Perioperative medicine: a new model of care?

ABSTRACT

The discipline of perioperative medicine provides a foundation for the consistent delivery of safe and good quality care to surgical patients. Its goals include the identification and optimal care of the high-risk surgical patient, fostering patient-centred decision making throughout the surgical perioperative pathway, and reducing unwarranted variation in practice. In turn, this should reduce preventable complications and improve patient satisfaction, long-term morbidity and survival.

This review concludes a series of articles which have described the epidemiology of surgical disease, the growth in the objective means of risk assessment, and novel outcome measures. It describes shortcomings in current practice, and how perioperative care pathways may overcome these. It discusses the growth of enhanced recovery programmes, which exemplify many of the sub-specialty's principles of patient-centred and coordinated care. Reported initiatives to modify local health-care systems, such as the Perioperative Surgical Home, are presented. Consideration is given to how clinicians can use the philosophy and tools of quality improvement methodology, with important current examples. The article concludes by looking at obstacles to change when introducing new frameworks and the future horizons for the discipline.

Preventable morbidity and mortality complicate the perioperative patient pathway. Older patients with multiple comorbidities, and advances in surgical complexity have contributed to a higher risk population requiring surgical intervention. These clinical and demographic changes, and political and financial challenges, have prompted a re-evaluation of the traditional paradigms of perioperative care.

Perioperative medicine provides multidisciplinary, patient-centred care which begins when surgery is contemplated, and extends beyond discharge to the period of rehabilitation. Articles in this issue have explored changing surgical epidemiology, the need for better risk stratification, and potential new outcome measures. This article describes how the practice of perioperative medicine has evolved, and how it may expand to enable health practitioners to deliver improved surgical outcomes and cost savings in already stretched health-care systems.

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Perioperative medicine and the surgical landscape

Existing NHS pathways do not consistently meet the needs of high-risk surgical patients (i.e. those with a predicted mortality risk of ≥5%). These patients account for 10–15% of surgical inpatients in the UK, but suffer more than 80% of in-hospital deaths after surgery (Pearse et al, 2006). Large national audits and reports have suggested that care can and should be optimized further for many of these patients (Findlay et al, 2011; Royal College of Surgeons and Department of Health, 2011). In response, several institutions have defined minimum standards of care, particularly in the context of emergency surgery. Monitoring process measures which reflect compliance with these standards may be one strategy to reduce harm.

Perioperative medicine is not just about improving short-term mortality. Occurrence of a postoperative complication is associated with a reduction in long-term median survival, and may be more significant than individual patient risk or intraoperative factors (Khuri et al, 2005). In the USA, hospitals with the lowest and highest postoperative mortality rates report similar complication rates. The differences in mortality rates appear to be a result of differences in patient management after a complication has arisen, i.e. a 'failure to rescue' (Ghaferi et al, 2009). These data suggest the prevention and prompt management of postoperative complications may offer significant benefits.

A collaborative, multidisciplinary approach

Fragmented delivery of care contributes to unwarranted variation, with multiple clinicians involved as independent assessors. This has the greatest impact on those with complex needs requiring a gamut of specialist input. The perioperative medicine team can provide leadership and a single point of communication for primary care, specialists and the patient. This allows for minimal disruption to existing medical care, optimal fitness for surgery, reduced cancellation rates and improved patient experience (Grocott and Mythen, 2015).

Patients having oncological surgery have long benefitted from a multidisciplinary team approach, with rigorous and well-established pathways for urgent referral from primary care, expedited investigation and review, and timely

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intervention. This has led to shorter waiting times and a reduction in morbidity and mortality (Pan et al, 2015).

Multidisciplinary teams have already been shown to be viable and effective in other perioperative settings. The Proactive care of Older People undergoing Surgery (POPS) team at Guys' and St Thomas' Hospital Trust was established after national reports highlighted shortcomings in the management of this group. Specialists in elderly medicine lead ward and clinic-based multidisciplinary team meetings to provide an early and comprehensive geriatric assessment, proactively review patients, and support education of other clinicians. They have reported a reduction in length of stay and complication rates (Harari et al, 2007).

Pre-assessment

Pre-assessment clinics are well established in 80% of NHS hospitals, and are commonly led by anaesthetists. The identification of higher risk patients here permits appropriate counselling, optimization, planning and resource allocation. Early coordination with primary care and referral for specialist review can help prevent lapses in care. Comprehensive care plans for the hospital stay and discharge can be formulated at this stage.

Common potential targets for intervention include smoking cessation advice, correction of anaemia, and optimization of blood pressure and glycaemic control. There is also increasing interest in the role of prehabilitation and exercise training, and whether this translates to better patient outcomes (Loughney et al, 2016).

Cardiopulmonary exercise testing is increasingly popular in the UK as an objective method to assess fitness for surgery (Pearse et al, 2011). It is often used as a triage tool to prompt referral for postoperative critical care, specialist referrals, further investigations and patient optimization. Results may provide an adjunct to surgical decision making in the high-risk patient.

Validated surgical risk tools are increasingly in use, such as the Surgical Outcome Risk Tool (Barnett and Moonesinghe, 2011). Unlike cardiopulmonary exercise testing, they do not require specialized training or investment, but the input of patient and operative variables to models which estimate individual patient risk. Plasma biomarkers, such as B-type natriuretic peptide and troponin, are currently being evaluated as predictors of poor outcome and postoperative markers of sub-clinical organ injury but none have been established in routine practice to date (Pearse et al, 2011).

Patient-centred care, consent and shared decision making

In 2015, the landmark case of Montgomery *vs* Lanarkshire Health Board fundamentally changed the practice of consent, supporting a more patient-centred approach. Doctors seeking patient consent for treatment are no longer protected by the Bolam principle (i.e. that doctors are not negligent if their actions would be considered

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proper practice by a responsible body of medical opinion). Instead, the Supreme Court ruled that doctors should take reasonable care to make a patient aware of those risks which the patient, or a reasonable person in his/her position, would consider significant (Lee, 2017).

Shared decision making is a collaborative process which empowers the patient to guide his/her clinical care in keeping with his/her own values, beliefs and preferences. It involves the sharing of information and evidence so the patient can consider his/her treatment options and arrive at an informed decision. The Choosing Wisely initiative, supported in the UK by the Academy of Medical Royal Colleges, recommends all patients considering an operation have shared decision-making consultations. A small number may even reject the option of major invasive surgery because of discussions which place greater weight on their own values and expectations (Royal College of Surgeons and Department of Health, 2011).

The surgical risk assessment and shared decision-making clinic at Torbay Hospital provides an example of best practice in an NHS general hospital. Exercise testing informs the estimation of a patient's postoperative mortality risk; this is supplemented by local data that have been collected on survival without surgery. The consultation with an anaesthetist begins with a discussion of the options, is guided further by the patient, and usually results in formulation of a shared care plan. Attendance at the clinic has been associated with a lower risk of mortality after surgery for colorectal adenocarcinoma, despite older age and higher American Society of Anesthesiologists grade in attenders compared with non-attenders. This may be a result of higher planned admissions to critical care for clinic patients (Dhesi and Swart, 2016).

The existence of the perioperative team can help maintain a high degree of patient and professional engagement throughout the continuum of care, including after discharge, with follow-up and ongoing support for the patient.

Enhanced recovery after surgery

In cardiac surgery, patients routinely benefit from consultant-led management, postoperative admission to intensive care, advanced monitoring and strong postoperative rehabilitation programmes. This undoubtedly contributes to the low mortality of 1.5% in this patient population of intrinsic high risk. In contrast, patients undergoing colorectal surgery, either emergency or elective, have a much higher mortality rate and there is

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considerable variation in their management (Grocott and Pearse, 2012). There has been a subsequent development of enhanced recovery programmes which aim to reduce these inconsistencies in elective patient care.

Enhanced recovery after surgery programmes illustrate many of the principles of perioperative medicine. These are scientific, evidence-based, multidisciplinary surgical care pathways. Interventions are delivered together to maximize the aggregation of marginal gains provided by the individual steps. Examples of common enhanced recovery after surgery interventions include preoperative oral carbohydrate loading, intraoperative use of goal-directed therapy, multimodal analgesia and early postoperative mobilization. There is also an emphasis on patient education and coordinated care throughout the patient journey.

Enhanced recovery after surgery programmes reduce length of stay and complication rates by 30–50% and contribute to early mobilization, significant cost savings and a reduction in readmission rates (Ljungqvist et al, 2017). Increasing compliance with an enhanced recovery after surgery protocol for patients with colorectal cancer is significantly associated with fewer adverse outcomes, indicating a dose–response relationship, and has been associated with an increase in 5-year survival (Gustafsson et al, 2011, 2016). There are also data to support enhanced recovery after surgery in other surgical sub-specialties. However, uptake of these pathways has been inconsistent. The Enhanced Recovery after Surgery Society was set up to address this, and has published several specialty- and process-specific guidelines to aid dissemination.

New models of perioperative care

An improvement in patient outcomes must involve not only preoptimization but the aggressive management of postoperative complications (Moonesinghe et al, 2014). The concept of the post-anaesthetic care unit has evolved as a stepping stone for patients who may require higher levels of monitoring, respiratory support or cardiovascular infusions for a short period, before continuing their recovery on a surgical ward (Simpson and Moonesinghe, 2013).

Co-management of surgical patients by medical teams has become the norm in some fields, such as orthogeriatric teams for patients with hip fractures. The provision of ward-based routine, daily intensive care registrar and nurse review has been trialled in Australia, although that study did not demonstrate any outcome benefit (Story et al, 2013). A pilot intervention at York Hospital provides an example from the UK where patients on surgical wards receive protocolised, nurse-led care, with supervision by consultant anaesthetists and intensivists, reducing both complication rates and length of hospital stay (Yates et al, 2016).

In the USA, the Perioperative Surgical Home was introduced by the American Society of Anesthesiologists as a patient-centred, surgical continuity of care model. Anaesthetists have provided much of the impetus for reform, to improve quality of care and adapt to a move to value-based funding of services. Their use of an anaesthesia-based model, founded on patient safety advances, their aim to impact on surgical morbidity as well as mortality, the chance for audit and outcome data collection and the subsequent health-care economic advantages are just some of the principles used in modelling this system (Vetter and Jones, 2015). As an example, one project modelled the acute pain team services as a template for delivering postoperative care (Kain et al, 2014).

Regardless of the structure or setting, a dedicated team can monitor the evolving needs of patients postoperatively, assist in discharge planning and help identify deteriorating patients. Even in advanced health-care systems, many patients who die after surgery do so without the benefit of critical care input (Pearse et al, 2011). Perioperative physicians may be able to address this failing. Conversely, they can encourage multidisciplinary discussion of frail patients and enlist the support of palliative care services when appropriate.

Much of the discussion of changes to current models of care refers to adult patients undergoing major surgery. However, a perioperative medicine team will adapt its processes according to local needs. For example, it might institute a telephone pre-assessment pathway for young, fit patients requiring day case procedures. Pioneering paediatric perioperative medicine, Boston Children's Hospital has validated the use of a paediatric scoring system to help identify and plan for those at highest risk of postoperative complications (Wood et al, 2013).

The perioperative physician

Delivering perioperative medicine is a multidisciplinary endeavour, but requires oversight and leadership from a physician. This may be any doctor who can 'effectively identify and meet the complex medical needs of patients at particular risk from the adverse effects of surgical treatment' (Grocott and Pearse, 2012). Elderly care physicians have a particularly important part to play and, together with the British Geriatric Society, have contributed to the debate, with good practice guides such as the *Comprehensive Assessment of the Frail Older Patient* (British Geriatric Society, 2013).

Anaesthetists may be best placed to define and develop the role of a perioperative physician, with their experience in pre-assessment, intraoperative management, critical care, pain control and patient safety (Cannesson et al, 2015). Professional bodies such as the Royal College of Anaesthetists and the American Society of Anesthesiologists have set out their vision for the future of the specialty, with acknowledgement from related bodies such as the Royal College of Surgeons (Royal College of Surgeons and Department of Health, 2011; Grocott and Mythen, 2015; Vetter and Jones, 2015).

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Training and accreditation bodies must collaborate to set out the essential and desirable competencies that a perioperative physician should demonstrate, to include non-clinical skills such as leadership and expertise in patient safety (Grocott and Pearse, 2012). In its curriculum, the Royal College of Anaesthetists has defined the learning objectives in perioperative medicine which it expects anaesthesia trainees at all stages to meet. In the USA, internal medicine or paediatrics residents can now apply to a joint training programme in anaesthesia (Vetter et al, 2013). There are a growing number of perioperative medicine fellowships and postgraduate qualifications available.

Quality improvement in perioperative medicine

Perioperative medicine has the potential to be the frontrunner in quality improvement within health care and act as an exemplar for other specialties. Quality improvement allows perioperative physicians to improve patient safety and disseminate and evaluate changes in practice.

The National Emergency Laparotomy Audit in England and Wales neatly demonstrates the power of measurement as a driver for quality improvement in surgical care (NELA Project Team, 2017). It was established in 2012 to monitor process and outcome measures, and report hospitals' performance against recommended standards of care. There has been increasing clinician engagement since then, resulting in higher rates of patient recruitment, consultant-driven care and preoperative risk assessment. There remains substantial variation in compliance with other standards, such as access to critical care, which require broader institutional change. Comparison of hospitals' performance allows the easy identification of outliers, which can prompt those with higher than expected mortality rates to re-examine their processes. Examples of good practice can be readily identified and shared. Since the National Emergency Laparotomy Audit began, there has been an improvement in standards of care, reduction in average length of stay and a reduction in 30-day mortality.

In the UK, the Perioperative Quality Improvement Programme has been launched to further embed the culture and processes of quality improvement into surgical and anaesthesia departments. In the USA, the aforementioned Perioperative Surgical Home programme and Boston Children's Hospital paediatric programme have similar models for cyclical improvement.

Obstacles to change

The growth of perioperative medicine has capitalised on recent advances, particularly the adoption of enhanced recovery after surgery. Even so, there are barriers to its widespread implementation. Scepticism among surgeons and anaesthetists persists, and there may be resistance to changes in working practices, or in achieving consensus in support of standardized care pathways (Kain et al, 2014). Strong leadership, continuing education and collaboration are required to present the evidence base and use quality improvement methods as described.

Health-care providers are under increasing pressure to reduce their costs, and may be reluctant to provide the investment required to reconfigure services or recruit additional staff. However, cost savings have been shown when perioperative pathways are implemented. In one example, introduction of a perioperative consult service for patients having elective colorectal surgery (predominantly bowel resection) reduced total hospital costs by 17% (McEvoy et al, 2016).

Future horizons

Perioperative physicians can expand the scope of perioperative medicine to meet other public health and research needs. The patient encounter with surgical services provides an opportunity for primary and secondary screening, promotion of health interventions, and the management of common conditions unrelated to the index operation, such as chronic kidney disease (Ackland and Laing, 2014).

Research in perioperative medicine will continue to advance understanding of the pathophysiology of the surgical insult, and allow better definition of which interventions may improve outcomes, and in which patient populations. Large randomized control trials of the perioperative use of beta blockers and aspirin in patients at high risk of cardiovascular complications are good examples (Devereaux et al, 2008, 2014). Aspirin use was associated with an increased risk of postoperative bleeding events, with no reduction in mortality or myocardial infarction. The initiation of beta blockers, however, was found to increase overall mortality and cerebrovascular events, even as it reduced cardiovascular mortality and non-fatal myocardial infarction and cardiac arrest. The UK

KEY POINTS

- Patients with complex medical needs who need surgery are best served by a team of professionals with the common aim of standardizing care to reduce preventable morbidity and mortality.
- Perioperative medicine allows a collaborative, multidisciplinary approach to ensure patient-centred decision making, to allow risk assessment and to avoid unnecessary interventions. The goal is to minimize postoperative complications, reduce the cost of patient care and improve longer term outcomes.
- Suggested models of care include leadership from a perioperative physician from specialties such as anaesthesia, critical care or geriatrics overseeing a multidisciplinary team from pre-assessment to rehabilitation.
- Quality improvement and research through data collection is key to modifying outcomes.
- Obstacles to change necessitate strong leadership, interdisciplinary collaborations and incorporation of the evidence base into existing training curricula.

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Perioperative Medicine Clinical Trials Network seeks to support multicentre collaborative research in the future to expand the evidence base in the specialty.

Conclusions

The emergence of perioperative medicine is a response to the recognition that surgical patient outcomes and experience are heavily influenced by multiple factors and are best served by interdisciplinary collaboration. There is greater emphasis on delivering care which is coordinated across health-care settings and at all stages of the patient journey. Active patient participation and shared decision making is encouraged. Several models for multidisciplinary perioperative teams have been discussed, and it is likely more will emerge. The iterative approach of quality improvement has driven change on national and local levels, and will remain key to the success of the discipline. The positive results of enhanced recovery after surgery and cardiac surgery justify optimism among those who aspire to deliver care of a consistently high standard to all surgical patients. **BJHM**

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