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EDITORIAL

Improving peri-operative outcome

Time once more to update protocols

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Thirty-day postoperative mortality is one of the top three global causes of death.[1] The burden of postoperative deaths is, therefore, considerable and is related to major postoperative complications. Shortcomings during preoperative decision-making may be one reason for high short-term mortality. Another reason may be the failure to identify opportunities to improve outcomes in high-risk patients. Two such opportunities would be first, the optimisation of physiological reserve to prevent complications, and second, the early identification and treatment of complications. This editorial aims to provide some new information from recently published scientific investigations and offers avenues for improving outcomes in high-risk adults having noncardiac surgery that could be incorporated into practice.

Many decisions in favour of surgical intervention do not consider the frail nature of patients. Frailty may be assessed with simple scores, and is associated with poor outcome across a wide variety of interventions.[2,3] Assessing frailty may improve preoperative decision-making, help tailor the peri-operative pathway, and trigger the best options for prehabilitation. Although prehabilitation has been shown to improve outcomes in frail groups, definitive studies are required to establish its frequency, intensity and duration.[4]

But optimisation before surgery has its limitations, and in severely frail patients, a nonoperative pathway may be offered. For instance, in demented and frail patients scheduled for hip fracture repair, this nonsurgical pathway may be considered when the added value of surgery is questionable.[5] Pain, antipsychotic drug use, physical restraint use and loss of ambulation were not reduced with surgical repair compared with conservative treatment.[5]

Peri-operative anaemia (Hb $<13\,g\,dl^{-1}$) may contribute to postoperative mortality[6] and should be detected and managed preoperatively.[7] Intravenous and oral iron increase haemoglobin values and reduces blood transfusion rates,[7] but not postoperative mortality when given prior to elective surgery in patients with iron-deficiency anaemia. Erythropoietin in addition to iron supplementation may be an option[7] but there is no evidence for improved outcome.[8]

Blood transfusion is frequently performed and is associated with benefits, risks and costs. Whereas there is some low-to-moderate evidence for applying strict transfusion thresholds in cardiac surgery (Hb $<7.5\,g\,l^{-1}$) and ICU patients (Hb $<7.0\,g\,l^{-1}$),[7] there is weaker evidence in geriatric settings.[9,10] It is, therefore, unsurprising that there is significant noncompliance with guidelines and also heterogeneity in patient blood management.[11]

Blood transfusion is associated with simultaneous peri-operative therapeutic anticoagulation and antiplatelet treatments in older patients undergoing cancer surgery[12] and the right balance between the risk of vascular occlusion and the risk of bleeding may be a delicate one. The recent study addressing the peri-operative interruption of direct oral anticoagulants without heparin bridging[13] and the recent guidelines on thromboembolism may be helpful for risk stratification.[14]

In patients with cardiovascular risk factors, peri-operative myocardial injury is common (16%) and is associated with 30-day (9%) and 1-year mortality (22%).[15] Preoperative plasma cardiac biomarker assessments may contribute to improved risk stratification.[16] A newer cardiac biomarker for the early identification of myocardial injury may be plasma copeptin,[17] and its determination may allow earlier interventions to limit injury or expedite recovery. One randomised controlled trial (RCT) has assessed the effect of oral anticoagulants after myocardial injury in

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noncardiac surgery, showing that dabigatran reduced the risk of major vascular complications without a significant increase in major bleeding but this requires confirmation.[18] Noncardiovascular variables associated with myocardial injury have been described recently. Patients with obstructive sleep apnoea syndrome (OSAS) including those with unrecognised OSAS seem to be at increased risk for cardiovascular events including myocardial injury.[19]

There is evidence that intra-operative hypotension defined as a mean blood pressure less than 65 mmHg,[20] is associated with myocardial and acute kidney injury.[21] There is, however, controversy about the effect of intra-operative tachycardia on myocardial injury.[22,23]

Patients with asymptomatic or compensated chronic heart failure may be overlooked preoperatively unless cardiac risk scores and plasma cardiac biomarker are assessed. In a large observational study, 7.9% of patients undergoing elective, noncardiac surgery had heart failure.[24] These patients had an increased risk of 90-day mortality, postoperative complications and increased hospital length of stay.

A decrease in the annual incidence of pneumonia from 1.8% in 2004 to 1.3% in 2014 was observed in two typical elective geriatric procedures, hip and knee arthroplasty.[25] Despite these encouraging results, further efforts are needed as postoperative pulmonary complications remain a major cause of mortality and morbidity, and are associated with prolonged hospital stay and increased costs.

A new prediction model for the detection of postoperative pneumonia that has good discrimination and calibration included the following predictors: decreased preoperative functional status, decreased preoperative SpO_2, intra-operative transfusion, intra-operative colloid administration and type of surgery.[26] If this model for postoperative pneumonia proves to predict accurately in further validation studies, it may also prove useful in identifying those likely to benefit from preoperative pulmonary optimisation. A strategy consisting of preoperative pulmonary education with a physiotherapist together with an explanatory booklet has been shown to decrease postoperative pneumonia rate.[27]

Early identification and treatment is particularly important in sepsis, including pneumonia.[28] The established Centers for Disease Control and Prevention (CDC) criteria for pneumonia are often late signs. Alternative criteria may allow earlier diagnosis and earlier implementation of treatment, and in doing so, avoid failure to rescue.[29] Formal studies based on alternative criteria are needed to estimate the effect of improved early detection of postoperative pneumonia.

The postoperative incidence of overt stroke after noncardiac surgery is low, about 0.7%. A higher incidence of stroke was observed after pneumonectomy and lobectomy compared with a background cohort in a registry study. The authors postulated that embolism from the pulmonary vein stump could contribute to this higher occurrence of postoperative strokes.[30]

In contrast to the low incidence of overt stroke after noncardiac surgery, the Neurovision study demonstrated that covert stroke occurs much more commonly, 7% in a noncardiac surgical population, and was associated with long-term cognitive decline.[31] Furthermore, the long term follow-up of the Whitehall II cohort provides some evidence for a small effect of surgery on long-term cognitive decline.[32] These new findings prompt the need for additional research.

Postoperative delirium is a major burden with incidences between 23 and 26% in the elderly, with no benefit seen when using EEG-guided anaesthesia.[33] A systematic examination for postoperative delirium is highly recommended, not only to detect delirium, but also to identify serious accompanying complications, which have delirium as a sentinel symptom. Such complications are sepsis, pneumonia, acute heart failure and stroke.

New, simple and valid diagnostic instruments for delirium, such the 3D-CAM may increase awareness for postoperative delirium, and should be validated in different European languages before implementation.[34] There is some limited evidence that an intervention with dexmedetomidine can reduce the incidence of postoperative delirium.[35] However, the optimal dose, timing and the target groups remain unclear and need further trials.

Postoperative sepsis contributes to mortality[36] and is highly prevalent after major abdominal surgery.[37] Lower gastrointestinal surgery contributes to postoperative sepsis, possibly via surgical site infections (SSI). In a recent meta-analysis, it was observed that the efficacy of antibiotic prophylaxis for the prevention of SSI in colorectal surgery has declined.[38] An improvement could be the addition of mechanical bowel preparation and oral antibiotics. However, a recent RCT demonstrated equivalence of no bowel preparation compared with mechanical preparation and oral antibiotics in terms of SSI and overall morbidity rates.[39]

The duration of treatment with antibiotics for postoperative sepsis was unknown until recently. A short and effective treatment of 8 days was equivalent to a treatment of 15 days in a RCT including patients with postoperative intra-abdominal infections.[40] Similar results were observed in patients with bacterial arthritis after surgical drainage; a short treatment of 14 days was equivalent to a treatment of 28 days.[41] This reduction in antibiotic use may decrease adverse events, such as clostridium colitis, costs and the complications of parenteral antibiotic therapy, in particular, central venous catheter complications.

Postoperative acute kidney injury (AKI) is frequent at 5 to 9%,[42] and is probably associated not only with renal flow, perfusion pressure and venous return but also with toxic substances. The same RCT demonstrated the importance of judicious fluid management, where an increased rate of AKI was observed in patients undergoing major abdominal surgery receiving a restrictive fluid regimen.[42] This result confirms the findings from a retrospective study where restrictive administration of crystalloids was associated with AKI.[43]

Recognising the limitations of serum-creatinine and urine output as a marker of AKI, a biomarker-based risk stratification[44] may be attractive especially for the early postoperative period.[45] A biomarker-guided intervention strategy was shown to improve renal outcomes, ICU and hospital stay after major noncardiac surgery.[46] Therefore AKI may be preventable and reversible.[47]

Frailty is an important determinant of outcome in surgical patients and should be assessed to enable appropriate risk stratification. In patients with advanced dementia and/or severe frailty, nonsurgical approaches may be considered. Preoperative anaemia correction and prehabilitation may be included into routine practice although there is still no consensus on the type of therapy required. Optimal perioperative bridging of anticoagulant may decrease bleeding and transfusion. Identification of patients with covert heart failure is challenging but is necessary to avoid increased mortality. Avoidance of intra-operative hypotension may improve cardiovascular and renal outcomes, and local protocols avoiding hypotension may be useful. Postoperative awareness for delirium, routine protocols for its detection and early treatment of underlying diseases may contribute to improved outcome. Postoperative sepsis has to be treated early and recent evidence supports shorter treatment times. Highly restrictive perioperative fluid therapy can no longer be recommended because of the risk of postoperative AKI.

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