

Improving the care for elective surgical patients: post-operative ICU admission and outcome

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Surgery has been defined by the World Health Organization (WHO) as an “essential component of health care worldwide and often the only therapy that can alleviate disabilities and reduce the risk of death from common conditions” (1,2). Surgery plays an important role in addressing a diverse set of cross-cutting health challenges delivered by multidisciplinary team of specialists (3). However, surgery implies in its nature an aggressive invasion of the boundaries (4) of the body which may be associated with life-threatening complications and impaired quality of life (5). Furthermore, according to previous reports, 5 billion people are unable to access safe and affordable surgical and anaesthetic care (6-8). Safe surgery has been considered a public health priority (9) and many efforts have been invested to outline the best strategy to be undertaken for the sake of surgical patients. An epidemiological analysis conducted by the International Surgical Outcomes Study (ISOS) (10) group enrolled 44,814 patients in 27 (19 high-, 7 middle-, and 1 low-income) countries worldwide. A total 16.8% rate of complications was detected: infections were the most frequent, followed by cardiovascular and bleeding events. The overall mortality rate after surgery was 0.5%, nevertheless, it sharply rode at 2.8% in case of post-operative complications. Conversely, of the 9.7% patients admitted to a critical care unit immediately after surgery, 50.4% developed a complication with a 2.4% death rate.

In a recent issue of *Intensive Care Medicine*, Kahan *et al.* (11) performed a planned secondary analysis of the ISOS data. They shed light on the relationship between provision and use of critical care resources and subsequent postoperative mortality, taking into account the income level of the countries. Overall, patients in low or middle-income countries were younger and had less comorbidities. Institutions located in high-income countries had higher levels of critical care capacity and rates of direct admission to critical care after surgery. The ICU stay turned out to be longer in planned than complication-induced admissions and, in both cases, it was longer in high than middle/low income countries (2.8 *vs.* 2.3 and 5.8 *vs.* 4.2 days respectively). At a patient-level analysis, the overall as well as country differentiated mortality was higher in patients admitted to the ICU for any reason than in patients admitted to standard ward after surgery. After risk adjustment for age, co-morbidities and surgical procedure characteristics, the odds ratio for mortality was 3.01 (95% confidence intervals 2.10–5.21; $P < 0.001$) and this association varied according to the national income, with significantly lower rate in wealthiest countries ($P = 0.07$). Conversely, at hospital-level analysis, admission to the ICU was not significantly related with mortality neither when planned immediately after surgery nor when given later to treat post-operative complications.

The ISOS is actually the first report providing such

important international epidemiologic data on post-operative outcomes of elective surgical patients. It succeeded in enrolling a wide sample size (more than 40,000 patients) using a reliable and effective online dataset. In addition, the present study was built on an accurate statistical method based on a patient-level analysis and on a three-level hospital analysis, in order to minimize the impact of any confounding factor. Indeed, this study lays the foundation for upcoming systems to monitor and hence to prevent complications and reduce mortality of elective surgery worldwide. Nevertheless, authors themselves claimed for caution in the interpretation of the observed results. Firstly, it had a non-randomized design and it can't be considered truly representative of the worldwide perspective, as only few hospitals of some countries took part to the study. Secondly, its results could be affected by huge heterogeneity of data collected and local for post-operative ICU admission. Probably, these could explain the difference in mortality showed at a patient-level and not confirmed at a hospital-level analysis. Thirdly, dealing with the immediate post-operative ICU admission, data available didn't allow the distinction between planned elective indications for monitoring of high-risk patients, and unplanned urgent admissions as a result of major intraoperative complications. Fourthly, in order to better associate surgical procedures with patient's outcomes and neutralize potential confounding factors, the authors performed an adjustment for risk factors which could result in underestimation of higher complications and mortality rate in centres performing more complex surgery on sicker patients.

Some observations are worthy to be further discusses, mainly dealing with actual indications for a planned, elective post-operative ICU admission. For instance, it is possible to distinguish surgical and patient-related perioperative risk factors which justify, in some cases, the avoidance of any "a priori" decision in favour of a case by case evaluation of real needs. In addition, the improvement of surgical and anaesthetic techniques has been associated with a reduction of perioperative physiological derangements, which may allow, in selected cases, a proper post-operative monitoring in standard wards, under the supervision of adequately trained medical staff. Hence, as recently proposed by Taccone *et al.* (12), a postoperative "intermediate care" ward may represent a future pathway of equipoise between clinical safety and limited costs.

Although one of the limitations of Kahan's study is the non-randomized design by the nature of the topic, a randomized controlled trial would lack of applicability due

to the heavy ethics burden and the challenge of identifying reliable criteria for ICU admission all over the world. According to previous reports (7,8,13), national health systems and quality of health services are conditioned by the income of the country and the provision of available resources. Then, the organ reserve of the patient is one of the components impacting the outcome in the perioperative periods. Many scoring systems [e.g., ASA and SORT (14)], cardiopulmonary exercise tests and biomarkers (15) have been used to assess the clinical condition of the patient and inform further decisions, orienting the trajectory of the perioperative management. Moreover, the adoption of a safety surgical checklist worldwide was associated with an improvement in perioperative complications and mortality rates (16-18).

In this context, a proactive patient care and an efficient in-hospital medical emergency system are valuable solutions to augment the protection of the patient (19) but, despite the availability of international guidelines aimed to drive the triage towards ICU admission (20), we are not aware whether such management is associated with any clinical benefit.

In conclusion, postoperative management turns out to be quite complex, and several variables must be taken into account when considering ICU admission. However, the ISOS results showed that at a hospital-level analysis, the postoperative outcome of elective surgical patients was not directly related to the intensity of care provided. Hence, a generalized improvement in the provision or use of critical care following elective surgery seems not to be justified. Ultimately, the most effective strategy should be an actual patient targeted stratification of risk, considering underlying conditions, surgical related aspects and care-giver features (ICU and standard ward). In such an attempt, further studies are hopefully expected to result in a worldwide applicable stratification panel of perioperative risks: this could enable prevention and treatment of perioperative complications as well as health care and economic optimization of resources.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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