Post-operative intensive care: Is it really necessary?

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It is estimated that more than 310 million patients receive a surgical treatment each year [1], and noted that the number of procedures performed each year is growing [2–6]. Despite a majority of cases being performed without significant complication, deaths after surgery have recently been demonstrated to account for a large portion of all deaths worldwide [7]. For a minority of patients, surgical procedures carry a significant burden of both death and disability. High-risk patients account for approximately 10-15% of the surgical population, but suffer around 80% of post-operative deaths [4][8]. These high-risk patients have only been loosely defined, being typically older with a higher burden of comorbid disease. The surgical population is ageing at a faster rate than the background population [3]. With increasing numbers of procedures on increasingly high-risk patients, there is a clear need to identify possible interventions that improve peri-operative outcomes [4][9], with many targeted at the high-risk group who stand to benefit the most.

A number of potential therapies have been proposed and investigated, including pharmacological, physiological and multimodal interventions to improve post-surgical outcomes. The challenge remains to personalise these interventions to those surgical patients most likely to benefit [10, 11]. Some interventions need to be targeted at carefully identified patient groups, whilst others are not cost effective in low-risk populations. Enhanced Recovery After Surgery (ERAS) pathways focus on protocolizing evidence-based interventions within defined surgical populations. These can improve outcomes whilst reducing burdens on healthcare systems [12]. At present, the high-risk non-cardiac surgical patient is much harder to identify within the greater surgical population, and move to an alternative patient pathway.

Post-operative admission to the Intensive Care Unit (ICU) is itself considered a standard of care in many healthcare systems [2]. Patients with major acute, yet widely varying primary pathologies, find themselves admitted to the ICU for generally similar supportive therapies. As physicians, this leads us to regard ICU as the gold-standard of high-risk and post-operative care. That said, ICU resources are

expensive, finite, and in ever-increasing demand [5][13]. The need to minimize unnecessary and inappropriate admission to critical care is important in all healthcare systems. It is of even greater importance in low resource settings, where critical care bed availability per captia is significantly less. Inappropriate allocation impacts not only the high-risk surgical population, but other cohorts concurrently needing critical care resources. Subsequently, the overall effects at a population level are negatively amplified.

Surgical patients continue to make up a sizeable proportion of ICU admissions [2],however, there is wide variation in admission rates to ICU after non-cardiac surgery, suggesting a lack of consensus on its optimal use [9][14][15]. Failure-To-Rescue (FTR) is of particular relevance and concern being a term used to describe those who die from early postoperative complications [15]. FTR may demonstrate current system weaknesses, with longer time periods before the identification and treatment of complications resulting in greater mortality [16]. The chronology of post-operative medical and surgical complications are of importance when considering delivery of any post-operative intervention. An intervention designed to either prevent, or promptly recognise and respond to a complication, must be provided at a time when the risk/frequency of occurrence is highest. These high-risk periods are not yet clearly defined, and ICU re-admission rates suggest further research in this area may be beneficial.

The potential missed opportunity for intervention is in line with findings that indirect post-operative admission to an ICU is associated with increased peri-operative and long-term mortality [15]. Figure 1 shows some key factors influencing current post-operative care. Secondary to global differences in capacity, culture and structure, there is variation in the patient demographics of admissions to ICU. In a cohort of mixed United States ICU's, almost 40% of all admissions were for monitoring purposes only [17], whereas in the UK, patients admitted to critical care tend to require higher levels of organ support.

The boundaries of exactly what does and does not constitute Intensive care remains a matter of debate, and described international variations further compound any data-analysis [16][17]. This is additionally complicated by the varied nomenclature used to describe the different critical care environments. For example, locations currently termed 'High Dependancy Units (HDUs)', 'Step-down Facilities' and/or 'Post-operative Anaesthesia Care Units (PACUs)' often offer similar capabilities. Some of the key aspects of more classical 'Intensive Therapy Units' are higher staff-to-patient ratios, integrated multi-disciplinary team (MDT) approaches, provision of advanced physiological support techniques, frequency of experienced clinician input, and enhanced monitoring crucially combined with rapid-response interventions.

Most post-operative patients do not require the full complement of ICU interventions available, and those interventions that are required could reasonably be delivered on a well-resourced ward with clear cost-saving implications. Indeed, key to most surgical patients' recovery, are relatively simple interventions such as analgesia, early mobilisation, and early identification combined with treatment of complications [15]. Several ongoing multi-centre clinical trials are exploring the benefits of typical peri-operative ICU interventions which have been modified to be delivered outside of the ICU. Notably, by simply having increased numbers of nursing and medical staff available per patient in an ICU environment may have important effects on outcomes. In the UK, organisations with a low 30 day mortality rate had significantly greater provision per bed of doctors and nursing staff [18]. In this regard, ICU is an expensive fix to more widespread system issues. The exact mechanism, however, by which greater use of critical care may improve outcomes after high risk surgery remains undefined [19].

Recently published results from the EPOCH trial [11] did not identify any survival benefit from a national quality improvement programme for patients undergoing emergency abdominal surgery. It

highlighted the complexity of modern hospital care pathways, and the difficulties in both implementing broad changes and measuring outcome. In many ways, the post-operative ICU concept is similar to this. In line with recommendations from EPOCH, building an evidence base for individual interventions will likely be key to improving outcomes. Once established, these proven individual interventions can sequentially be placed into the overall process of care pathway in various guises as appropriate.

Conclusion

Intensive care is not an intervention that can be easily tested in a randomised trial, relying instead on observational data and the inherent difficulties this presents. Research into early identification of the high-risk population for whom interventions could be targeted for a maximal dose-response will aid understanding of who could benefit the most from post-operative ICU admission and facilitate improved resource utilization. The patient-societal balance in high, middle, and low income countries may have further influence on resource utilization. Investigation into specific peri-operative interventions continues to provide the essential evidence base to help clarify the role of the individual components of post-operative ICU care. As clear evidence-based interventions are established, the location of where these interventions are delivered in a hospital system can then be addressed. In the interim, ICU continues to function as an attractive solution. For the future, we need to understand the question we are asking of post-operative ICU before we try to assess and rationalise the solutions it provides.

Conflicts of interest

RP holds research grants, has given lectures, and/or performed consultancy work for Nestle Health Sciences, BBraun, Medtronic, Glaxo SmithKline, Intersurgical, and Edwards Lifesciences. All other authors declare no conflicts of interest.

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Figure legends

Figure one. Flow diagram indicating post-operative care factors

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