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Mini Review

The Roles and Challenges of a Perioperative Geriatric Service

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Abstract

It is increasingly recognised that perioperative complications in the elderly population are associated with an increased length of hospital stay and an increased rate of morbidity and mortality. This has led to the development and implementation of proactive perioperative geriatric services aimed at preoperative optimisation, anticipation of possible complications and early perioperative intervention. In this review, we will discuss the impact of non-surgical complications on perioperative outcome in the elderly population, as well as the evidence for perioperative geriatric services and its resource allocation.

Abbreviations: MI: Myocardial Infarction; SIRS: Systemic Inflammatory Response Syndrome; CNS: Central Nervous System; POD: Postoperative Cognitive Decline; AKI: Postoperative Acute Kidney Injury; CGA: Comprehensive Geriatric Assessment; NCEPOD: National Confidential Enquiry into Patient Outcome and Death; AAGBI: Association of Anaesthetists of Great Britain and Ireland; POPS: Proactive Care of Older People Undergoing Surgery; HDU: High Dependency Units

Introduction

With the advancements in anaesthetic techniques and an ageing population, it is projected that patients will undergo surgery at increasingly advanced age. While most elderly patients will have an uneventful postoperative recovery, some can have a significantly protracted postoperative course. This is often associated with the development of postoperative complications with increased length of stay, functional deterioration and increased morbidity and mortality. Often such complications are not directly related to the surgical procedure but are results of the patients' preoperative comorbidities, hospitalisation and the multisystem response to the surgical trauma. In order to minimise postoperative complications and improve outcomes, a number of surgical centres have developed a proactive multidisciplinary approach to the postoperative management of at-risk elderly patients. Here we will review the values and challenges of such services.

Postoperative complications and outcomes

The postoperative period is often characterised by an elevated stress and pro-inflammatory response; combined with immobility, malnutrition, dehydration and sleep disturbances. It is well recognised that these factors are associated with an increased risk of developing cardiovascular, respiratory, renal, immunological and cognitive dysfunctions. In an analysis of over one million surgical cases, Ferraris et al reported that non-surgical complications such as sepsis and myocardial infarction accounted for almost half of the total postoperative complications, and are associated with considerably higher mortality rates than the surgical complications [1]. This highlights the notion that the greatest threat to postoperative outcome is not the surgical trauma itself but the systemic pathophysiological changes associated with surgery and anaesthesia.

Cardiovascular complications

Postoperative myocardial infarction (MI) occurs as a result of the mismatch in myocardial oxygen demand and supply, whereby increased postoperative myocardial oxygen demand coupled with reduced coronary artery perfusion increases the risk of ischemia and infarction Contributory factors include the systemic inflammatory response syndrome (SIRS), the acute stress response due to surgical trauma and pain; hypovolemia due to blood loss and dehydration; as well as intraoperative hypotension. Postoperative MI has the highest mortality rate of all postoperative complications, with a 30 day mortality of 45% and a 5 year mortality of 66% [1,2].

Respiratory complications

Significant postoperative respiratory complications include atelectasis, lower respiratory tract infection, exacerbation of existing lung pathologies and acute lung injury/acute respiratory distress syndrome. These are thought to be partly a result of intraoperative invasive positive pressure ventilation, use of neuromuscular junction blockers, postoperative pain, immobility and opioid use. While the incidences of respiratory complications are heterogeneous in the literature [3,4], the reported mortality rate is consistently high [4-6]. Respiratory complications are associated with significantly longer hospital and intensive care unit stay [7-8].

Central Nervous System complications

Central nervous system (CNS) complications include postoperative delirium (POD), postoperative cognitive decline (POCD) and cerebral vascular events. The reported incidence is varied, but can be up to 60-70% [9,10]. While the exact pathophysiology is unclear, it is thought to be a result of the postoperative acute stress response, neuro inflammation, neurotransmitter imbalance and intraoperative hemodynamic instability [11-14] CNS complications can unmask or worsen pre-existing cognitive impairment [15,16]. Conversely, preoperative cognitive impairment also increases the risk of developing postoperative CNS complications [17]. In addition to increased length of hospital stay and mortality rate [18-21], CNS complications are associated with significant functional decline [22,23] and subsequently increased requirement for care facilities[24,25].

Renal complications

Postoperative acute kidney injury (AKI) has been reported to occur in 1-10% of the surgical population, however in high-risk groups the incidence can be as high as 30% [1,26,27]. While postoperative AKI is traditionally attributed to renal hypo perfusion, more recent studies suggest that systemic inflammation may play a role in its pathogenesis [28-30]. Postoperative AKI may progress to chronic renal impairment needing renal replacement therapy [31,32] and is also associated with significantly higher short and long-term mortality [1,26,33,34].

It is worth noting that studies have demonstrated that patient age is predictive of the postoperative risk for all of the aforementioned complications [5,21,26,35] as well as postoperative sepsis [36], therefore it is not surprising that elderly patients are more likely to develop complications and have worse postoperative outcomes [37]. This forms the basis of the recommendation that a physician-led team should proactively manage postoperative elderly patients with multidisciplinary input aimed at optimising recovery, minimising complications and initiating early treatment.

Role and values of a perioperative geriatric service

In 2001, the National Service Framework for older people set out the recommendation that elderly patients in hospital should be managed under the supervision of a care of the elderly medicine consultant. A specialist old age multidisciplinary team in all hospitals was also advocated; a team consisting of a care of the elderly consultant, nurse specialist, physiotherapist, occupational therapist, speech and language therapist, dietician, social worker and pharmacist [38]. The importance of the specialist multidisciplinary team providing a 'comprehensive geriatric assessment' (CGA) service is again highlighted in the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) 2010 report and in a 2014 consensus document produced by the Association of Anaesthetists of Great Britain and Ireland (AAGBI), where the expanded role for senior geriatricians in coordinating peri-operative care for elderly patients is strongly supported [39,40].

The organisational structure of a CGA unit has been in existence since the 1980s. In a meta-analysis of 28 trials and over 9000 patients, Stuck et al reported significant reduction in mortality and functional independence in patients cared for under such arrangements [41]. In 2007, Harari et al. [42] first reported on their implementation of a CGA unit for elderly elective orthopaedic patients termed 'proactive care of older people undergoing surgery' (POPS) [42]. The scheme involved a comprehensive medical and functional preoperative assessment; as well as care of the elderly consultant led perioperative management. During the implementation stage, the wider team consisted of a full time nurse specialist and an occupational therapist, as well as the involvement of a physiotherapist and social worker that assessed and managed orthopaedic cases over a 6-month period. A significantly lower rate of postoperative non-surgical complications were reported, including delirium and pneumonia; earlier postoperative mobilisation; and a significantly shorter length of stay in hospital.

Subsequently, the POPS service has been adopted for most elective surgical specialties in the same centre including postoperative urology patients; again demonstrating a significant reduction in complication rate and a significant reduction in length of hospital stay [43]. Other centres that have adopted components of the POPS service in their perioperative management, have also reported promising results in terms of complication rate and length of stay [44-46].

Parallel to services such as POPS, surgical patients thought to be medically complex may often be referred to high dependency units (HDU) for postoperative management under the supervision of an intensive care physician, with higher nurse to patient ratios and access to continuous monitoring. The timely management of medical comorbidities and earlier identification and treatment of postoperative complications aims to prevent overt decomposition. Studies have demonstrated that surgical patients who are electively admitted to critical care units have significantly better outcomes than those admitted to the ward and subsequently require critical care. This demonstration of improved outcome is despite the fact that patients with elective admission to critical care sometimes having more medical comorbidities [47-49]. It has been shown that proactively admitting at-risk surgical patients to critical care may in fact reduce the mortality and length of stay without increasing the overall critical care unit bed burden [50].

Limitations with both the POPS and HDU model of postoperative care are that both have significant staffing and

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resources implications. In the next section we will discuss some of the rationing strategies which have been used to identify patients at highest risk of developing postoperative complications.

Resource limitation and rationing criteria

In the climate of limited resources, commissioners facing a number of challenges as increasing evidence support elderly medicine teams forming part of routine clinical care for at-risk older patients undergoing surgery. Workforce planning, resources and funding will be required to establish these services within existing pre-assessment and surgical pathways, and strategies developed to identify those patients at greatest risk of perioperative morbidity so resources can be best utilised. Efforts so far have largely focussed on specific patient populations, namely those with acute hip fracture. The successes of such initiatives are widely reported, often demonstrating significant reductions in length of stay [45,51,52] However, the rationing of resources in such a diagnosis-based manner may ultimately result in disparity and inequality amongst the elderly surgical patient population.

Work in 2007 by Harari et al was initially funded by charitable grant and substantively funded when financial viability, including a reduction in length of stay, was demonstrated [42]. Inclusion criteria for referral to their POPS service are reportedly broad, and referrals by surgeons, GPs, and nurse-led pre-operative triage are encouraged. Referral criteria include those patients aged over 65 with listed systemic comorbidity risk factors or daily living needs. Harari et al had initially used a pre-operative screening tool in an attempt to identify patients at greatest risk of post-operative problems but the sensitivity and specificity for a low vs. high-risk cut-off point was too low to limit the clinical intervention to patient's with ≥2 risk factors.

Rationing strategies, like those above, use comorbidity risk stratifications a means to derive inclusion criteria. In 2000, Liu and Leung identified factors that were associated with postoperative morbidity in 367 patients over the age of 80 [53]. The most prevalent preoperative risk factors were a history of hypertension and coronary artery, pulmonary, and neurological diseases. A history of neurological disease (OR 4.0,95% confidence interval [CI] 2.3 - 6.9), congestive heart failure (OR 2.7, CI 1.4 - 5.3), and a history of arrhythmia (OR 2.3, CI 1.2 - 4.3) increased the odds of adverse postoperative events. Decreased functional status (OR 3.0, CI 1.4-6.4) and clinical signs of congestive heart failure (OR 2.1, CI 1.1-5.1) were the two most important predictors of postoperative adverse outcomes in a similar study of 544 patients aged 70 and older by Leung & Dzankic [54]. A number of global comorbidity indices have been successfully used to predict surgical outcomes [55] and may represent a more practical approach to developing referral criteria. One such tool is the Charlson Comorbidity Index (CCI); an index shown to stratify morbidity and mortality across a number of surgical specialities [56-58] and may have a role in the evaluation of perioperative risk in elderly patients [59]. However, its use as a tool in rationing access to perioperative elderly care services is not yet clearly established.

Other such predictors of surgical risk and outcomes include the concept of frailty. Frailty can be defined as a lack of physiological reserve seen across multiple organ systems and is an independent predictor of mortality, morbidity and institutionalisation after surgery [60]. Despite a growing body of evidence that frailty is associated with an increased risk of adverse health outcomes [61-63] there is not yet a consensus on the definition of frailty or how best to assess and diagnose it. In 2010, Makary et al used a validated 5-point scale that included weakness, weight loss, exhaustion, low physical activity, and slowed walking speed to classify patients as frail, intermediately frail or non-frail. They concluded that the degree of frailty independently predicted postoperative complications, length of stay, and discharge to a skilled or assisted-living facility in older surgical patients [64]. The Edmonton Frail Scale is a further validated scoring assessment which is increasingly being utilised as a method of refining risk estimates of postoperative complications in older adults [65,66]. Results of a 2016 systemic review by Hui-Shan et al suggested that regardless of how frailty was measured -21 instruments in total - the strongest evidence was for associations between frailty and increased mortality, post-operative complications and length of stay [67].

Conclusion

While perioperative geriatric services are staff intensive and can require considerable set-up cost, the proactive multidisciplinary approach to managing postoperative complications will likely reduce complication rate and length of hospital stay. With appropriate rationing strategies, it could prove to be cost effective while also improving postoperative outcomes in elderly patients.

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