PERIOPERATIVE MORTALITY

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This talk aims to discuss risk factors for perioperative mortality with particular emphasis on preoperative patient factors and postoperative complications.

Outcome Studies

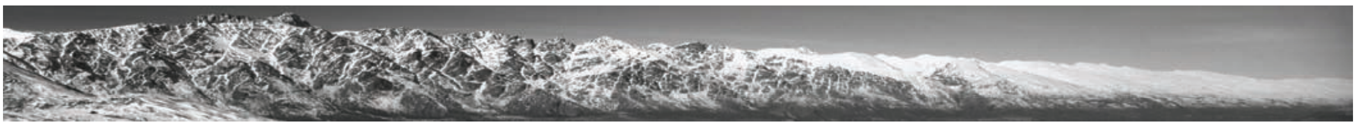
In 2010 we published a study of perioperative mortality and complications in Anaesthesia.[1] We called this study the REASON study; a slightly dodgy acronym: Research into Elderly Patient Anaesthesia and Surgery Outcome Numbers. The REASON study included around 4,100 patients. Based on previous work our primary hypothesis was that the overall rate of complications would be around 19%. The REASON study focused on elderly (70+ years) patients undergoing major non-cardiac surgery. Major surgery was defined as requiring at least one night's stay in hospital. While we excluded many patients undergoing day stay endoscopy and cataract surgery, some (often sick) inpatients requiring endoscopy were included. We were interested in the association of 30 day mortality with preoperative patient factors, a limited number of surgical factors (particularly non-elective surgery), and post-operative complications. Complications were pre-defined using definitions from previous Australian and New Zealand trials including the ENIGMA and MASTER trials. We followed up patients after 30 days, both in and out of hospital: we included more than just in-hospital mortality.

The most important findings of the REASON study were that, consistent with our hypothesis, 20% of the patients experienced complications within 5 days, and 5% died within 30 days. Because many patients developed more than one complication there were around 30 complications per 100 patients. Compared to patients who did not have a complication, patients who experienced one or more complications stayed a week longer in hospital. One in ten patients were admitted to critical care (ICU or HDU), half were admitted electively and the rest non-elective. Half the patients were ASA 3 and 13% were ASA 4. Compared to ASA 1 and 2 patients, the adjusted odd ratio (OR) for 30-day mortality was 3.0 for ASA 3 patients and 12.4 for ASA 4 patients. ASA physical status had a strong association with 30-day mortality. The value of the ASA status probably lies in it being a measure of global severity of co-morbidity. Many risk factors, such as diabetes are assessed in a yes / no dichotomous way without a measure of severity. This finding of the value of the ASA is in line with studies from the massive National Surgical Quality Improvement Program (NSQIP) run by the American College of Surgeons. The ASA scores stood out statistically over a number of individual comorbidities probably because of the global nature of the ASA score; for example both dialysis dependent renal failure and cardiac failure make a patient ASA 4.

Another grossly underestimated predictor of postoperative mortality is plasma albumin concentration. Decreased albumin is a marker of chronic disease and malnutrition. A NSQIP study suggested a curvilinear relationship between mortality and preoperative albumin concentration with an inflexion point at 30 g/L. That is the degree of hypoalbuminaemia reflects the severity of metabolic dysfunction. For simplicity we defined albumin less than 30 g/L as hypoalbuminaemia. Hypoalbuminaemia affected 1 in 6 patients and was associated with a more than doubled the risk of 30-day mortality.

Thoracic surgery had the highest mortality even when adjusted for patient factors. Increased mortality in thoracic surgery relative to other types of surgery is well known and important factor in the NSQIP data. The high mortality rate in thoracic surgery is likely to be multifactorial including factors such as: high incidence of aggressive cancer, frail patients, but also the possibility that intrathoracic surgery has greater systemic effects than abdominal surgery. When the odds ratios for mortality were adjusted for patient factors, the odds ratio for mortality in orthopaedics, plastics and urology fell considerably. These results highlight the importance of taking patient factors into account when looking at mortality rates; as patients become older and sicker and operative surgery becomes safer, patient factors are increasingly more important than the type of surgery.

In another study, the European Surgical Outcomes Study (EuSOS) group[2] examined mortality across Europe. Like REASON[1] they studied patients undergoing non-cardiac surgery requiring at least one night in hospital in



2011. Unlike REASON they studied all patients aged 16 years or older and looked at in-hospital rather than 30-day mortality. They studied 46,500 patients, of whom 1,855 (4%) died before hospital discharge. In the spirit of European unity the Researchers used the UK as a reference point (mortality 3%) and compared mortality between countries with odds ratios ranging from 0.44 for Finland (2% mortality) to 6.98 for Poland (18% mortality). Important factors for in-hospital mortality were, again: age, ASA status, urgency of surgery. An important finding was that three quarters of patients who died where at no point admitted to critical care services. Unfortunately, the EUSOS study did not measure complications.

Frailty

The 2010 National Confidential Enquiry into Patient Outcome and Death (NCEPOD)[3] report on the elderly discussed assessing frailty, suggesting that this is another factor which should be considered when caring for elderly surgical patients. Frailty, like other things in life can be hard to define but vulnerability is an important factor: individuals with a diminished capacity to effectively compensate for external stressors, or more simply: easily broken. One approach is to view frailty as an overall global vulnerability.[4] Some suggested indicators from the Canadian Veterans Heart Study for global frailty are: weight loss, exhaustion, slow walking speed and low physical activity, with a dichotomous yes no with three or more. Another version, the Canadian Study of Health and Aging (CSHA) Frailty Scale is a bit like the ASA scale looking at dependence, with a severity component, however like ASA and anaesthetists the CSHA Frailty Scale is best in the hands of experts: our geriatrician colleagues.

CSHA Frailty Scale

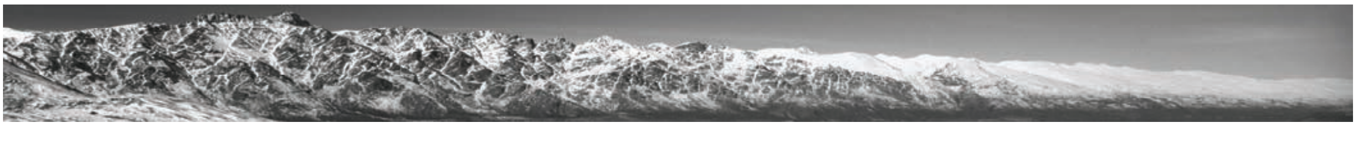
1. Very fit – robust, active, energetic, well-motivated and fit; these people commonly exercise regularly and are in the most fit group for their age
2. Well – without active disease, but less fit than people in category 1
3. Well, with treated comorbid disease – disease symptoms are well controlled compared with those in category
4. Apparently vulnerable – although not frankly dependent, these people commonly complain of being “slowed up” or have disease symptoms
5. Mildly frail – with limited dependence on others for instrumental activities of daily living
6. Moderately frail – help is needed with both instrumental and non-instrumental activities of daily living
7. Severely frail – completely dependent on others.

Another way to consider frailty is deficit accumulation. In addition to their frailty scale The Canadian Study of Health and Aging also has the CSHA frailty index. This lists 70 deficits that can accumulate eg: falls, restlessness, and thyroid problems. In a recent surgical study using NSQIP data Velanovich et al[5] found that a simple 11-point frailty index correlated with both mortality and morbidity for all surgical specialties. One advantage of the cumulative system in addition to its quantitative side is when considering limitations on treatment one point is the frailest older people can no longer accumulate deficits (ie become more frail); the next insult will cause failure of the system (ie death).

Unfortunately we do not have a simple robust quantitative measure of frailty that can be done by those with limited training eg orthopaedic registrars.[6] Further, there may be an inverse relationship between frailty and anaerobic threshold, or VO_2 max for a given patient, which is an important area that requires further research. No matter how frailty is defined there is emerging evidence that it is an additional factor in assessing mortality risk as well as discharge destination for survivors.

Complications

In the REASON study the most frequent complications within five days of surgery were systemic inflammation and acute renal impairment. Systemic inflammation ranged from systemic inflammatory response syndrome (SIRS: inflammation without clear infection) to sepsis (inflammation with infection) to severe sepsis (inflammations with infection and organ dysfunction) to septic shock (inflammations with infection, organ dysfunction, and hypotension). Importantly after surgery there is often inflammation without infection (SIRS) that will depend on the site and extent of surgery. The definition used for acute renal impairment was 20% increase in creatinine. Patients with these types of complications included those at the more benign end of the disease spectrum, and yet they



were associated with marked increases in risk of mortality. These patients at the more benign end are likely to receive less attention in most surgical units, in part due to failure to recognise their association with mortality. An important study using NSQIP data looked at long-term outcome up to 5 years post-surgery. Patients who experienced either renal failure or systemic sepsis had increased mortality at 30 days, and even after 1 year and 5 years. This emphasises that these types of events around the perioperative period can have a significant long-term effect. Unplanned ICU admission was also a frequent and important independent predictor of mortality. Like preoperative ASA, unplanned ICU admissions are an indicator of the level of postoperative care required within an institution. We can identify preoperative variables that are particularly important patient factors for assessing risk: age, ASA, albumin, urgent surgery and emergency surgery. Importantly, these risks are increased when a patient has a postoperative complication.

As the safety of surgery has improved and rates of surgical mortality and risk of anaesthesia have decreased, patient factors, patient factors have become far more important in risk assessment. ASA status and low albumin are also associated with wound infections, that is a useful risk to communicate to orthopaedic surgeons in particular, as complications are associated with longer hospital stays.

Postoperative Care

Of the three phases of perioperative care: preoperative, intra-operative, and post-operative, the safest time is intraoperative with continuous anaesthesia care and high standard ANZ operative surgical care. Out of OR surgical care (surgical medicine) is an area for improvement, particularly postoperative care.

There are five domains in postoperative care –

- Surgical site management
- General medicine in the postoperative period
- Pain medicine
- Resuscitation
- Rehabilitation

In addition to allied health professionals, particularly nurses and physiotherapists, postoperative care is provided in the first few days by one or more of the following: surgeons, anaesthetists, ICU physicians, and internal medicine physicians. Currently, no medical craft group has expertise in all the domains of postoperative care.

Preventing and managing complications is the principal focus of postoperative care. This requires both surveillance and intervention. Using the NSQIP database Ghaferi et al[7] reported in the New England Journal that among 80,000 patients in 150 hospitals in the United mortality after complications almost doubled from 12.5 to 21.4% comparing the best 50 hospitals (lowest mortality) with the 50 worst hospitals (highest mortality). They called this “failure to rescue.” Two interrelated approaches to providing appropriate surveillance and intervention for appropriate rescue on the wards are co-management and critical care outreach. Unlike consultation which involves giving an opinion with the parent surgical unit conducting the suggested on-going management, co-management has been described as “…collaboratively managing patients with surgeons and specialists, sharing responsibility and authority.”[8] Critical care outreach can be provided by the critical care specialties: anaesthesia, intensive care medicine, and emergency medicine. This can enhance both surveillance and intervention. Current critical care outreach includes – the respond blue team, medical emergency teams (MET), intensive care liaison nurses, and the most underappreciated, Acute Pain Services.

We have examined models of critical care outreach and co-management. In a pilot study of the Acute Pain Service[9] providing added surveillance and interventions for identified high risk patients, we found that critical care outreach through the acute pain service was associated with decreased complications and mortality benefit but also found that this critical outreach was very resource intensive. We subsequently audited another clinical project, with a critical care registrar and nurse co-management team.[10] While POST was popular with ward nursing staff[11] and surgical staff, length of hospital stay was increased rather than decreased as expected. This study had limitations and raises important questions about the reliability of hospital administrative data bases. In response to POST we are developing another model: the Surgical Medicine Fellow. This model differs from the POST in that the clinician is more senior (Fellow of the College of Intensive Care Medicine), and is involved in patient care for more of the inpatient stay. We plan to prospectively audit complications.

Future aims should be to improve both the accuracy of precision of risk assessments. This will help patients and medical teams decide on optimal care, which will increasingly include non-surgical options, or treatment limitation. Postoperative care requires on-going improvement with a particular focus on preventing, detecting and managing complications. Future education should focus on improving deficits in training.

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