PAR PERIOPERATIVE ANESTHESIA REPORTS

NARRATIVE REVIEW

First proposed guideline for the allocation of surgical patients in an intensive care unit

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ABSTRACT

The increasing number and complexity of surgeries worldwide necessitate effective preventive measures and appropriate postoperative care to avoid complications and organ dysfunctions. However, the scarcity of intensive care unit (ICU) bed space in most hospitals poses challenges in allocating surgical patients to the ICU. This article proposes a protocol and algorithm for indicating ICU hospitalization of surgical patients based on international guidelines and a national survey with anesthesiologists. The protocol aims to improve resource utilization, ensure appropriate patient allocation, and reduce surgery cancellations or postponements. The proposed algorithm considers factors such as surgical complexity, patient's physical status, and risk of acute organ dysfunction to determine ICU indication. The protocol provides guidance for both elective and urgent/emergency surgeries, emphasizing the need for individualized clinical judgment in exceptional cases. Implementing this protocol and developing a national guideline can optimize postoperative care, mitigate the impact of limited ICU bed space, and enhance patient outcomes. The proposed algorithm aims to rationalize ICU bed requests, reduce patient waiting times, and minimize financial costs associated with postoperative care.

KEYWORDS

Surgical patient; intensive care unit admission; intensive therapy allocation

INTRODUCTION

The number of surgeries is increasing worldwide due to population aging, earlier diagnoses, and more cancer surgeries. Surgeries complexity has been increasing[(1,2)] and mortality rates due to surgeries are close to 0.5%. However, surgical complication rates are higher, at approximately 16%[(3)]. Therefore, preventive measures should be taken to avoid complications in the perioperative period and to know the appropriate time for an intervention. As stated above, a patient's admission to the Intensive Care Unit (ICU) is the most appropriate place to allocate postoperatively, as it is a suitable environment for the early diagnosis and

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treatment of surgical complications[1], and prevention of organ dysfunctions.

It is well known that ICU bed space is expensive and limited in most hospitals, especially in the public system. Referring patients to the intensive care unit is still controversial among medical specialists. Usually, anesthesiologists are responsible for indicating surgical patients to the ICU, and one of the most frequent questions is, "who should go to the ICU in the postoperative period?"

The scarcity of ICU bed space impacts the health network, including the suspension/postponement of surgeries and the transfer of patients between hospitals and even cities, in addition to worsening the prognosis of rapidly evolving diseases in patients with oncological and vascular disorders. Therefore, the patient indicated to the ICU during the postoperative period must clearly know the benefits. Either because the interventions in the intensive care environment improve the disease evolution, preventing bad prognostic for organic dysfunctions, or because the intensive care environment responds/intervenes fast to the risks of statistically expected complications. Therefore, the benefits should be well-scored.

Many anesthesiologists use the physical status classification proposed by the American Society of Anesthesiologists (ASA) to indicate the postoperative period in the ICU, including age and comorbidities. However, according to the Royal College of Surgeons of England, age and comorbidities should not be isolated variables for postoperative indication to an intensive care bed unit, but as predictors of high mortality[3]. Moreover, the perception that intensive care is beneficial and a differential for high-risk surgical patients is common sense, but the definition and determination of surgical risk[4] are variables.

A protocol for ICU indication suggested here for surgical patients is beneficial in terms of social, logistical, and financial reasons. However, a protocol must not be superior to the careful, individualized clinical judgment about the patient. The protocol proposed here is generalist for surgical patients. A safer patient allocation should be a priority in exceptional cases and during uncertainties.

OBJECTIVE

To suggest a protocol and, ultimately, a national guideline with proposed indications for ICU hospitalization of surgical patients in the postoperative period based on international guidelines and a national survey carried out with anesthesiologists[5-8]. The protocol should be easy to apply and accessible.

PROPOSITION AND THE DEVELOPMENT OF AN ALGORITHM

The following proposal suggests an algorithm to help anesthesiologists indicate an ICU bed space more assertively for patients undergoing elective surgeries and urgent and emergency surgeries. The proposal can improve the use of resources, adequate allocation of patients, and the reduction of unnecessary cancelation or postponement of surgeries. The algorithm can be used later as a guide to preparing a National Guideline for postoperative indication/allocation in intensive care units.

It is critical to describe the terms to be used in this proposal. We will define the size of the surgery (below), updated ASA classification (below), acute organ dysfunction (below), and what is "expected" from "extended Post Anesthesic Recovery (e-PAR)".

The physical status reported by the ASA can be used alone as a risk predictor of perioperative mortality[6]. The study that independently adopted the ASA classification had the following results: ASA I has a mortality risk between 0 and 0.3%; 0.3% to 1.4% for ASA II; 1.8% to 5.4% for ASA III; 7.8% to 25.9% for ASA IV and 93.3% risk of death for ASA V[9]. Furthermore, the ASA classification is linked to increased postoperative complications, the higher is the patient's rating. There is a 20- to 180-fold increase in postoperative morbidity from the ASA I patient to the ASA IV patient[9]. For this reason, we used the ASA classification in the flowchart allocation for urgent surgeries.

Definitions

Regarding the Complexity of surgery: surgeries can be classified according to the size as minor, intermediary, or major complexity, using the probability of blood and fluids lost during surgery. We use the classification of surgical complexity for fluid and blood loss here since we already use patient functionality criteria. We use the classification: "Major surgery": surgery with a high probability of fluid and blood loss (greater than or equal to 20% of blood volume). For example: emergency and arterial vascular surgeries. Intermediate surgery: surgeries/procedures with a medium probability of fluid and blood loss (between 15% and 20% of blood volume). For example: head and neck – resection of squamous cell carcinoma, or orthopedics – hip prosthesis. "Minor surgery": small probability of expected fluid and blood loss (virtually insignificant loss or up to 5% volume loss). For example: small procedures performed in plastic surgery, dermatological, dental, and endoscopic procedures. The anesthetist must individualize each procedure based on the surgical plan of the day and its expertise. The classification should not be seen as "definitive."

Classification of the American Society of Anesthesiologists (ASA) (Appendix 1**)**[6]**:** Patients are classified into six levels of physical status: ASA I – normal and healthy patient, ASA II – patient with mild systemic disease, no functional restrictions; ASA III - patient with severe systemic disease, which imposes functional restrictions; ASA IV - patient with life-threatening systemic disease; ASA V - moribund patient, who will not survive without surgery and ASA VI - patient with brain death, organ donor. The letter “E” is added when it is an emergency surgery.

Organic dysfunction: Monitoring organic functions is another commitment assumed in the extended Post Anesthesic Recovery (e-PAR). We describe below the main definitions and goals regarding the patient’s organic functions (Appendix 2).

Extended Post Anesthesic Recovery (e-PAR): We will define extended Post Anesthesic Recovery (e-PAR) as the patient’s stay in the anesthetic recovery room between 04 and 06 hours under continuous monitoring and supervision of an anesthesiologist. During this period, the patient must have the most pertinent postoperative exams for his case (see Appendix 2), and the results evaluated and treated (if necessary). He must also have his organic functions monitored within standard limits during this period or must be in the baseline condition (Appendix 3). The patient will be eligible for ward/nursery destination whenever all these criteria are met. It is critical to remember that all PAR routines and legislative regulations must be followed.

We immediately define the fundamental and non-transferable interventions for allocating patients to an intensive care unit bed. These are: the need for invasive Mechanical Ventilation (MV) or dependence on non-invasive mechanical ventilation; the use of vasoactive drugs; continuous or invasive monitoring of organic functions and vital signs, including intracranial pressure monitoring[1,10,11]; risk of loss of airway patency or autonomy of ventilatory capacity (whether of neurological or respiratory causes); increased risk of cardiovascular decompensation; high risk of hemorrhage, severe hydro electrolytic disorders with risk of fatal arrhythmias or surgeries in patients with rare diseases under general anesthesia and neuraxial block. In this case, the postoperative evolution is unknown and should be well described in the literature, and, finally, post-cardiac arrest patients (intraoperative)[11-16].

We will divide the following 02 algorithms into patients undergoing elective or urgent/emergency surgeries since these are different categories for a surgical patient regarding the expected severity[16].

Allocation proposal for elective surgeries

The algorithms for ICU indication involving elective surgeries comprise 02 distinct moments: preoperative decision (Figure 1) during the pre-anesthetic evaluation or the intraoperative or immediate postoperative period (Figure 2).

We start in the **preoperative period** of the surgery: surgeries classified as major must have preoperative ICU indication; for minor surgeries, the ICU is not indicated unless the patient’s condition has a high risk of clinical decompensation related to the surgical or anesthetic procedure (example: patients with complex congenital heart diseases; severe pulmonary and neurological disorders); minor surgeries may have ICU indication for the postoperative period when evaluated preoperatively. Includes those patients with moderate to severe risk of cardiovascular diseases; patients with pulmonary diseases who need physiotherapeutic interventions and a higher risk of reintubation or oxygen supply; patients with degenerative muscular or neurological disorders, whose risk of muscle weakness and reintubation may be necessary. Another ICU indication involves surgeries associated with a high risk of acute intraoperative organ dysfunction (e.g., low level of consciousness or muscle weakness in patients susceptible to secondary anesthetics or due to genetic diseases). If in doubt about each patient’s cases allocation, the following question should be asked: “this patient needs to be monitored for more than 12 hours for safety, or he needs a serial collection of exams, or he has the risk of organ dysfunction acute in the next 12 hours?” If one of the responses was yes, this patient should be referred to the ICU; if it was negative, the patient should stay in the Post Anesthesic Recovery and then be referred to the ward if the safety goals were achieved (Figure 1).

Intraoperative ICU indication occurs when detecting clinical criteria related to patient severity since preoperative assessment should have been observed earlier. Therefore, major surgeries maintain the ICU indication in the postoperative period. Medium and minor surgeries should only be indicated for ICU if objective criteria of organic deterioration or new acute organic dysfunction evolve after surgery (Figure 2).

Allocation proposal in cases of urgency/emergency

The following algorithm indicates the ICU for urgent/emergency patients (Figure 3).

In this algorithm, we use the ASA classification; patients classified as ASA higher than or equal to 3 (ASA > or = 3E) should have a postoperative indication inside ICU; patients undergoing major surgery should be referred to the ICU; those undergoing minor surgery will be referred

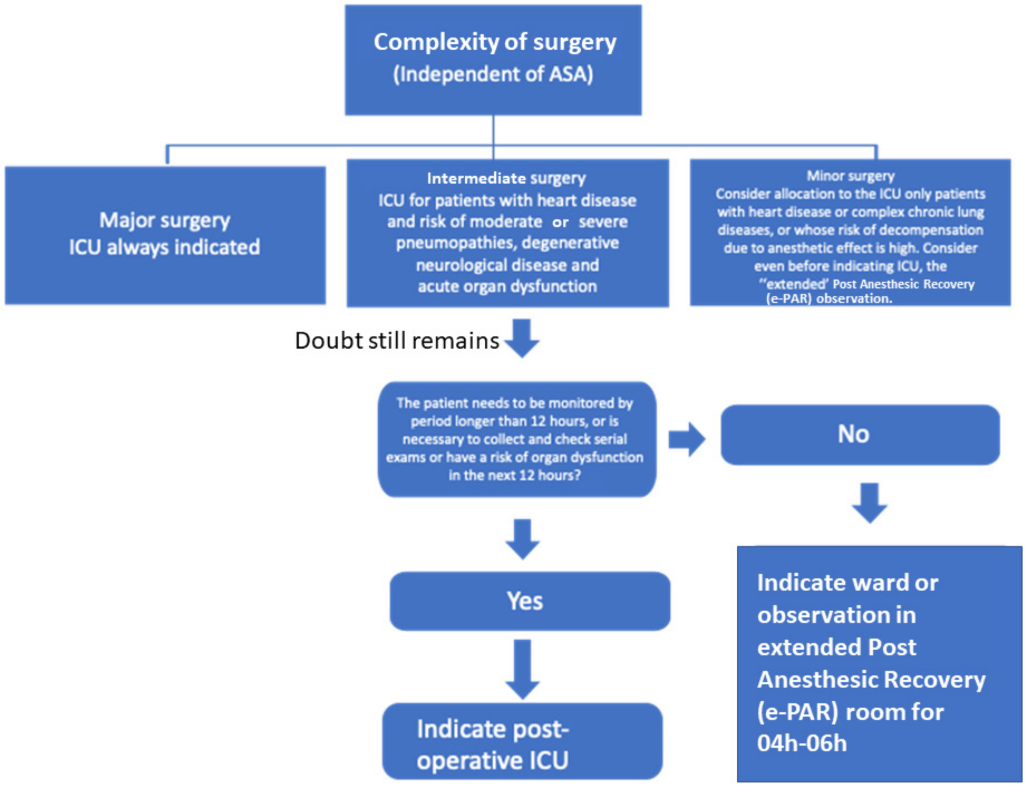

Figure 1. ICU indication in the preoperative period for elective surgeries.

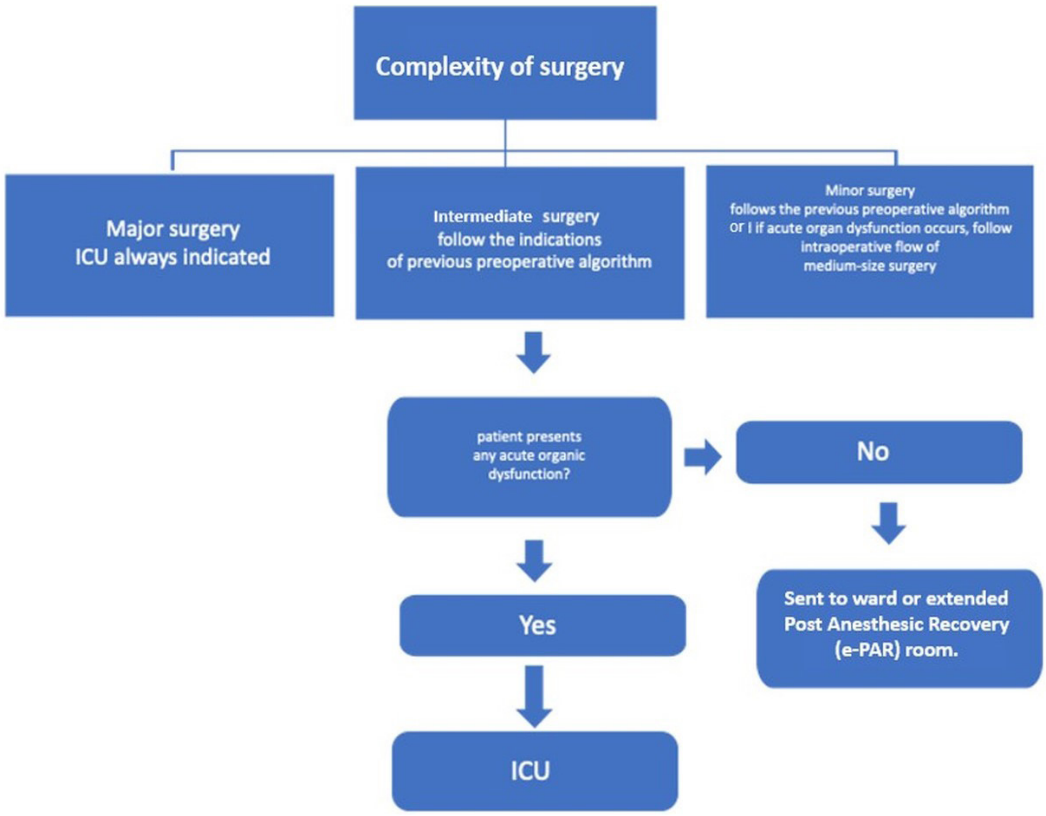

Figure 2. ICU indication in the intraoperative period.

to the ward; finally, patients undergoing medium-size surgery should be assessed for advanced support including vasoactive drugs, or intubation; risk of airway patency loss following the surgical procedure; onset of acute organ dysfunction. If so, this patient should be referred to the ICU. If not, the patient can be referred to

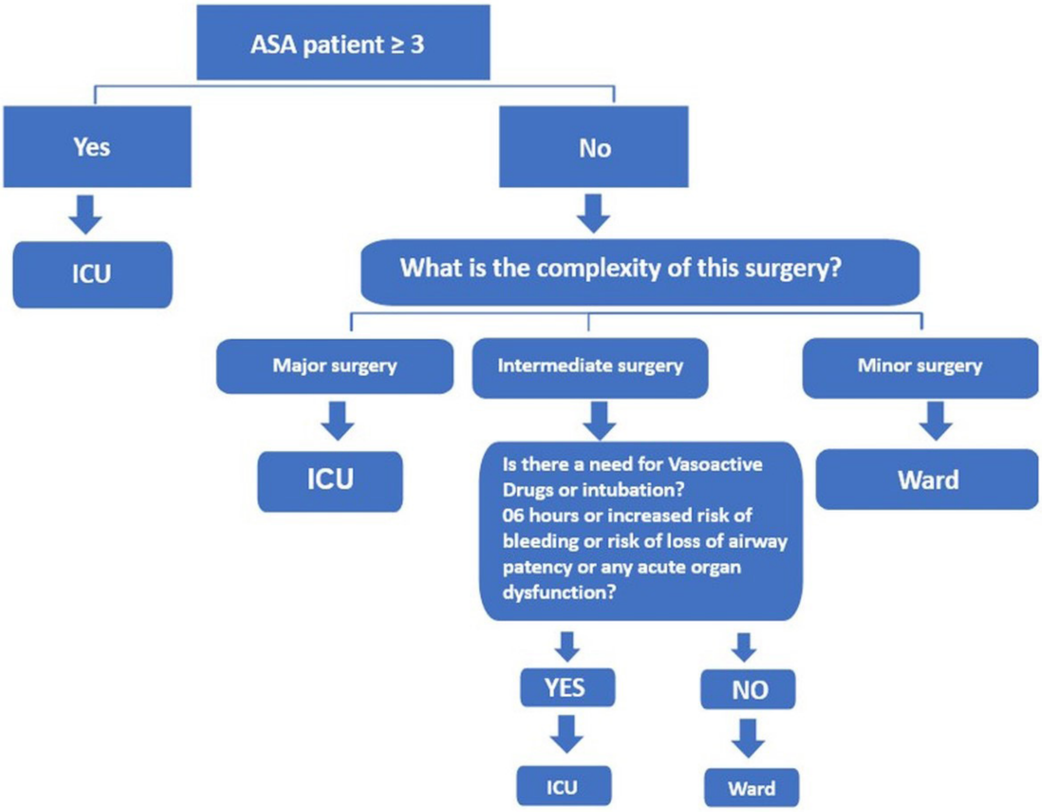

Figure 3. Algorithm for ICU allocation in emergency situations.

the extended Post Anesthesic Recovery (e-PAR) regime, and if all goals are met, the patient can be referred later to the ward.

RATIONALE

Intensive care resources are limited and expensive[9,13,15,17]. Therefore, indicating the surgical patient benefitting from the intensive care unit admission is critical[3,7,18,19]. Although admission to the postoperative intensive care unit is the standard of care for many types of surgery, admission is sometimes arbitrary, driven by local practice or bed availability[3,13]. Low numbers of intensive care beds are a reality in developing countries, such as Brazil[7]. The pandemic of COVID-19[13] further aggravated the situation.

Therefore, this work aims to develop a protocol to help physicians decide when to allocate patients to intensive care for the immediate postoperative period.

EXPECTED RESULTS

The proposed algorithm will help decision-making, seeking to rationalize requests for postoperative ICU vacancies, reducing patient waiting times for a bed unit, improving allocations, and consequently reducing financial costs.

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APPENDIX 1. AMERICAN SOCIETY OF ANESTHESIOLOGY (ASA) PHYSICAL STATUS CLASSIFICATION

Physical Status	Description
ASA I	Healthy patient, without comorbidities
ASA II	Mild systemic disease
ASA III	Severe, non-disabling systemic disease
ASA IV	Severe, disabling systemic disease
ASA V	Dying patient who is not expected to survive without surgery
ASA VI	Brain-dead patient, organ donor
E – Emergency surgery	

APPENDIX 2. THE EXTENDED POST ANESTHESIC RECOVERY (E-PAR) ASSUMES ADDITIONAL COMMITMENTS IN MONITORING ORGANIC FUNCTIONS, PERFORMING PROPHYLAXIS, AND CHECKING DEVICES

Organic Functions and devices	Goals
Neurological	Awake or slightly drowsy or maintain baseline neurological status
Respiratory	1) Patient able to maintain SpO_2 > or equal to 92% without oxygen and without ventilatory effort. Consider Non-Invasive Ventilation (NIV) in the first hours in patients with Chronic Obstructive Pulmonary Disease (COPD), obese and/or with atelectasis, provided there are no contraindications.
	2) Patient maintaining baseline oxygen saturation with a baseline and/or comfortable respiratory pattern.
	3) Absence of bruises on the neck and/or airways that could compromise ventilatio.
Cardiovascular	1) Maintain hemodynamic stability (SBP > 90 and/or DBP > 60 mmHg or MAP > 65 mmHg.
	2) Normal lactate or in progressive whitening.
	3) Normal troponin or without ischemia criteria.
	4) Sinus rhythm or baseline rhythm with hemodynamic stability.
Renal	1) Blood gas analysis without metabolic acidosis or in clear improvement.
	2) Diuresis greater than or equal to 0.5m/kg/hour (adult) or respect the baseline condition, in the case of dialysis patients.
	3) Absence of hydroelectrolytic disorders.
Digestive	Absence of peritonitis and/or significant distension.
Prophylaxis	Check the need for Deep Vein Thrombosis (DVT) and gastric stress ulcer prophylaxis.
Devices	Check proper allocations, fixations and/or removal thereof.
Coagulation	1) Absence of active bleeding that compromises the patient's hemodynamics.

APPENDIX 3. EXTENDED POST ANESTHESIC RECOVERY (E-PAR) - PATIENT STAY IN THE ANESTHETIC RECOVERY ROOM BETWEEN 04 AND 06 HOURS UNDER CONTINUOUS MONITORING AND SUPERVISION OF AN ANESTHESIOLOGIST. PERTINENT POSTOPERATIVE EXAMS FOR THE PATIENT'S SITUATION MUST BE COLLECTED, EVALUATED, AND TREATED (IF NECESSARY) DURING THIS PERIOD. THE PATIENTS' ORGANIC FUNCTIONS SHOULD BE MONITORED AND MUST BE WITHIN NORMAL LIMITS; IF ALL THESE CRITERIA ARE MET, THE PATIENT IS ELIGIBLE FOR WARD/NURSERY DESTINATION. IT IS CRITICAL THAT ALL POST ANESTHESIC RECOVERY (PAR) ROUTINES AND LEGISLATIVE REGULATIONS MUST BE FOLLOWED

Proposed exams:

Exams	Goals
12-lead ECG	Normality or no change in relation to the previous one.
Chest X-ray (if needed)	Normality or no change in relation to the previous one.
Complete blood count with platelets	Hb greater than or equal to 7g/dl (evaluate individually) Platelets > 50 thousand, without bleeding.
Electrolytes (Na; K; Mg^{2+}, Calcium)	Normal Range.
Venous or arterial blood gases with lactate	Normal Range or progressive improvement (elevated or progressively rising lactate and/or sustained metabolic acidosis, should alert the team about the need for ICU allocation).
Troponin (in patients with known or suspected coronary artery disease or with dynamic ECG changes)	Collect at Post Anesthesic Recovery (PAR) admission and repeat after 03 hours; should not rise more than 20% between the 1st and 2nd collections.
Urea and creatinine	Normal range or equal to preoperative values in chronic patients.
Coagulogram, platelets and serum fibrinogen (in cases with risk of bleeding)	Platelets > 50 thousand without bleeding. Fibrinogen > 100 mg/dl
Highly recommended: Point-of-Care ultrasound (lung, heart; hemodynamic)	Exclude injuries; rule out pneumothorax; optimize hemodynamics.