultants bring competencies gained from training, qualification and experience, with the potential to improve the outcome in high-risk patients. High-risk patients provide a great opportunity to train juniors, but under direct consultant supervision. It is now rare for a high-risk elective general surgical patient not to have their operation performed by a consultant surgeon and anaesthetist, but the situation is more varied for high-risk emergency admissions. For patients having an emergency laparotomy with a predicted risk of in-hospital mortality greater than 10%, a consultant surgeon and consultant anaesthetist are present 83.8% of the time. For patients with a predicted risk of 5–10% presence of both consultants falls to 76.9% of cases.[15]

In addition to patient assessment, decision making and procedural skills, consultants are also often better placed than junior colleagues to prioritise the high-risk patient when there are competing demands and to overcome some of the hurdles in the provision of timely care. It is notable that the proportion of patients having their emergency laparotomy conducted by a consultant surgeon and a consultant anaesthetist increased in the four units participating in a study of a quality improvement care bundle that reduced risk-adjusted mortality by 38%.[10]

In broader UK practice for emergency laparotomies (some of which are not high-risk), both a consultant surgeon and consultant anaesthetist are present for 83% of operations performed during daytime hours on a weekday. However, for operations performed after midnight, where the predicted risk of death is more than twice as high as it is for daytime cases,[82] the proportion of cases with both a consultant surgeon and consultant anaesthetist falls to 56%.[15] This is despite the fact that patients arriving in theatre after midnight are 25% more likely to be admitted to critical care directly after surgery than patients whose surgery begins between 8 am and midnight. While the involvement of consultant surgeons is generally the same at weekends as it is on weekdays, daytime consultant anaesthesia presence is significantly lower at weekends than at corresponding times on weekdays.[15] In some units, both a consultant surgeon and consultant anaesthetist are present for all emergency laparotomies with a predicted mortality of ≥ 5%, but in others they are only present for half of such cases.[15]

The lower level of consultant involvement in emergency laparotomies outside of 'office hours' coincides with the times when the highest risk cases are undertaken. This variation in consultant involvement at different times of the week and from one unit to another cannot be justified on clinical grounds.

While consultant involvement in high-risk laparotomy procedures has increased over recent years, coinciding with the associated national audit, consultant involvement in non-laparotomy operations in high-risk general surgery patients is less consistent, although data are limited. As an example, patients presenting as an emergency with an obstructed femoral hernia have a mortality of 8%.[19] There is no reason why consultant presence for such high-risk cases should not be prioritised in exactly the same way as for laparotomies.

Consultant expertise is of potential value at all stages of high-risk surgery. In implementing the World Health Organization checklist for safer surgery,[83] there are advantages to having consultant presence during the team briefing stage, although for an unstable emergency patient those advantages need to be weighed against any deterioration that would be incurred by delaying the team briefing to await a consultant who is off-site and travelling to the hospital. However, it should be very rare for a consultant within 30 minutes travelling time not to be able to attend in time for the time out, another key moment for multidisciplinary communication.[84]

It is not unusual for a patient's clinical condition to change, often for the worse, towards the end of a high-risk operation. The physiological consequences of sepsis or blood loss can become more apparent in the latter stages of surgery. Not infrequently this warrants reconsideration, either of the intraoperative strategy or of the postoperative plans; for example, an anastomosis may be best avoided, the abdomen may need to be left open temporarily or extubation may be best deferred. Additionally, determining whether and how to apply goal-directed fluid therapy can be difficult in a deteriorating patient. Consultants working together will generally find it easier to recognise the need to change an earlier plan than more junior colleagues who have been left with instructions to 'finish off' a course of action prescribed by their senior colleagues. A direct handover at the end of surgery between consultant surgeon, consultant anaesthetist and critical care consultant is likely to be of benefit in aligning expectations about the postoperative course, promoting timely recognition of deterioration and aiding consistent communication with the patient and their supporters.

It is recognised that there are competing calls on consultants' time when on-call for emergencies. For example, most consultant surgeons will have experience of a patient arriving in theatre just as an unstable patient in the emergency department requires assessment and a planned ward round of existing emergency admissions is scheduled to start, or other similar conflicting responsibilities. Accordingly, eliminating the variation in consultant presence for high-risk operations at different times of the week, between different units and for non-laparotomy operations will in some cases require significant changes to the ways of working, either within hospitals or by hospitals working together. However, such change is now overdue.

Action

Surgery on high-risk patients should be conducted in the presence of a consultant surgeon and consultant anaesthetist, shown by their names being clearly recorded on the operation note. The consultants should be present for the time out, unless that would result in potentially unsafe delay, and they should be present for the sign out and end-of-operation decision making. The consultant surgeon and consultant anaesthetist should ensure an effective handover to the critical care consultant.

Goal-directed fluid therapy

The use of goal-directed fluid therapy is currently the subject of a major randomised controlled trial in emergency laparotomy patients (Fluid Optimisation in Emergency Laparotomy trial).[85] A Cochrane systematic review showed no benefit on mortality of increasing perioperative blood flow using fluids with or without inotropes/vasoactive drugs to explicit defined goals in adults.[86] In only two studies of emergency surgery included in the systematic analysis, with only 130 patients, no beneficial effect on mortality was seen. However, importantly, a reduction in complications and length of stay was observed. In the OPTIMISE study, a randomised trial of high-risk patients undergoing major GI surgery, the reduction seen in a composite outcome of complications and 30-day mortality with use of a cardiac output-guided hemodynamic therapy algorithm compared with usual care was not significant[87]. However, inclusion of these data in an updated meta-analysis indicated that the intervention was associated with a reduction in complication rates. Another study, the FEDORA trial, showed a reduction in complications and length of stay in low to moderate risk surgical patients.[88] Overall, the evidence for the use of goal-directed fluid therapy suggests no clear benefit on mortality but at least no harm. Further information is likely to be available in the next few years from both prospective trials[85] and quality improvement study outcome analysis.

Action

Other than within a trial, the use of goal-directed fluid therapy should be considered in high-risk surgical patients on a case-by-case basis until further evidence emerges.

Sepsis

Sepsis, a life-threatening organ dysfunction caused by a dysregulated host response to infection,[89] remains the principal cause of avoidable death and serious morbidity in general surgical patients. It is present in nearly 20% of emergency general surgical admissions.[90] The key steps to achieving satisfactory outcomes in general surgical patients with sepsis are timely recognition, antimicrobial therapy (as soon as possible and always within one hour) and source control, all delivered within the context of the other measures in the resuscitation bundle detailed in the Surviving Sepsis Campaign.[1,91] Measures that improve the management of sepsis are likely to make an appreciable difference to outcomes, particularly for high-risk patients, who tolerate deficiencies in this area particularly badly. However, despite the evidence that prompt recognition, early intervention and the use of sepsis care bundles results in a significant reduction in mortality, as well as long-term morbidity, compliance with sepsis guidelines has been demonstrably poor in emergency general surgical practice[90] and delays at all stages of recognition, antibiotic therapy and source control are common. The 2015 NCEPOD audit noted that there were potentially avoidable delays in administering intravenous antibiotics in 37% and achieving source control in 43% of relevant cases examined.[92]

Recognition

Terminology regarding sepsis has been updated by the Sepsis-3 consensus definitions of 2016.[89] Septic shock is a subtype of sepsis characterised by profound circulatory and metabolic abnormalities, typically with hypotension resistant to vasopressor treatment and a raised lactate level (>2 mmol/l) in the absence of hypovolaemia. It is associated with an inpatient mortality greater than 40%. The term 'severe sepsis' has now been replaced by 'sepsis', which explicitly describes sepsis in terms that include life-threatening organ dysfunction.[89] However, while organ dysfunction in a critical care setting, measured by Sequential (sepsis-related) Organ Failure Assessment (SOFA), may be of diagnostic and prognostic importance,[89] it is strongly recommended that the operational definition of sepsis set out by NHS England in its implementation guidance for adults,[93] which relies on NEWS, should be routinely used. An aggregate NEWS 2[94] score of 5 or more in a patient with known infection, signs or symptoms of infection or at high risk of infection (categories that account for almost all general surgical patients) is likely to be indicative of sepsis and should lead to immediate escalation of care, confirmatory investigation (where appropriate) and treatment.[93,94] Patients with a NEWS 2 score of less than 5 may also have or be at risk of sepsis and clinical judgement should be exercised to diagnose sepsis promptly in some patients with a single significantly abnormal (red flag) observation that scores 3 in the NEWS 2 score,[93] such as systolic blood pressure ≤ 90 mmHg.

While poor outcomes in adult patients with suspected infection are more likely if at least two of the quick Sepsis-related Organ Failure Assessment (qSOFA) criteria are met; namely a respiratory rate of 22 breaths/minute or greater, altered mentation or a systolic blood pressure of 100 mmHg or lower,[89] NEWS score, which shares some of the same variables, appears to significantly outperform qSOFA in predicting outcome[94,95] and has been specifically validated in surgical patients.[96] The use of the NEWS 2 score, rather than qSOFA, is therefore recommended.[94]

Action

All patients admitted or transferred under the care (or joint care) of a general surgeon should be screened and monitored for sepsis using the NEWS 2 score. For high-risk patients, the outcome of this screening should be documented, even if negative.

Delivery of the Sepsis 6 care bundle

The Sepsis 6 care bundle is recommended across the UK as best practice in identifying and treating sepsis. It has been shown to be associated with significant mortality reductions when applied within one hour.[97] Sepsis 6 is the care bundle used by 94% of units in the UK.[92] Delivering Sepsis 6 requires nothing more than timely (within one hour) maintenance of oxygen saturations of between 94% and 98%, by administration of oxygen as required, taking peripheral blood cultures, administration of intravenous antibiotics (see below) and intravenous fluids, and measurement of blood lactate and urine output. Despite this, the Sepsis 6 care bundle was not used in over 60% of patients even after recognition of sepsis in the 2015 NCEPOD study.[92]

Action

The Sepsis 6 care bundle should be implemented immediately (within one hour) in all patients with suspected sepsis. All patients with sepsis should be managed jointly with the support of the critical care team.

Antimicrobial therapy

Many studies have demonstrated an association between delayed administration of appropriate antimicrobials and adverse outcome in these patients,[98–103] with each hour of delay in starting antimicrobial treatment being significantly associated with in-hospital mortality.[104] Administration of antimicrobials within one hour has been shown to be independently associated with a lower risk of hospital death.[101] NHS England introduced a national Commissioning for Quality and Innovation (CQUIN) measure in 2015/16 to incentivise the administration of intravenous antibiotics within one hour in patients who screened positive for sepsis.[23]

Despite the widely-promoted Surviving Sepsis Campaign and the national CQUIN, there is evidence to suggest there is still more to be done in this area in UK practice. In patients undergoing surgery within 24 hours of hospital admission, having been scheduled to undergo emergency bowel surgery within six hours of a decision to operate for suspected peritonitis, less than 25% received their first dose of antibiotics within one hour of hospital admission, with a greater proportion waiting longer than six hours (median 3.5 hours) for antimicrobial treatment to be commenced.[15] This problem is not unique to UK practice; a qSOFA score ≥ 2 was associated with an almost fourfold increase in mortality in the Perth Emergency Laparotomy Audit but only one in six patients in that category received antibiotics within one hour.[60]

Action

Patients with sepsis should receive broad-spectrum antibiotics, preferably after collection of blood cultures, at the earliest opportunity and always within a maximum of one hour, in line with current Surviving Sepsis Campaign guidance. Subsequent antimicrobial chemotherapy should be modified, where appropriate, according to the results of blood cultures.

Source control

Current surviving sepsis guidelines recommend that 'a specific anatomical diagnosis of infection requiring emergent source control be identified or excluded as rapidly as possible in patients with sepsis and septic shock, and that any required source control intervention be implemented as soon as medically and logistically practical after the diagnosis is made' (best practice statement) and:

"Infectious foci suspected to cause septic shock should be controlled as soon as possible following successful initial resuscitation. A target of no more than 6–12 h after diagnosis appears to be sufficient for most cases. Observational studies generally show reduced survival beyond that point. The failure to show benefit with even earlier source control implementation may be a consequence of the limited number of patients in these studies. Therefore, any required source control intervention in sepsis and septic shock should ideally be implemented as soon as medically and logistically practical after the diagnosis is made."[91] It should be noted that the speed with which source control intervention is 'medically and logistically practical'[91] depends on how we design our systems. Examples of conditions requiring such source control pertinent to general surgical patients include intra-abdominal abscesses, GI perforation, ischaemic bowel or volvulus, cholangitis, cholecystitis, necrotising soft tissue infection, other deep space infection (e.g., empyema) and implanted device infections.[91]

In high-risk cases, delays in source control of more than six hours are significantly deleterious, especially in cases of septic shock, where the Royal College of Surgeons of England has previously recommended that source control should be 'immediate' and underway within three hours of the decision to operate.[1] Evidence for the adverse effects of delay in high-risk general surgical patients with sepsis comes from non-randomised studies,[105,106] many of which combine patients with septic shock and those without shock but with sepsis complicated by organ dysfunction (previously known as 'severe sepsis'). The requirements of the two groups may be subtly different.

A delay to source control of more than 12 hours in patients with septic shock has previously been associated with a mortality of 60%, compared with 25% when the source is controlled within 3 hours.[107] In adults with septic shock and GI perforation, a preoperative protocol that achieved initiation of surgery in 3.1 ± 1.5 hours from arrival in hospital resulted in survival rates of 82.5% and 77.9% at 28 and 60 days, respectively. The time to initiation of surgery was independently associated with 60-day survival, with an adjusted odds ratio (OR) of 0.29 per hour delay (95% confidence interval, CI, 0.16, 0.47); when surgery was initiated within two hours of admission 60-day survival was 98% but when it was delayed more than six hours survival was 0%.[108]

The timeliness of arrival in theatre for emergency laparotomies in NHS practice has been improving in recent years and now lies above 80%, yet patients listed for emergency laparotomy in the most urgent category are the least likely to arrive in theatre within the required timescale. There is some suggestion that this may partly reflect the time taken to investigate and prepare elderly patients with co-morbidities.[15] This is likely to impact particularly on patients with septic shock, who require the most expeditious interventions for source control. It is demonstrably challenging to initiate surgery within three hours in this group of patients, even in a motivated unit with a highly protocolised pathway. CT is a notable diagnostic, but non-therapeutic, part in the process. There may be some patients where the delay incurred by a preoperative diagnostic CT outweighs the benefits. This area warrants further specific research.

In some patients with sepsis, source control is achieved by means of interventional radiological and/or endoscopic means. Cholangitis is a high-risk diagnosis, with a mortality of approximately 8%,[19] and many patients benefit from timely non-operative source control.

In cholangitis-associated septic shock, delayed biliary decompression for more than 12 hours has been shown to be significantly associated with increased mortality (OR 3.40; 95% CI 1.12, 10.31) as has delayed appropriate anti-microbial therapy (OR 1.15 per hour; 95% CI 1.07, 1.25).[109] Few accurate data are available for the outcome of interventional radiology-led source control, but it seems likely that the target time scales pertaining to source control should logically be the same, irrespective of whether source control is undertaken by surgical, endoscopic or interventional radiological means.[110]

High-risk general surgery patients with sepsis are at greatest risk of organ function deterioration and subsequent septic shock. In a multicentre study of patients in intensive care with 'severe sepsis' or septic shock, where a median time to source control of three hours was achieved, patients receiving surgical or interventional radiological source control later than six hours after onset of organ dysfunction had a significantly higher 28-day mortality than patients with earlier source control.[103]

In a multicentre study of patients undergoing emergency laparotomy for perforated peptic ulcer disease, for each hour between admission and surgical source control the crude relative risk of death was 1.035 (95% CI 1.024, 1.047) and the adjusted relative risk 1.024 (95% CI 1.011, 1.037). This means that every hour of delay in initiating surgery was associated with an adjusted 2.4% decreased probability of survival compared with the previous hour.[111] The 30-day survival rate was 95.7% with surgery within one hour of hospital admission, 56% with surgery within six hours and 20% with surgery after more than 24 hours. The median delay before surgery was five hours.

Taking the next available place in the emergency theatre or otherwise undergoing surgery within six hours of the decision to operate was part of the care bundle that delivered a 38% reduction in risk-adjusted mortality in emergency laparotomies.[10] However, in a study of high-risk patients undergoing expedited laparotomy or laparoscopy for any cause, no statistically significant association between mortality and surgical delay was found, once adjusted for prognostic covariables,[112] despite crude 90-day survival falling by 2.2% with each hour of delay after admission. It appears that the imperative for time-critical abdominal surgery in high-risk patients relates particularly to the treatment of intra-abdominal sepsis. There may be some patients who require emergency abdominal surgery but who are not septic, where the timeline to theatre may also need to take account of any benefit from brief deferment to allow preoperative patient optimisation or imminent availability of other key personnel or equipment, while monitoring for any deterioration.

Actions

High-risk general surgical patients with septic shock should be managed in accordance with the Surviving Sepsis protocol and require immediate implementation of the Sepsis 6 care bundle, including administration of broad-spectrum antibiotics.

Control of the source of sepsis by surgery or other means should be immediate upon diagnosis and underway within a maximum of three hours.

Further study is warranted to determine whether there are identifiable groups of patients with septic shock for whom source control should proceed immediately upon clinical diagnosis, without prior radiological confirmation of cause.

High-risk general surgical patients with sepsis but without shock should be managed in accordance with the Surviving Sepsis protocol and require immediate implementation of the Sepsis 6 care bundle, including administration of broad-spectrum antibiotics.

Control of the source of sepsis by surgery or other means should be urgent once diagnosed and underway within a maximum of six hours.

Radiology

Diagnostic radiology

The vital part played by diagnostic radiology in the management of high-risk surgical patients cannot be overstated. Demand for diagnostic services is sometimes a major cause of delay that is associated with an increased incidence of death, critical care admissions, unplanned returns to theatre and postoperative complications in general surgical patients.[113] In UK practice, greater institutional use of CT is independently associated with reduced mortality in high-risk emergency general surgical patients.[19] It is therefore worrying that radiology continues to suffer in the UK from a workforce crisis. In the 2016 census by the Royal College of Radiologists it was noted that the 10% mean annual growth of CT was outstripping the increase in consultant radiology workforce of around 3% and the UK had the third lowest number of radiologists of 31 European countries for which 2015 data were available.[16] Unfortunately, there is little sign of the workforce crisis being resolved soon, the Royal College of Radiologists further noting, 'No end in sight for the UK's radiologist staffing crisis – patients will continue to suffer'.[16]

The lower standard of care afforded high-risk general surgery patients presenting as an emergency in comparison with elective patients scheduled for relatively lower risk major surgery is particularly stark for radiology. It would not be considered acceptable to decide to undertake an elective colectomy for cancer based on a provisional report from a radiologist in training or without joint preoperative review of the imaging by a consultant surgeon and consultant radiologist. However it is not unusual to undertake emergency surgery in high-risk patients in such suboptimal circumstances. In fact, even elective cancer care is adversely affected by the constraints of the radiology workforce, the Royal College of Radiologists observing, 'Patients with cancer in the UK continue to suffer worse outcomes than patients in other similar countries. Much of the difference is due to late diagnosis'.[114]

There is concern over both the availability and accuracy of reporting for emergency abdominal CT. Patients requiring an immediate laparotomy are less likely to have CT performed than patients needing the same procedure less urgently. When it is performed, they are less likely to have it reported by a consultant radiologist preoperatively.[15] Inaccuracy of emergency CT reporting in cases of non-traumatic abdominal pain can lead to a non-therapeutic laparotomy, depending on the anatomical site of pathology.[115]

Similar numbers of patients suffer major trauma or undergo emergency laparotomy for non-traumatic abdominal pain in the UK. Nearly 90% in both groups undergo emergency CT.[15,116] The radiology standards for severely injured patients require that consultant radiologists should provide the final report within one hour of CT image acquisition, supported by a further standard regarding the availability of teleradiology facilities to enable on-call radiologists to accurately report off site.[117]

In an attempt to meet the greatly increased demand on emergency radiology services, particularly CT reporting, many units now outsource provision to radiologists, generally consultants working off site with no affiliation to the admitting unit (reviewed in the Clinical Radiology UK workforce census 2016 report).[16] It should be noted that this practice is therefore different from 'in-house' trust consultants who report remotely when on call, typically from home. However, a 2017 audit raised concern over radiology outsourcing for patients in the UK with non-traumatic acute abdominal pain.[30]

The incidence of major discrepancies with operative findings in provisional CT reporting for on-site consultants, on-site senior registrars and off-site reporters was 3.1%, 4.6% and 8.7%, respectively, and for patients undergoing surgery the corresponding figures were 3.9% (on-site consultants), 6.3% (on-site senior registrars) and 12.7% (off-site reporters), the differences being statistically significant. The correlation of provisional reports with laparotomy findings was also significantly lower for off-site reporters than for on-site consultants or senior registrars. The standard applied for a major discrepancy for a trust consultant (or off-site reporter) was 5%.

The reasons for these disparities are not fully understood but may include better access to previous imaging for in-house reporting radiologists and differences in the quality of communication between the surgeon and the radiologist, preoperative discussion potentially being richer with trust reporters than when outsourced.[30] Indeed, even when radiology reports are correct, close collaboration between the reporting radiologist and the surgeon often influences subsequent patient management.[118] The importance of discussion of imaging at debriefing meetings and of errors of protocol or fact being discussed at discrepancy meetings has previously been highlighted in standards for trauma patients.[117] The shortcomings of radiology outsourcing for general surgical patients with acute non-traumatic abdominal pain are compounded by the limited opportunity it brings for feedback and shared learning.

The Royal College of Radiologists has previously noted that, 'NHS trusts are spending more and more on costly and inefficient outsourcing to try to plug the gap [i.e. in reporting resource]'.[16] It would be troubling if attempts to increase access, timeliness or preoperative consultant reporting of abdominal CT for emergency general surgical patients resulted in a further increase in outsourcing, given the associated higher discrepancy rates, lower correlation with operative findings and constrained potential for quality improvement work. Where it remains impossible to report emergency abdominal CT on-site, 'outsourcing' within local networks of neighbouring units may mitigate some of the disadvantages of more remote reporting and in any event preoperative discussion between surgeon and radiologist before and after the scan is likely to be of benefit, even if only by telephone.

Actions

When general surgery patients being considered for major surgery undergo emergency abdominal computed tomography (CT) for non-traumatic abdominal pain there should be a senior radiologist's (ST3 and above) report available within one hour.

All emergency abdominal CT imaging should be discussed at debriefing meetings and errors of protocol or fact discussed at radiology and surgery discrepancy meetings. A significant discrepancy is an error of fact in the radiology report, which leads to incorrect management or patient harm and is determined by multidisciplinary review of the imaging report, imaging findings and operative findings.

The incidence of significant discrepancies should be less than 5%.

For high-risk general surgery patients being considered for major surgery, there should be joint preoperative discussion between senior surgeon and senior radiologist (ST3 and above), either in person or by telephone, followed by postoperative comparison of imaging and operative findings. Best care includes preoperative discussion between a consultant surgeon and an in-house consultant radiologist.

Units should formally assess, at least annually, the timeliness and incidence of discrepancies in emergency abdominal CT and work with those who commission care to reduce the risk posed to high-risk general surgery patients by any shortfall in radiology provision.

Interventional radiology

Control of the source of sepsis in general surgical patients is often achieved non-surgically, mainly by radiologically guided and/or endoscopic means and delays are associated with increased mortality.[109] Nationwide data from the United States show that the number of percutaneous drainage procedures for abdominal abscesses more than doubled between 2001 and 2013, while the laparotomy rate fell by 21% during the same time interval,[119] underlining the increasing importance of interventional radiology techniques for sepsis source control. The Royal College of Radiologists' 2017 standards for interventional radiology identify the management of sepsis secondary to biliary obstruction or intraabdominal abscesses as situations where urgent or emergency interventional radiology is indicated, as were conditions involving haemorrhage, ischaemia or colonic obstruction.[120]

Only 33% of NHS hospitals provide 24-hour access to on-site interventional radiology; in smaller hospitals provision is 9%.[15] NELA 2017 observed:

"The lack of a comprehensive interventional radiology service remains a real threat to patient safety. Interventional radiology is the treatment of choice for certain types of abdominal bleeding and for drainage of some abdominal collections in patients with sepsis, coming ahead of laparotomy in modern treatment algorithms for certain conditions. An interventional radiology service should be available 24/7 on site or by network but matters have improved too slowly and the authors remain aware of occasional but continuing major adverse outcomes as a consequence."[15]

The Royal College of Radiologists observed, 'all patients, regardless of geography or hospital size, should have timely access to interventional radiology. Several surveys have shown that this is not currently the case' and, 'due to insufficient resource out-of-hours service provision remains patchy. This situation puts patients at risk'.[120]

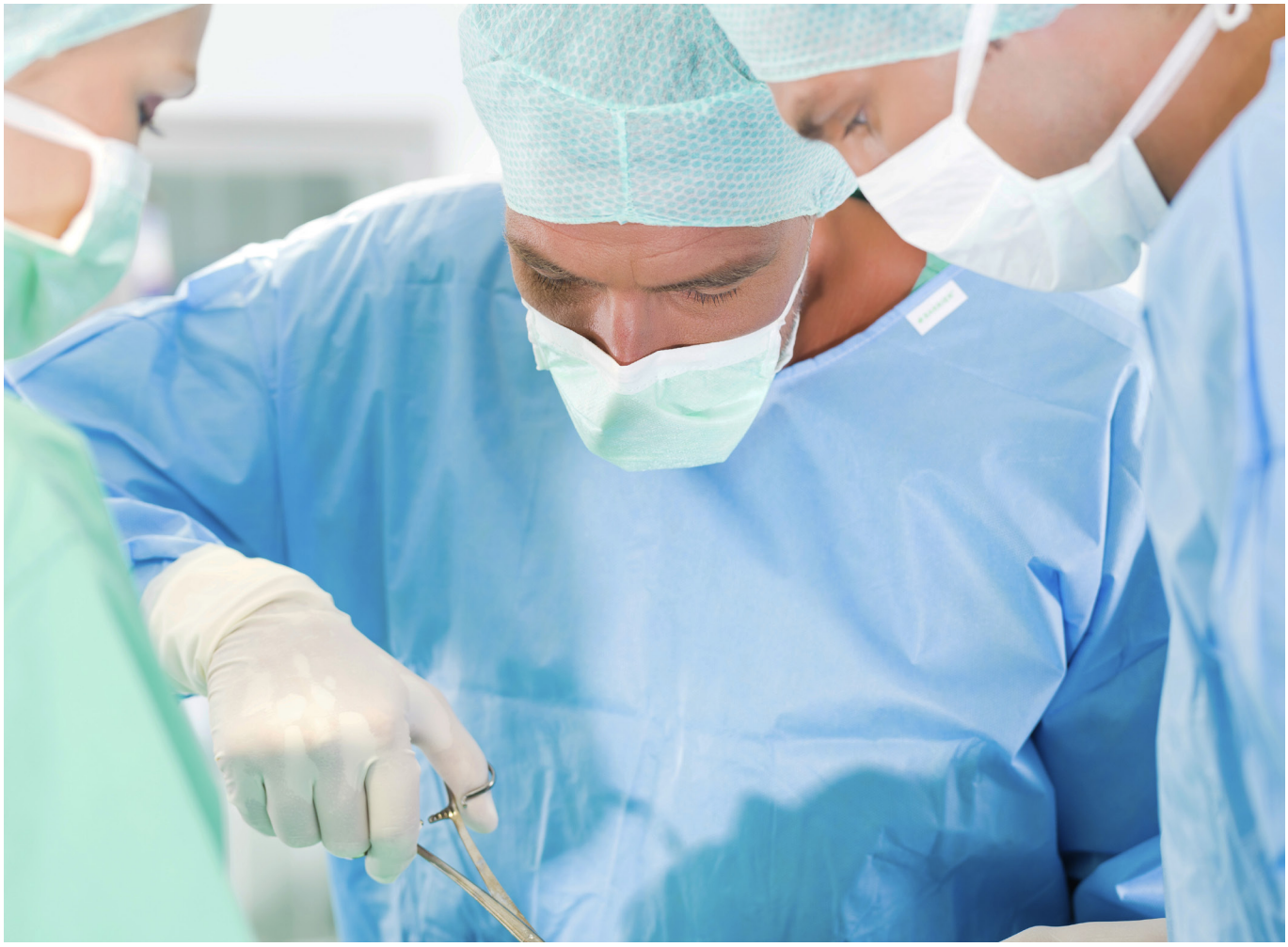
The most recent Surviving Sepsis Campaign guidelines stated, 'the selection of optimal source control methods must weigh the benefits and risks of the specific intervention, risks of transfer for the procedure, potential delays associated with a specific procedure, and the probability of the procedure's success'.[91] And, 'In general, the least invasive effective option for source control should be pursued. Open surgical intervention should be considered when other interventional approaches are inadequate or cannot be provided in a timely fashion'.

All too often, responsible clinicians face the dilemma of choosing between very high risk operative source control that can be made available in the near future or waiting for interventional radiology-guided source control that is less invasive but will only be available after a period of delay and an associated further deterioration by the patient. The dilemma is often compounded by less-than-certain arrangements for interventional radiology, either on site or across a network. Service provision is sometimes informal and is not always supported by a written commitment such as a duty rota, meaning that responsible clinicians are sometimes not sure whether interventional radiology will actually become available within a finite period of time, even if surgical source control is actively deferred to await it. Moving patients for interventional radiology within a network is made more challenging in the absence of a robust standard operating policy covering interfacility transfer and the assistance of coordinators.

Action

Image-guided drainage by radiology should be available in all centres admitting elective and emergency general surgical patients, with procedures performed by suitably experienced radiologists or dedicated interventional radiologists. Comprehensive interventional radiology services are required for more complex procedures; ideally on site or through a defined and effective network arrangement.

The choice between operative and radiologically guided intervention for source control, in patients with sepsis, should be an active process which weighs respective risks and benefits and is informed by robust information about availability of those options. The outcome of clinical discussions about potential radiologically guided interventions should be recorded contemporaneously in the patient's record.



Critical Care

Until the 2000s, access to critical care was denied to the large majority of high-risk general surgery patients. Most patients who died did so outside of critical care. Mortality was significantly higher when high-risk surgical patients were admitted to critical care after deterioration on a ward rather than directly from the operating theatre.[121] This observation informed the recommendation in the previous document that all high-risk general surgical patients should be considered for critical care and, as a minimum, patients with an estimated risk of death of ≥ 10% should be admitted to a critical care location.[1]

There is evidence of a persistent difference in approach to allocation of critical care beds for elective and emergency surgical patients. Across Europe, most admissions to critical care after elective non-cardiac surgery are planned or direct, while most admissions after emergency surgery are unplanned or indirect.[122] Meanwhile, in the UK, it is notable that some units routinely aim to admit patients directly to critical care after major elective surgery with considerably lower predicted mortalities than 10%. For example, some advocate that the threshold for planned high-dependency care after elective colorectal surgery should be a predicted mortality in excess of 1% in the first postoperative month. This approach has been shown to lower rates of reoperation and unplanned admissions to critical care and to reduce costs.[123]

From epidemiological studies, it remains unclear which surgical patients benefit from critical care and by how much. In a US study of over 129,000 patients undergoing one of five surgical procedures (including two GI procedures) admission to intensive care varied between institutions from less than 5% to 100% of patients for each procedure, with no association between hospital use of intensive care and mortality for any of them.[124] However, caution may be needed in extrapolating from studies in different health systems. A multinational study of outcomes of 69,000 emergency general surgery patients showed better outcomes when intensive care bed ratios were higher.[125] In the UK, NHS hospitals with relatively larger numbers of critical care beds are associated with lower 30-day mortality rates for all emergency general surgery patients[126] and for high-risk emergency general surgery patients, whether operated on or not,[19] and critical care bed use has been associated with significant reduction in regional-level acute hospital postoperative mortality.[127] Furthermore, direct critical care admission has been associated not only with shorter critical care lengths of stay and lower early mortality in high-risk surgical patients but also lower mortality years later, when compared with indirect critical care admission.[128] A policy of direct postoperative admission to critical care was a key component of a perioperative pathway shown to reduce postoperative mortality substantially after emergency laparotomy, with a statistically significant increase in critical care admission demonstrated in participating units.[10]

Currently nearly 90% of actively-treated patients with a P-POSSUM predicted 30-day mortality greater than 10% are admitted directly to critical care following emergency laparotomy; the corresponding figure being nearly 80% in those with a predicted 30-day mortality of ≥ 5%.[15] Although the rates of direct postoperative critical care admission after emergency laparotomy are rising each year, currently more than a third in the 5–10% risk category do not follow that pathway.[15] The length of stay in critical care is lower for patients with an end-of-laparotomy P-POSSUM predicted mortality of less than 10% than those admitted directly from theatre with a higher risk, the median being three and four days, respectively.[15]

Fifty per cent of patients undergoing emergency laparotomy undergo surgery at least six hours after being booked for theatre. These patients are significantly less likely to be admitted directly to critical care postoperatively than patients undergoing more urgent laparotomy (51% and 74%, respectively).[15] This means that, for many patients currently not admitted directly to critical care after an emergency laparotomy, there is some time available to plan for such admissions.

Their lengths of stay in critical care might be expected to be relatively short, so there may be a logistical benefit from planning for a postoperative critical care bed when booking such cases for theatre rather than being in a situation some hours later of having to 'create' one at short notice at the end of surgery. Premature discharge of patients from critical care, typically to free a bed for a new admission, brings its own dangers, with high-risk general surgical patients readmitted to critical care after initial step-down having a particularly high mortality.[121] Furthermore, discharging patients from critical care at night is often upsetting. Choosing between the competing calls on a critical care bed by patients who may each benefit is an everyday problem in NHS practice, albeit one that many patients may wish to be more aware of.

Although rates of direct admission to critical care after emergency laparotomy have increased in recent years, this may not be the case for high-risk emergency general surgery patients undergoing operations other than laparotomies. However, there is no logic in adopting a lower standard for such cases.

It is acknowledged that lowering the mortality risk that justifies routine admission to critical care following general surgery to 5% will increase the number of patients admitted, as will adopting a policy of accepting the worst predicted risk when calculated by more than one means, including clinical judgement. However, some operative patients, predominantly after emergency surgery, are currently clearly being disadvantaged in comparison to elective patients undergoing lower risk surgery. That is not clinically justifiable. While this new standard may be implemented within ways of working in many existing units, it may be that a network solution that involves patient transfer for high-risk surgery and critical care is more appropriate for patients in some localities.

It is not fully known what aspects of critical care bring clinical benefit to this group of patients. It probably includes treatment of organ failure and dysfunction. Substantial benefit may come simply from invasive monitoring and the ability to treat hypotension with means additional to a fluid challenge. Benefit is also likely to be derived from better staffing ratios, junior and senior, across multiple disciplines (medical and non-medical) than those seen on general wards, enabling relatively simple interventions to be delivered in a timely and reliable manner. Timely recognition and effective management are considered important in lowering rates of 'failure to rescue' the deteriorating patient after GI surgery[129] and that may be facilitated in a critical care environment.[130]

In part mitigation of the scarce critical care bed availability, some units have developed in-house solutions for high-risk postoperative patients such as post-anaesthesia care units and enhanced care ward areas that would not be recognised as critical care (level 2 or 3) but which allow for a higher level of monitoring and better staffing ratios (typically one nurse to three patients) than are available on standard wards (level 0 or 1). The capabilities of what have been coined 'level 1.5' areas vary; most (but not all) can provide continuous monitoring (including invasive monitoring) and epidural care and a minority can administer vasoactive infusions and provide non-invasive ventilation for respiratory support.[15,128,131] However, given the variation in availability of enhanced care areas and in what they can provide it is difficult to make robust recommendations for when they should be used.

Action

Patients should have their risk of in-hospital mortality reassessed and documented at the end of surgery, using available risk prediction tools and clinical judgement. Patients with an end-of-operation predicted hospital mortality of ≥ 5%, by any measure, should be transferred from theatre directly to critical care.

There is concern that patients transferred from theatre directly to a general ward bed (level 0 or 1) following an emergency laparotomy may not reliably receive the monitoring and resulting interventions they require. As a minimum, this group requires an enhanced level of early postoperative monitoring, in an area where high-flow humidified oxygen, blood products, analgesia and other essential perioperative medications can be administered as needed and where deterioration can be detected and responded to in a timely manner. A decision not to admit a patient with an end-of-emergency laparotomy predicted hospital mortality of less than 5% to critical care (i.e. level 2 or 3) should be an active process taken by the operating surgeon and anaesthetist, once they have satisfied themselves that arrangements are in place to detect and respond promptly to postoperative deterioration, and that decision should be documented. Particular vigilance is required to avoid the error of persisting with an earlier plan that the patient will not require critical care when the intraoperative or early postoperative course is such that it means the risk has changed and the decision should be reconsidered.

Action

Where the operating surgeon and anaesthetist cannot satisfy themselves at the end of an emergency laparotomy that adequate arrangements are in place, including enhanced monitoring, to detect and respond promptly to postoperative deterioration, the patient should be admitted to critical care following discussion with the critical care consultant.

High-risk general surgical patients admitted as an emergency and not undergoing operative intervention are greater in number than those who do have surgery[19,132] and they, too, may benefit from critical care admission. However, this group of patients has wide-ranging needs. In some cases surgery may become indicated, if non-operative treatment fails, if coexisting acute illnesses can be treated or if chronic diseases can be optimised. For some, definitive treatment includes interventional radiology procedures, for example for biliary disease. Other patients have treatment that is completely medical or non-procedural, sometimes being entirely or largely palliative in nature. In each of these groups of patients, consideration should be given to their premorbid health, frailty and quality of life, as well as their acute diagnosis, treatment plan and prognosis. The patient's wishes regarding treatment options, including any ceilings of care, should be carefully established and used to inform shared decision making.[65,66,71]

Considering whether or not admission to critical care will benefit a high-risk patient under the care of a general surgeon for non-operative treatment should be an active decision that takes into account all these factors, as well as the facilities available outside critical care, whether on a standard ward or a ward where enhanced levels of monitoring can be delivered.

Action

All high-risk non-operative patients admitted or transferred under the care (or joint care) of a general surgeon should be considered for admission to critical care and the decision and rationale recorded in the medical records by a senior doctor (ST3 and above) within four hours of admission or transfer. Consideration should be given to advance care planning and ceilings of care.

Departmental Resources

Trusts should make the safety of their patients their first priority.[12,13] That attention to safety is especially important for patients who present as emergencies and are (or become) high risk and for whom there is often little margin for error in care. Poor resourcing of the emergency take is a source of much avoidable harm for general surgery patients. In 2016–17, emergency general surgical care involved more than 650,000 hospital admissions in England alone.[133] These patients present with a group of markedly heterogeneous conditions. Approximately 5% will require an emergency laparotomy[15] but most will not have an operation during their hospital episode.[134] The overall 30-day mortality for emergency general surgical admissions is around 3% but for those undergoing surgery the figure rises to approximately 5%.[134] When it is considered that these mortality figures include a substantial number of relatively young, low-risk patients with self-limiting conditions or requiring relatively minor surgery, it becomes clear that there is also a large group of emergency general surgery admissions whose risk of in-hospital death far exceeds 5%.[19,132] Many of these are elderly and/or frail patients, in whom the interplay between acute surgical pathology and chronic disease is complex. Mortality among emergency general surgical admissions rises sharply with advancing age, from 1.5% in the under 70s to 12% in the over 80s.[135] This group of patients is increasing in size as the population ages. Effective management requires a significant investment in multidisciplinary assessment and treatment that may require specialist geriatrician involvement.[135]

There have, however, been recent expressions of concern from surgical royal colleges and from surgical and medical associations regarding the risks posed by resource shortfalls, to patients and also to healthcare professionals.[136,137] That there is felt to be a need for statements such as these is indicative of a widely held view that there is currently a significant gap between the resources made available and those actually needed for the safe care of patients, particularly those who are acutely ill. There is now an immediate need for commissioners, hospital managers and clinicians to work together in reviewing the resources required to care reliably for this group of patients and to address any shortfall. Without this, continuing avoidable patient harm is inevitable.

Systematic differences are often apparent in the allocation of staff (clinical and non-clinical) deployed for high-risk emergency patients and others, particularly elective patients. This can impact directly on the reliability and safety of emergency care. Elective activities, such as operating and endoscopy lists and outpatient clinics generally have some rudimentary cap on workload that is matched to the workforce available, because of a scheduled list finish time or a specified number of patient slots allocated (at least before any overbooking). In addition, guidance already exists on how many new outpatient appointments a population may need and how to calculate the number of elective operating theatres and lists units should require.[138]

The situation is very different for on-call emergency general surgical activity (that is often combined with a responsibility on the same staff to care for existing inpatients ‘out of hours’). Some groups of medical staff are protected by some workload capping; for example, the activity of a ward being broadly limited by its bed numbers. Other groups, including the general surgeons themselves, have little or no defined upper limit on their workload. The number and case mix of general surgical patients admitted as an emergency varies widely within and between units but can be up to 50 patients in a 24-hour period.[138]

The emergency department is almost never closed to general surgical admissions and if it does close, patients are simply directed to neighbouring units that are generally under similar pressures. Existing guidance makes clear the timelines within which emergency general surgical admissions should be assessed by juniors and by consultants[7] and how quickly definitive treatments should be initiated.[1,7,91] Further guidance also indicates that existing inpatients should be reviewed by a consultant at least once a day, seven days a week, unless that would be superfluous to patient care.[139] However, the staffing required to deliver such standards reliably is frequently not deployed. As a consequence, for both emergency admissions and existing inpatients those reviews are often delayed, overly brief or unstructured and sometimes they do not occur at all. Definitive interventions are similarly delayed, for want of sufficient time on behalf of a dangerously overstretched on-call workforce.

Feedback from colleagues describes difficulties including the non-availability of other members of the multidisciplinary team on ward rounds, high numbers of outliers in geographically remote parts of the hospital, a lack of information technology facilities and an inadequate environment for comprehensive handover, despite existing guidance to the contrary.[140] A practice of preferentially directing temporary staff to the on-call service, so that permanent staff can concentrate on elective activity, only makes matters worse, putting doctors with little or no experience of local policies, procedures or culture in a position where they are responsible for the most vulnerable group of general surgical patients, sometimes with inadequate support and supervision. Consultant staff ‘dipping out of on-call’ for a period of time to undertake an elective activity can be similarly problematic.

Although this problem is familiar to many, there is little evidence that units routinely conduct an objective calculation of the medical staffing required to provide reliable care of emergency general surgery admissions and existing inpatients when host teams are off duty. All too often the time apportioned to patient assessment and continuing care is dictated by staffing availability and historical ways of working, rather than by the patient cohort’s clinical need.

For comparison, it is worth considering that many units now track patient acuity and use real-time analytics to inform deployment of nursing staff. Existing guidance on safe nursing levels recommend that to determine nursing staff requirements, the following are taken into account.[141]

- Each patient’s holistic needs, taking into account their acuity, dependency, specific nursing requirements and other patient factors that may increase nursing staff requirements, such as difficulties with cognition or confusion, end of life care, increased risk of clinical deterioration.
- Ward factors, taking into account patient turnover including planned and unscheduled admissions, discharges and transfers, ward layout and size and the distance needed to travel to access resources.
- Nursing staff factors, activities and responsibilities in addition to direct patient care including communicating with relatives and carers, managing the team and providing professional supervision and mentoring to juniors and support workers, conducting audit, appraisals and performance reviews.
- The support available from non-nursing colleagues, such as doctors, allied health professionals and administrative staff.

It is readily apparent that a similar approach could be adopted to objectively assess the safe staffing levels required for general surgeons and other groups involved in the provision of emergency general surgical services. It would be possible, for example, to assess the number and acuity of such patients and take account of how many are high-risk, have a perioperative neurocognitive disorder, are on end of life care or require more frequent review because of a risk of deterioration. Adjustment could be made for patient turnover and for the inherent inefficiencies of patients distributed over distant wards. Case mix will influence the number and complexity of multidisciplinary discussions and meetings required with patients' supporters. Responsibilities for teaching, training and audit could be factored in. Allowance could be made where a service is dependent on temporary staff, requiring additional support. When a service depends on daytime reviews of radiology reported overnight through an outsourcing service that too could be captured. Services with limited or delayed access to interventional radiology will require more frequent clinical review to mitigate some of the risk to patients waiting for delayed intervention. Administrative time coordinating prompt investigations, operations and interfacility transfers is also measurable. Time spent on operative procedures should of course be part of such an analysis. This list is by no means exhaustive.

In our experience such a formal assessment of the workload of the on-call service rarely happens at present, but it is long overdue.

The provision of resources must be appropriately reactive to an acute increase in demand, whether from a single patient with complex needs or from a collective case mix that would otherwise overwhelm the on-call team's capacity; in effect a departmental 'major incident'. When it falls to the on-call consultant to arrange additional ad hoc support at short notice, because a surge in demands on the service exceeds existing capacity, the danger is that the consultant is diverted away from delivering the care that patients require, in order to explore unrehearsed options for back-up. The same applies when interrupting elective diagnostic or operating lists to ensure timely emergency care. Often the consultant tries to 'cope', which in practice means patient care becoming suboptimal and sometimes worse. A fit-for-purpose system would instead track, detect and respond proactively to an increased need for personnel, diagnostics, theatre or critical care.

There is much variation in the approach used to manage the emergency take from one unit to another. Some use 'front-door' consultant surgeons who assess patients within minutes of their arrival at hospital; others favour the more traditional model whereby patients are initially assessed by junior surgeons and later reviewed by a consultant, at a time partly determined by their clinical urgency and partly by the scheduling of planned ward rounds. Some units co-locate emergency general surgical admissions, while others admit them to a variety of wards. Many units, but not all, operate a 'surgeon of the week' model of care but there is much variation around the duty periods, approach to handover and degree of subspecialisation.[142]

Given the extent of variation, both in ways of working and in patient numbers and case mix, our recommendations here are relatively general. As a guide, at least 20 minutes is required for a consultant to reliably assess an average complexity emergency general surgical patient, assuming the ready availability of the patient, nursing and other multidisciplinary assessments, baseline test results, observation and medication charts, and a team to assist with making records and arranging tests and so on. Delays in the availability of any of these and a need to commute around the hospital to see patients will inevitably add to the time needed for assessment, if reliability and safety are not to be inevitably compromised. Furthermore, patients with more complex needs will require longer.

Handovers of general surgical patients from outgoing to incoming teams are both inevitable and indeed desirable. However, they can add risk if conducted with inadequate time and documentation for effective communication. At least five minutes are required for an outgoing consultant-led team to reliably inform an incoming consultant-led team about an average complexity general surgical patient being handed over, assuming the ready availability of support documentation and handover facilities. At least 20 minutes are then required for the incoming consultant to reliably assess an average-complexity patient new to them. A face-to-face handover at the bedside of high-risk patients is likely to align the understanding of incoming and outgoing consultant-led teams about a patient's current condition.

Action

Units should review the number and complexity of both high-risk general surgical patients and general surgical patients overall. Taking note of the detailed guidance given here and elsewhere, they should formally consider, at least annually, the staffing and facilities required for patient initial and follow up assessments, operative interventions, handovers and all other aspects of safe multidisciplinary general surgical care and ensure that the resources made available are adequate to reliably deliver that care. They should also formally consider, at least annually, the diagnostic, theatre and critical care capacity required and the managerial and administrative support needed.

Units should put in place systems to track, detect and respond to an acute increased risk of harm to general surgical patients caused by an individual or collective patient demand on staff, equipment or estate that exceeds the capacity for safe care. This should include encouraging and empowering staff to raise concerns when they believe emergency general surgical patients are endangered and should specify how and when escalation will trigger deployment of more staff and prioritised access to hospital facilities, including diagnostics, theatre and critical care. It should be supported by a standard operating policy.

Royal colleges and specialty associations should develop detailed guidance on the resources needed for safe general surgical care.

For high-risk general surgical patients, handover should be conducted by incoming and outgoing consultants in person in the presence of the patient.

Quality Assurance and Improvement

There are opportunities in most units to use the wealth of data now available to improve both quality assurance and active quality improvement for these patients. The act of measuring data is known to improve outcomes in healthcare.[143,144] Published audits have shown year-on year reductions in mortality after both elective and emergency major general surgery.[2,15] Areas of care requiring focus for better performance are identified and outlying results can be investigated, understood and addressed. Yet there remains much to be done to link such data to understand what the safest and most effective processes are for NHS surgical patients, based on diagnosis, not just on operative procedures.[14]

Units now undertake structured judgement reviews as a part of the National Mortality Case Record Review Programme[145] and guidance already exists on how to run morbidity and mortality meetings.[146] Most deaths in general surgical patients will be within the high-risk population and there is likely to be much to learn from reviewing the care of general surgery patients who die, whether operated on or not. Decisions not to operate on high-risk patients, for conditions that are frequently treated surgically, are also worthy of multidisciplinary review, irrespective of outcome. Learning should not be confined to those cases that result in in-hospital death, with much to learn from how care could have been delivered better for high-risk patients who did not die or suffer major complications.[14]

Given the multidisciplinary nature of modern care for high-risk general surgery patients, reflection and learning should also be an experience shared by the specialties involved in these patients' care. The propensity for outsourcing of emergency radiology means that there is a particular need to incorporate the radiology team in such work. Given the readily available data, early focus is warranted on contemporaneous multidisciplinary review of performance against the metrics collected for NELA. However, there is also much to learn from high-risk patients who do not undergo surgery or have interventions other than a laparotomy.

High-risk emergency care bundles

Focus should not be confined to quality assurance. There is great potential for teams to improve the experience and outcomes of these patients. Standardised bundles of key interventions are an effective way of improving healthcare outcomes,[147,148] and have been successfully used to reduce morbidity[149] and mortality[150] in general surgical patients. Well-run quality improvement programmes designed to embed high impact interventions have demonstrated substantial improvement in outcomes after emergency laparotomy in the UK. In ELPQuIC, use of a pathway quality improvement care bundle by four units resulted in a 38% decrease in adjusted risk of in-hospital mortality after emergency laparotomy.[10] The bundle incorporated key Royal College of Surgeons of England and Department of Health recommendations:[1,7] use of early warning scores and an escalation policy to promote prompt patient recognition; broad-spectrum antibiotics for all patients suspected of peritoneal soiling or sepsis; a laparotomy within a maximum of six hours from a decision to operate; resuscitation using goal-directed techniques started as soon as possible; and admission of all patients to the intensive care after emergency laparotomy. Consultant surgeon and anaesthetist presence also rose during the programme. Notably, introducing a quality improvement care bundle was not associated with increased hospital costs per patient or per survivor.[151]

Forming a collaborative network specifically targeting improvement in care for readily identifiable high-risk groups can be very effective, with colleagues presenting data and learning with and from each other. The Emergency Laparotomy Collaborative aimed to scale up implementation of the ELPQuIC care bundle for patients undergoing emergency laparotomy across 24 NHS trusts and described an 11% reduction in mortality.[152] There were several large and local quality improvement events.

Similar findings have been reported elsewhere. Introduction of a care bundle in Denmark that included continuous staff education, consultant-led care, early resuscitation and high-dose antibiotics, surgery within six hours, perioperative goal-directed fluid therapy, enhanced postoperative care, standardised analgesia, early postoperative ambulation and enteral nutrition was associated with reductions in unadjusted mortality of 29% at 30 days and 25% at 180 days in patients undergoing acute high-risk major abdominal surgery.[153]

However, while quality improvement initiatives are demonstrably effective in both implementing bundles of interventions and improving outcomes in cohorts of patients undergoing high-risk abdominal surgery, the effectiveness of a national quality improvement programme in improving mortality for these patients cannot be assumed, given the heterogeneity in local conditions within the NHS and in the context of limited time and resource for quality improvement activities. The results of the Enhanced Perioperative Care for High-risk Patients (EPOCH) trial, expected to be published soon, may inform future population-level quality improvement work.[154]

Examples of high-risk emergency care bundles for immediate operation, non-immediate operation and non-operative care are included in the appendix. The evidence for both the key components of high-risk general surgical care bundles and the role of quality improvement in embedding practice are now sufficiently robust that recommendations can be made that bring both together.

Actions

Adult patients admitted or transferred under the care (or joint care) of a general surgeon, whether for operative or non-operative management, should be managed in accordance with a unit protocol led by general surgery and agreed by emergency medicine, acute medicine, radiology, anaesthesia, critical care and, for patients aged over 65 years, care of the elderly. This protocol should include the following key components: administration of appropriate antimicrobials within one hour, when indicated; availability of a radiologist's report within one hour when emergency abdominal CT is performed; assessment of risk and appropriate response at key points within the patient pathway, and of escalation pathways in the event of patient deterioration in both peri- and non-operative periods.

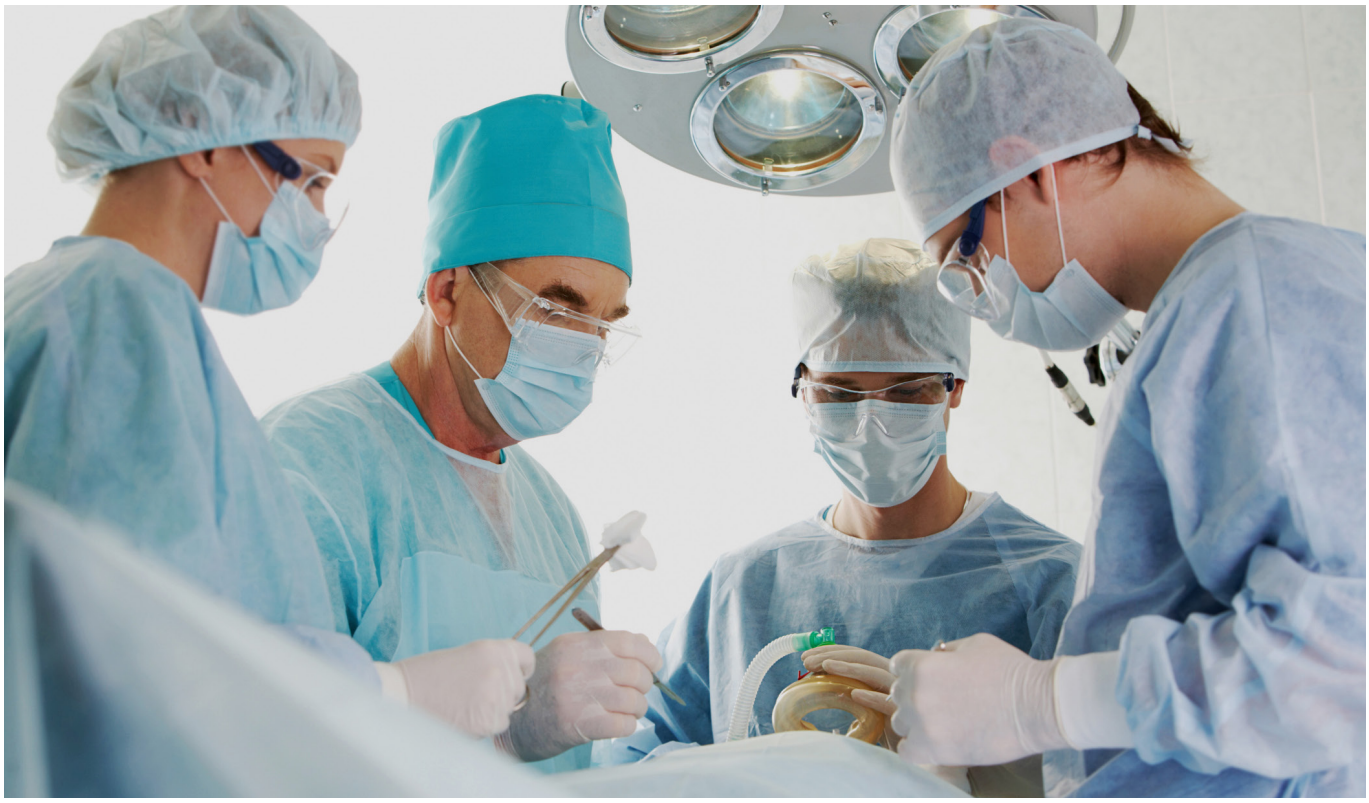
Unit protocols for high-risk patients undergoing surgery should include the following key components: a time-compliant operation that, for a patient with septic shock or sepsis requiring operative source control, is underway within a maximum of three hours or six hours, respectively; surgery conducted in the presence of a consultant surgeon and consultant anaesthetist; and immediate postoperative admission to critical care. Compliance with these standards should be continuously audited and breaches of these key components of this high-risk operative care bundle should be considered to be suboptimal care and should undergo structured review by the unit.

Unit protocols for high-risk non-operative patients should include consideration of admission to critical care with the decision and rationale recorded in the medical records by a senior doctor (ST3 and above) within four hours of admission/transfer and consideration of advance care planning and ceilings of care.

Commissioners and hospital service managers should incentivise delivery of care for high-risk general surgical patients that complies with these key components.

Units should adopt a programme of continuous quality assurance and improvement for the care of high-risk general surgical patients that embeds a bundle of high-impact interventions into daily practice. The programme should be multidisciplinary and should be led by a named clinician with time established in their job plan. Data should be collected on a range of outcomes, including risk-adjusted mortality, morbidity and patient-reported outcome and experience measures for both operative and non-operative care. Quality improvement meetings should be held at least monthly and should include structured judgement reviews. Key performance indicators including breaches of compliance with the high-risk operative care bundle should be reported to the board and to relevant hospital departments as part of that process.

Review of the radiological assessment of high-risk patients that considers breaches of protocol, discrepancies between radiological and operative findings and notable practice should be incorporated within quality assurance and improvement processes.



Areas for Further Research

There is a need for further research in this group of patients, experimental as well as observational, and we recommend that the following areas be prioritised:

- General:
  - A consensus study to develop an agreed standard core set of outcomes for future studies involving high-risk general surgical patients.
- Assessment, risk prediction and decision-making:
  - Predictors of prognosis of mortality, morbidity, dependence and quality of life beyond 90 days in high-risk patients whether undergoing emergency general surgery or receiving non-operative care for conditions often associated with operative management.
  - Identification of valid and clinically feasible tools for screening for and diagnosing frailty in emergency general surgical settings.
  - The relationship between measured frailty and outcomes of interventions, including those reported by general surgical patients themselves, especially beyond 90 days.
- Diagnostics:
  - The risk and benefits of preoperative cross-sectional imaging in the setting of septic shock.
- Treatment:
  - The role of comprehensive geriatric assessment and optimisation in improving outcomes for older patients presenting as emergency surgical admissions.
  - Prospective study of timing of source control and outcome in patients with sepsis, to identify more clearly key timescales for effective intervention.
- Models of care:
  - The impact of models of care, such as ‘front-door consultants’, subspecialty surgical consultants, networked emergency general surgery services and proactive geriatric medicine services on a range of metrics, including mortality, morbidity, patient and staff satisfaction and cost effectiveness.

Conclusions

The 2011 *Higher Risk* document contributed to raising the standard of care for general surgical patients, particularly those presenting as an emergency.[1] Care for those undergoing an emergency laparotomy in particular has improved. It is anticipated that implementation of these latest recommendations will improve care still further.

It is intentional that this document is titled *The High-Risk General Surgical Patient*, rather than being targeted only at patients presenting as an emergency. Partly, this reflects the fact that pathways evolve and some patients who would once have been treated definitively during an emergency admission are now stabilised to undergo subsequent scheduled definitive treatment. Additionally, whether a patient is admitted as an emergency is itself sometimes rather arbitrary, depending as it does on local processes and facilities for expedited scheduled care. However, mainly it reflects our assertion that the standard of care a high-risk patient requires and should receive must not be determined by their mode of presentation. To that end we have sought to 'level the playing field', for example recommending consultant surgeon and anaesthetist presence and direct postoperative critical care admission for all operative patients who are at high risk, defined as those with a predicted hospital mortality of ≥ 5%. Currently, such an allocation of resources is seen less frequently in an emergency than in elective care, for no justifiable reason.

It is clear to us that this group of patients benefits immensely from early senior multidisciplinary input and shared decision making and our recommendations are intended to encourage that to happen. Estimating risk and speaking with patients and their supporters about it is becoming more nuanced, taking in issues of morbidity, dependence and quality of life. We caution against an overly rigid reliance on a single risk prediction model for a single outcome, such as mortality, for operative patients. As we better understand the complex relationship between frailty, chronic ill-health and the postoperative outcomes most important to individual surgical patients, multidisciplinary shared decision making is likely to become all the more important.

Delivering care that complies with these recommendations will require hospital managers to work closely with clinicians to ensure that sufficient staff, including senior staff, are on duty 24/7 and that there is adequate capacity for timely access to diagnostics, theatre and critical care. Systems will need to track, detect and react promptly to increases in demand, releasing the additional resource when required. While some changes to ways of working may be accommodated within units, we anticipate that in some circumstances units may need to work more broadly with commissioners and neighbouring organisations to determine how best to deliver care for their collective patients. It is our expectation that these recommendations will shape such conversations and, if implemented, will lead to a further step change in the quality of care for general surgical patients.

Appendix

High-risk emergency care bundles

High-risk patients are a heterogeneous group whose risk may be determined by virtue of a high-risk diagnosis, the nature of an operation proposed to treat it, severe coexistent disease and/or frailty or a combination of these factors. In the elective setting, there is usually some time to thoroughly assess risk and use it to inform shared decision making. In the emergency setting, although the care needs of individual patients are sometimes nuanced, we consider it useful to categorise high-risk general surgical patients into three broad groups. These are:

- *The high-risk immediate surgery group*, who typically need surgery within a maximum of three hours for control of a source of septic shock or six hours for control of a source of sepsis otherwise. Though fewer in number, patients with uncontrolled haemorrhage also require immediate surgery as a National Confidential Enquiry into Patient Outcome and Deaths category 1 patient[155], meaning surgery being undertaken within minutes of the decision to operate.
- *The high-risk non-immediate surgery group*, where surgery may be safely deferred to allow an operative patient to be optimised or to await the availability of key personnel, equipment or estate facilities, subject to effective continuing monitoring.
- *The high-risk non-operative group*, who have diagnoses that are primarily managed without surgery or who are unfit for surgical intervention. This group also includes patients where non-operative treatment is undertaken in the knowledge that surgery may become necessary if non-operative treatment is unsuccessful.

Each of these pathways encompasses bundles of diagnoses and it is evident that some patients may move between the pathways either as a particular diagnosis becomes apparent or the management plan changes.

High-risk immediate surgery care bundle

Even without comorbidities, patients with certain surgical diagnoses will usually be at high risk and in need of immediate surgical intervention. Where there are also concurrent comorbidities, the risks of death or other serious complication will be still higher. These are time-critical diagnoses and even modest delays in diagnostic imaging, sepsis source control or haemorrhage cessation will lead to significantly poorer outcomes. Immediate multidisciplinary consultant input is required for timely decision making and early contact with diagnostic, theatre and critical care departments can aid coordination. The majority of patients in this group will benefit from expedient cross-sectional imaging. However, there are some with septic shock or exsanguinating haemorrhage for who the delay associated with diagnostic imaging may impact adversely on outcome. This group is not confined to those undergoing an emergency laparotomy as defined by NELA.[82] The criteria for inclusion as an emergency laparotomy are to an extent arbitrary and patients with conditions such as emphysematous cholecystitis or necrotising fasciitis may not qualify for inclusion in NELA yet they require the same pathway of care. Notably, the definition of sepsis has recently been updated[89] and a high-risk patient meeting modern criteria for sepsis and in need of operative source control requires management on the immediate surgery care bundle. These patients require critical care admission postoperatively.

For most general surgeons, operative management of life-threatening major intraperitoneal or GI haemorrhage is considerably rarer than management of sepsis. There are existing recommendations pertinent to the management of patients with severe GI haemorrhage, the large majority of whom are treated medically, endoscopically or by interventional radiological means.[156] However, on occasion, immediate high-risk surgery is required to control bleeding.

High-risk non-immediate surgery care bundle

This group includes patients for whom it is readily apparent that major surgery is likely to be necessary but there is some time available to further investigate and prepare the patient and their supporters, in order to undertake surgery in the most favourable circumstances. There is more time for in-depth multidisciplinary discussions with the patient and their supporters where risk warrants, including with specialists (e.g. oncologists) or generalists (e.g. geriatricians) who may not be instantly available. Coexisting illnesses may be optimised and preoperative interventions such as assessment by a stoma therapist may be appropriate. On occasion, it may be appropriate to await availability of a subspecialist, examples including where that means that a stoma may then be avoided, an operation may be conducted laparoscopically or a non-operative treatment such as a stent may then be attempted.

This group also includes those who are at high risk because of comorbidities and who require surgery for infective conditions such as appendicitis or superficial abscesses, in the absence of sepsis. These patients are at risk of deteriorating and becoming septic and then having a significantly worse outcome as a result. Although surgery does not generally need to be immediate, it does need to be timely and should normally be underway within a maximum of 18 hours from a decision to operate. Where surgery is not immediate, these patients require frequent reassessment, with a decision to escalate management to immediate surgery being based on objective criteria. Importantly, when a high-risk patient requires surgery for control of a source of sepsis, they should follow the immediate surgery pathway.

Management for this group follows a similar structure to the immediate surgery group and early consultant input is key, but the timelines for this pathway have more flexibility to reflect these somewhat less time-critical conditions, subject to arrangements for monitoring and escalation.

High-risk emergency non-operative care bundle

Most patients admitted under the care of general surgery as an emergency will not be managed operatively.[134] Surgical diagnosis,[19] frailty assessment[48] and/or other scoring systems[62,63] may assist in identifying the high-risk patient, so that appropriate adjustments can be made to monitoring and the urgency of care. Timely senior review and decision making remain instrumental to good outcomes. Some of these patients require prompt interventional radiological control for infective conditions, with or without sepsis, particularly for biliary disease or intra-abdominal/pelvic collections. Then, the choice between operative and radiologically guided intervention should be an active process that weighs the likelihood of respective harms and benefits and is informed by robust information about availability of those options. Critical care admission should be considered for all high-risk patients on a case-by-case basis. There will be a significant proportion of this group for whom careful counselling regarding ceilings of care will be appropriate.

This group also include patients for whom a period of non-operative treatment may be indicated in the hope of successfully avoiding high-risk surgery, for example for conditions such as non-tender adhesional small bowel obstruction or diverticulitis. Failure to settle requires consideration of transfer to the non-immediate surgery care bundle while deterioration, for example the development of bowel ischaemia or perforation necessitates consideration of transfer to the immediate surgery care bundle pathway. In determining how long to pursue non-operative treatment, continuing account is taken of the respective risks, burdens and benefits of non-operative and operative care as the patient's condition evolves. Again re-assessment should be frequent and the decision to escalate management should be based on objective criteria. Early consultant input remains important but the timelines for this pathway are more variable, reflecting the heterogeneity of underlying conditions, but remain subject to arrangements for monitoring and escalation.

High-Risk Surgical Patient Care Bundles

CLINICAL ASSESSMENT TO INCLUDE:
+/- Presence of sepsis or septic shock*
+/- NEWS 2 total ≥ 5 or ≥ 3 in any one variable
Risk-predictor/frailty/judgement=predicted mortality ≥ 5%.
Assess presence and post-operative risk of PONCD
+/- Age >65, dialysis dependency, ASA>3, immunosuppression, IDDM
Disease severity score where appropriate e.g. acute pancreatitis

Immediate Surgery

e.g. SUSPECTED DIAGNOSES
Generalised purulent or faeculent peritonitis
GI or gallbladder perforation or infarction
Uncontrolled Haemorrhage: GI or intra-abdominal
Strangulated hernia
Necrotising fasciitis

INITIAL MANAGEMENT:

SEPSIS: treat as per Sepsis 6/SSC
1st SURGICAL REVIEW ST3 OR ABOVE: within 30 mins of admission/referral
SURGICAL REVIEW BY CONSULTANT: review / discussion within 1 hr hour of admission / referral
CT SCAN: immediately, arranged by ST3, if applicable
CT REPORT: by radiologist within 1 hour
ACCESS TO: interventional endoscopy or radiology in the event of uncontrolled GI bleeding

PERIOPERATIVE CARE:

TIMING: Immediate surgery for uncontrolled bleeding. To control sepsis; underway < 3 hours (septic shock) or < 6 hours (otherwise)
CONSULTANT PRESENCE: surgeon & anaesthetist present in theatre
OPTIMISATION of cardiovascular and respiratory function

Non-Immediate Surgery

e.g. SUSPECTED DIAGNOSES
Non-tender small or large bowel obstruction
Infection without sepsis e.g.
- Diverticulitis
- Cholecystitis
- Appendicitis
- Perianal or soft tissue abscess

INITIAL MANAGEMENT*:

1st SURGICAL REVIEW ST3 OR ABOVE: within 1 hr of admission/referral (30 mins if septic)
SURGICAL REVIEW BY CONSULTANT: review / discussion within 4 hrs of admission / referral if plan uncertain
CT SCAN: within 6-12 hours, if applicable
CT REPORT: by radiologist within 1 hour
ACCESS TO: interventional endoscopy or radiology or ERCP for stenting, drainage etc.

PERIOPERATIVE CARE:

TIMING: timely surgery following decision to operate; underway < 18 hours for infection without organ dysfunction
CONSULTANT PRESENCE: surgeon & anaesthetist present in theatre
OPTIMISATION of cardiovascular and respiratory function

Non-Operative

e.g. SUSPECTED DIAGNOSES
Pancreatitis
Diverticulitis
Adhesional small bowel obstruction
Self-limiting lower GI bleeding
Cholangitis
"Surgical" diagnoses in a severely unfit patient

INITIAL MANAGEMENT:

SEPSIS: treat as per Sepsis 6/SSC
1st SURGICAL REVIEW ST3 OR ABOVE: within 1 hr of admission/referral (within 30 mins if septic)
SURGICAL REVIEW BY CONSULTANT: review / discussion within 4 hrs of admission / referral if plan uncertain (within 1 hour if septic shock)
CT SCAN: immediately, arranged by ST3, if applicable
CT REPORT: by radiologist within 1 hour
ACCESS TO: interventional endoscopy or radiology or ERCP for stenting, drainage etc.

INITIAL MANAGEMENT:

TIMING: To control sepsis; underway < 3 hours (septic shock) or < 6 hours (otherwise); underway < 18 hours for infection without organ dysfunction
CRITICAL CARE: Consider the risks, burdens and benefits of critical care or enhanced-level care, if not on a palliative pathway; ST3 to document the decision and rationale within 4 hours of admission. Consider ceilings of Care

DECISION MAKING MUST BE CONSULTANT-LED:
Guided by risk and frailty assessment.
MDT decisions (surgery/anaesthetics/critical care/others) regarding operative and non-operative care.
Discussions about ceilings of care and benefit of critical care admission.
Consent process informed by risk of death, life-limiting morbidity, QOL and dependency.

POSTOPERATIVE CARE (THEATRE/CRITICAL CARE):
End of surgery bundle:
Repeat risk prediction/frailty/judgement
Repeat ABGs and lactate,
Reversal of hypothermia & muscle relaxant
Fluid management plan
Admission to critical care for all with ongoing predicted mortality ≥ 5% by any criteria, unless palliative

PERIOPERATIVE OR NON-OPERATIVE CARE:
Early COTE review in age >65
Screen for, prevent and treat PONCD
Enhanced recovery interventions
Nutritional assessment and support
Discharge planning

*high risk patients needing source control for sepsis should receive it immediately upon that decision.

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Glossary and Abbreviations

4AT	A tool to assess delirium rapidly.
Abdomen	Anatomical area between chest and pelvis, which contains numerous organs including the bowel.
Adhesiolysis	Surgical procedure to remove intraabdominal adhesions that often cause bowel obstruction.
Anastomotic leak	Leak from a join in the bowel.
APACHE II	Acute Physiology and Chronic Health Evaluation (APACHE II) calculator.
ASA	American Society of Anesthesiologists.
AWOL	A risk prediction tool that assigns one point to each of four items assessed upon enrolment that were independently associated with the development of delirium (age ≥ 80 years, failure to spell 'world" backwards', disorientation to place and higher severity of illness).
Bowel	Part of the continuous tube starting at the mouth and finishing at the anus. It includes the stomach, small intestine, large intestine and rectum.
CGA	Comprehensive geriatric assessment.
CI	Confidence interval.
Colitis	Inflammation of the colon.
Colon	Part of the large intestine.
Colorectal resection	Surgical procedure to remove part of the bowel.
Colostomy	Surgical procedure to divert one end of the large intestine (colon) through an opening in the abdominal wall (tummy). A colostomy bag is used to collect bowel contents.
CQUIN	Commissioning for Quality and Innovation.
CT	Computed tomography.
Elective	In this report, refers both to mode of hospital admission and to urgency of surgery. The timing of elective care can usually be planned to suit both patient and hospital (can be weeks to months). In contrast, urgent/emergency care usually has to take place within very short timescales (hours).
ELPQuIC	Emergency Laparotomy Pathway Quality Improvement Care Bundle.

Emergency general surgery	Often refers to the group of patients admitted to hospital with conditions that require the expertise of general surgeons. Of these, 10% require emergency bowel surgery.
Emergency laparotomy	Bowel surgery that, because of underlying conditions, must be carried out without undue delay.
EPOCH study	Enhanced Peri-Operative Care for High-risk patients study.
GI	Gastrointestinal.
Hartmann's procedure	Surgical procedure to remove part of the large bowel, resulting in the formation of an end colostomy, and leaving part of the rectum in place.
Ileostomy	Surgical procedure to divert one end (or two ends in a loop colostomy) of the small intestine (small bowel) through an opening in the abdomen (tummy). An ileostomy bag is used to collect bowel contents.
Intestine	Part of the bowel.
Intra-abdominal	Inside the abdomen/tummy.
Intraoperative	During surgery.
Ischaemia	Loss of, or insufficient, blood supply to an affected area or organ.
Laparoscopic surgery	Keyhole surgery.
NCEPOD	National Confidential Enquiry into Patient Outcome and Death
NELA	National Emergency Laparotomy Audit.
NEWS	National Early Warning Score.
Non-operative	Treatment options that do not require surgery.
Obstruction	Blockage of the bowel. It can be caused by a variety of conditions and can cause the bowel to burst (perforate). It has the potential to make people very unwell and can be life threatening.
OR	Odds ratio.
Perforation	One or more holes in the wall of the bowel. It can be caused by a variety of conditions. It has the potential to make people very unwell very quickly and can be life threatening.
Perioperative	Around the time of surgery (incorporating preoperative, intraoperative and postoperative).

Peritonitis	Infection or inflammation within the abdomen, causing severe pain. It has the potential to make people very unwell very quickly and can be life threatening.
POPS	Proactive Care of Older People undergoing Surgery.
Postoperative	After surgery.
P-POSSUM	Portsmouth Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity. A tool that has been validated for estimating an individual patient's risk of death within 30 days of emergency general surgery.
Preoperative	Before surgery.
qSOFA	quick Sepsis-related Organ Failure Assessment.
Radiological imaging	Diagnostic techniques including x-ray and computed tomography.
Rectum	The final section of the large intestine.
Sepsis	Widespread, severe inflammation in the body resulting from infection.
SIRS	Systemic Inflammatory Response Syndrome.
Small bowel resection	Surgical procedure to remove part of the small bowel (small intestine).
SOFA	Sequential (sepsis-related) Organ Failure Assessment.
ST3	Specialty trainee year 3
Stoma	Surgical opening in the abdominal wall for the bowel to terminate (see also colostomy and ileostomy).
STP	Sustainability and Transformation Plan.
Subtotal colectomy	Surgical procedure to remove part of the large bowel except the very lowest part or 'rectum' of the large bowel.

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