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Original Article

Anaesthesia Section

# Incidence of Postoperative Intensive Care Admissions in Elective Surgical Patients with High-risk Anaesthesia Consent Preoperatively

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## ABSTRACT

**Introduction:** Surgical patients who require high-risk anaesthesia consent are often at risk of developing perioperative complications and morbidity often warranting postoperative Intensive Care Unit (ICU) admissions.

**Aim:** To study the incidence of postoperative ICU admissions among surgical patients who require high-risk anaesthesia consent preoperatively.

**Materials and Methods:** A retrospective study using chart analysis of 64 patients who required high-risk consent for elective surgery over a period of 18 months from January 2018 to July 2019 was done. The details on demographics, the American Society of Anaesthesiologists (ASA) class, the reason for obtaining high-risk consent, type of anaesthesia administered, intraoperative events, duration of surgery and reason for shifting to Intensive Care Unit (ICU) was collected and recorded. Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) software, version 20.0. Multiple logistic regressions were performed to determine the predictors of postoperative ICU admissions.

**Results:** Out of 64 high-risk patients, 35.9% of patients were shifted to ICU postoperatively, with the most common reason for ICU admission being metabolic/haemodynamic instability intraoperatively (47.8%). Among the various preoperative factors (presence of cardiovascular, respiratory diseases with poor reserve or functional impairment, chronic kidney disease, morbid obesity) for obtaining high-risk consent, anticipated long duration surgery with blood loss was associated with a 3.9 {95% CIs of 1.25 and 12.22} times higher odds of being shifted to ICU postoperatively.

**Conclusion:** About one-third of elective surgical patients who required high-risk anaesthesia consent preoperatively required ICU admission postoperatively. In addition, anticipated long duration surgery with blood loss was found to be an independent predictor of ICU requirement postoperatively.


**Keywords:** Elective surgical procedure, Informed consent, Intensive care unit, Surgical blood loss

## INTRODUCTION

Due to a growing threat of litigation and medico-legal issues, a large number of surgeries are being conducted under high-risk anaesthesia consent [1,2]. Data on characteristics and outcome of postoperative follow-up of these patients who require high-risk anaesthesia consent preoperatively are often limited and inadequate [3,4]. A fraction of these patients are often shifted to ICU postoperatively. In a study, 12.3% high-risk surgical population was detected, which constituted to 83% deaths, however of these only 15% were admitted to ICU postsurgery suggesting inadequate critical care provision and reservations [5]. Thus, a better preoperative identification and preparedness for high-risk patients is required.

Though some scoring systems such as Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM) and Portsmouth-POSSUM (P-POSSUM) are used to identify patients who require ICU admissions following surgery, there are no universally followed criteria for admitting surgical patients to the ICU [6]. It is often difficult to determine which patients are at risk of developing postoperative complications. At the same time, it might not be possible to do preoperative ICU bed reservation for all high-risk anaesthesia patients. Hence, an appropriate triage of these patients for elective ICU reservation based on evidence is warranted especially in a resource limited setting.

Many a time, it is seen that patient's relatives are provided with either inadequate or too much information containing medical jargons in an attempt to obtain high-risk consent which may be counter-productive and lead to confusion [7]. Evidence on postoperative ICU requirement in patients who required high-risk anaesthesia consent preoperatively might help the anaesthesiologist in future to facilitate patient surrogates to have a better understanding of the significance of signing a high-risk consent form and making a balanced decision.

The aim of the study was to study the incidence of postoperative ICU admissions among patients who required preoperative high-risk anaesthesia consent for elective surgery.

## MATERIALS AND METHODS

The retrospective observational study was performed in Pondicherry Institute of Medical Sciences after obtaining Institutional Ethical Committee Clearance (Ref No. IEC:RC/18/108). Retrospective chart analysis of patients who required high-risk consent for elective surgery from January 2018 to July 2019 was performed with the data retrieved from the Medical Records Department.

**Inclusion and Exclusion criteria:** All patients from the record who required high-risk anaesthesia consent were included in the study. Patients who underwent cardiothoracic surgery and patients already in ICU preoperatively were excluded from the study as these patients were invariably shifted to ICU as per institute protocol. In addition, patients undergoing emergency surgical procedures were also excluded.

### Study Procedure

Data was collected by the researchers and organised by the primary author. For each patient, demographic details, the ASA class, the reason for obtaining high-risk consent, type of anaesthesia administered, intraoperative events (requirement of inotropes, blood and invasive monitoring), duration of surgery, reason for shifting to ICU and number of days of ICU stay was recorded.

**Sample size calculation** was done from a previous similar study [5] taking incidence of postoperative ICU admissions among high-risk surgical patients (15%) as the primary outcome. A minimum of 51 patients would be required in the present study to determine a similar proportion with a power of 80% and an alpha error of 0.05.

## STATISTICAL ANALYSIS

Statistical analysis was performed with the SPSS software, version 20.0. Categorical variables were summarised as frequencies and percentages and continuous variables were summarised as mean and standard deviation. Univariate logistic regression analysis was conducted to determine the association between the odds of being shifted to ICU postoperatively and the potential independent variables. Only those variables which showed trend level association (p-value <0.2) on univariate analysis were entered into the equation of multiple logistic regression analyses. Chi-square test was done to detect the association between type of anaesthesia and various intraoperative interventions (namely inotropes, blood transfusion and invasive monitoring) with postoperative ICU admission. Association between duration of surgery and postoperative ICU admission was evaluated using Spearman correlation analysis.

## RESULTS

During the study period of 18 months, a total of 64 patients required high-risk anaesthesia consent preoperatively among the patients undergoing elective surgical procedures. The mean age of study population was 60.56±15.86 with 81.25% of patients belonging to ASA II and III [Table/Fig-1].

| Patient characteristics | N (number of patients) |
|---|---|
| Age (years) | 60.56±15.86* |
| Sex (M/F) | 43/21 |
| **Department** | **n (%)** |
| Orthopaedics | 34 (53.1) |
| General surgery | 15 (23.4) |
| Obstetrics | 3 (4.7) |
| Plastic surgery | 3 (4.7%) |
| General medicine | 6 (9.4) |
| Neurosurgery | 1 (1.6) |
| Urology | 2 (3.1) |
| **ASA physical status** | |
| I | 12 (18.8) |
| II | 28 (43.8) |
| III | 24 (37.5) |
| **Type of anaesthesia** | |
| General anaesthesia | 43 (67.2) |
| Regional anaesthesia | 11 (17.2) |
| Peripheral nerve block | 10 (15.6) |

**[Table/Fig-1]:** General Characteristics of elective surgical patients requiring high-risk consent preoperatively.
*Age expressed as mean±SD

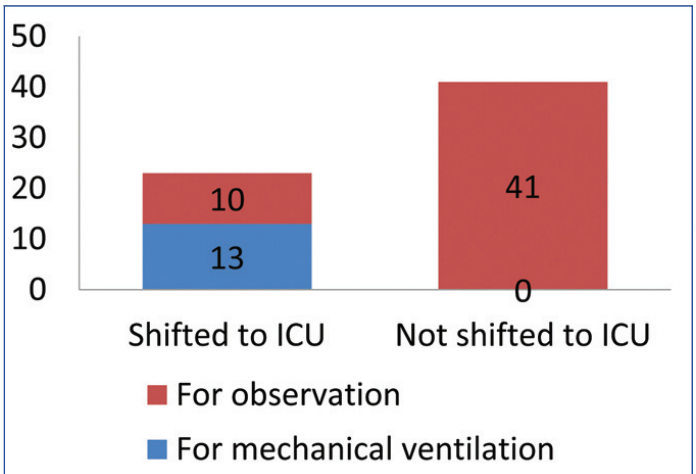
The major reasons for obtaining high-risk consent were presence of preoperative cardiovascular disorder (51.6%) and presence of more than one systemic condition preoperatively (51.6%). Majority of risk consent preoperatively were administered general anaesthesia as compared with regional or peripheral nerve blocks [Table/Fig-1,2].

Out of 64 high-risk patients, 23 patients were shifted to ICU (35.9%) with the most common reason for ICU admission being haemodynamic/metabolic instability intraoperatively [Table/Fig-3,4. Anticipated long duration of surgery was found to be correlated with postoperative intensive care (rho coefficient 0.384, p-value 0.002).

Regression analysis was conducted to find the independent predictors of ICU admission among high-risk patients. Only those

| Reason preoperatively | n (%) |
|---|---|
| Presence of cardiovascular disorder | 33 (51.6) |
| Presence of respiratory disorder | 18 (28) |
| Presence of renal disorder | 15 (23.4) |
| Presence of neurological disorder | 10 (15.6) |
| Anticipated long duration with blood loss | 22 (34.4) |
| Presence of other reasons* | 19 (29.7) |
| Presence of more than one reason | 33 (51.6) |

**[Table/Fig-2]:** Reasons for obtaining High-risk consent.
*Other reasons include severe anaemia, morbid obesity with obstructive sleep apnea, deranged liver function tests with severe malnourishment




**[Table/Fig-3]:** Bar chart showing fraction of patients shifted to ICU postoperatively among patients requiring high-risk consent preoperatively.
*number of patients

| Reason | n (%) |
|---|---|
| Trial extubation failure | 4 (17.3) |
| Haemodynamic/metabolic instability intraoperatively | 11 (47.8) |
| Planned elective postoperative ICU stay/mechanical ventilation | 8 (34.7) |
| Total | 23 |

**[Table/Fig-4]:** Reasons for shifting high-risk consent patients to ICU postoperatively.

variables which showed trend level association (p-value <0.2) on univariate analysis were entered into the equation of multiple logistic regression analysis. Univariate logistic regression analysis revealed age (OR 0.96, 95% CI 0.93-0.99, p-value 0.04) and preoperative anticipated long duration surgery with blood loss (OR 4.62, 95% CI 1.52-13.99, p-value 0.007) to have a significant association with patients being shifted to ICU postoperatively [Table/Fig-5]. Multivariate logistic regression analysis revealed anticipated long duration of surgery remained significant after adjusting for age (OR 3.90 CI 1.25-12.21, p=0.019) [Table/Fig-5]. The model had 67.2% of correct classification rate and explained about 20.3% of the variance (Nagelkerke $r^2$=0.203).

| Preoperative patient parameters | Shifted to ICU (n=23) | Not shifted to ICU (n=41) | OR (95% CI) | p-value |
|---|---|---|---|---|
| **Univariate logistic regression** | | | | |
| Age (years) | 54.96±19.26 | 63.71±12.80 | 0.96 (0.93-0.99) | 0.04 |
| ASA (I/II/III) | 3/10/10 | 9/18/14 | 1.424 (0.69-2.93) | 0.617 |
| **Reason for obtaining high-risk consent** | | | | |
| Presence of cardiovascular disorder | 12 | 21 | 1.03 (0.37-2.88) | 0.942 |
| Presence of respiratory disorder | 6 | 2 | 0.85 (0.27-2.68) | 0.786 |
| Presence of renal disorder | 5 | 10 | 0.86 (0.25-2.91) | 0.810 |

| | | | | |
|---|---|---|---|---|
| Presence of neurological disorder | 5 | 5 | 2.00 (0.51-7.81) | 0.319 |
| Anticipated long duration with blood loss | 13 | 9 | 4.62 (1.52-13.99) | 0.007 |
| Presence of more than one reason | 12 | 21 | 1.03 (0.37-2.88) | 0.942 |
| **Multivariate logistic regression** | | | | |
| Age (years) | 54.96±19.26 | 63.71±12.80 | 0.97 (0.93-1.00) | 0.122 |
| Anticipated long duration with blood loss | 13 | 9 | 3.90 (1.25-12.21) | 0.019 |

**[Table/Fig-5]:** Comparison of high-risk consent patients according to outcome based on preoperative parameters.

The mean postoperative ICU stay was 2.87±1.79 days with 0.67±0.65 ventilator days. The mean duration of surgery and intraoperative requirement of inotropes, blood and invasive monitoring were significantly high in patients shifted to ICU [Table/Fig-6].

| Intraoperative parameters | Shifted to ICU (n=23) | Not shifted to ICU (n=41) | p-value |
|---|---|---|---|
| Duration of surgery (hours) | 5.04±3.00 | 2.88±1.14 | 0.002 |
| **Type of anaesthesia** | | | |
| General anaesthesia | 21 (91.3%) | 22 (53.6%) | 0.006 |
| Regional anaesthesia | 2 (8.6%) | 9 (21.9%) | |
| Peripheral nerve block | 0 | 10 | |
| **Intraoperative interventions** | | | |
| Intraoperative Ionotropes | 7 | 2 | 0.008 |
| Intraoperative blood transfusion | 11 | 0 | <0.001 |
| Intraoperative invasive monitoring | 16 | 6 | <0.001 |

**[Table/Fig-6]:** Comparison of high-risk consent patients according to outcome based on intraoperative parameters.

## DISCUSSION

A report by the American Medical Association reveals over 57% of physicians in surgical specialities have been sued. It was seen that a majority of legal suits imposed by the patient on the anaesthesiologists have been due to lack of adequate information provided about the complications of anaesthesia or their expected postoperative outcomes [8]. Identifying which of the patients are at risk of developing complications or require ICU admission postoperatively often remains difficult [4]. Hence, it becomes mandatory to obtain a high-risk anaesthesia consent in a patient who is likely to be at high-risk of developing perioperative complications related to anaesthesia and surgery.

When the reasons for obtaining high-risk anaesthesia consent were analysed in the study retrospectively, it was found that high-risk consent was obtained from patients having cardiovascular disorders (Ischaemic heart disease, structural heart diseases with poor cardiac reserve/functional impairement, respiratory diseases, neurological (cerebrovascular disease, Alzheimer's, Parkinson's disease) and renal disorders (chronic kidney disease). The most common reason among them, was presence of cardiovascular disorder (51%) which included presence of coronary artery diseases, valvular lesions and other cardiac disorders likely to worsen or derange under anaesthesia.

In this study, 35.9% of the elective surgical patients who required high-risk anaesthesia consent preoperatively were shifted to ICU postoperatively while the remaining patients were shifted to post anaesthesia care unit.

In one of the retrospective studies done by Uzmaan S et al., on postoperative patients admitted to ICU, it was found that haemodynamic/metabolic instability constituted to 41% of the reasons for ICU admissions postoperatively [2]. The above findings are similar to our study where haemodynamic/metabolic instability constituted to 47% of patients who required postoperative ICU stay. In a prospective, observational study done by Patel SK et al., on 240 patients admitted to surgical ICU postoperatively revealed, anticipated blood loss and anticipated mechanical ventilation were responsible for majority of planned admissions whereas unexpected intraoperative hypotension was the principal cause of unplanned admissions into the ICU [9].

Routine postoperative care in ICU after high-risk surgical procedures may allow for greater recognition and correct management of postoperative complications, thereby reducing long term mortality and morbidity [3]. However, due to limited number of ICU beds worldwide, it becomes difficult to reserve ICU bed/shift all high-risk patients to ICU postoperatively [10]. Also, there is wide difference in nature and practice of triage decision for postoperative patients [4,11].

The characteristics and outcomes of high-risk patients shifted to ICU vs not shifted to ICU were studied and it was found that the ASA classification had no impact/association with patients being shifted or not shifted to ICU. There was no statistically significant difference in ASA class between the two groups. ASA classification is one of the known scoring systems used preoperatively to assess postoperative outcomes and takes into account the patient's premorbid status [12]. Several retrospective studies have demonstrated a correlation between ASA classification and perioperative mortality and suggested its usefulness as a predictor of patient outcome [13,14]. However in the present study, the primary outcome studied was the need for ICU admission postoperatively and it was found that ICU admission was not associated with high ASA scores. This could be explained by the fact ASA classification does not determine individual patient risk and surgical procedure. Moreover, literature determining the association between ASA scores and requirement of ICU postoperatively is scarce. It shows a poor ability to identify individuals likely to experience complications in the postoperative period or predicting ICU requirement because the outcome of shifting to ICU is often a complex interplay of patient's preoperative status, type of anaesthesia, anaesthesia complications and the type of surgery performed [15,16]. Thus, the scoring system is insufficient for predicting postoperative outcomes.

Reasons for obtaining high-risk consent were analysed to find if there were any significant association between preoperative parameters and requirement of ICU postoperatively. Anticipated long duration of surgery with blood loss was associated with a 3.9 times higher odds of being shifted to ICU postoperatively, suggesting it to be an independent predictor/determinant of ICU admission postoperatively.

In a UK perspective audit of patients having inpatient surgery, it was found that the patients having preoperative cardiovascular disease (IHD, arrhythmias and heart failure) had a major 30 day mortality compared to other patients [17]. A number of preoperative risk indices (RCRI, Lee's cardiac index) also include presence of Cardiovascular System (CVS) disease to be a major factor in predicting mortality [18,19]. In this study, presence of CVS disorder constituted a major fraction of patients who required high-risk consent (51.6%), however mere presence of CVS disease failed to establish association with ICU requirement postoperatively. Only 36.3% of CVS patients were shifted to ICU. Adequate preoperative optimisation and intraoperative careful anaesthetic management in these patients especially in an elective setting could have been the probable reason for not requiring ICU postoperatively. However, they are more prone to develop arrhythmias and sepsis related complications in the late postoperative period which was not followed-up and assessed in the present study.

In the present study, patients shifted to ICU had more frequently received general anaesthesia (91.3%), with long duration of surgery (rho coefficient 0.384, p 0.002) and greater intraoperative interventions (p-value<0.05). Uzmann S et al., retrospectively analysed postoperative patients admitted to ICU and found 85.8% patients had received general anaesthesia in comparison to only 14.2% regional anaesthesia suggesting a wide use of general anaesthesia in high-risk patients likely to be shifted to ICU postoperatively [2].

Though, it is mandatory to obtain informed high-risk anaesthesia consent from patients with known cardiovascular, respiratory or renal disorders with poor systemic reserve and/or functional impairment, elective ICU reservation might not be practically feasible for all the patients [20]. In the present study, patients in whom a long duration surgery was anticipated and obtained a high-risk consent preoperatively, there was higher odds of being shifted to ICU postoperatively compared to other reasons suggesting it to be a strong predictor of ICU requirement postoperatively. Hence, elective ICU reservations for such patients are warranted.

The main strength of this study lies in the fact that it reflects the existing practices of postoperative ICU admissions in a clinical setting. Due to the broad nature of inclusion criteria, the results are generalisable to a wide variety of elective surgical patients from various surgical disciplines.

### Limitation(s)

Due to the retrospective nature of study, it was not possible to have predefined criteria for obtaining high-risk consent or for shifting to ICU postoperatively. Details on postadmission follow-up data in regard to ICU morbidity, mortality or discharge was not assessed in the present study.

## CONCLUSION(S)

About one third of elective surgical patients who required high-risk anaesthesia consent preoperatively required ICU admission postoperatively. Preoperative anticipated long duration surgery with blood loss was found to be an independent predictor of ICU requirement postoperatively. Future prospective and multi-centric studies would be warranted to establish the temporal relationship between preoperative variables and postoperative ICU admissions. Development of robust evidence based criteria will help in identifying patients who would benefit most from postoperative ICU admissions.

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