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ORIGINAL RESEARCH INTENSIVE CARE

Evaluation of risk factors for postoperative ICU admission in a tertiary care hospital – A case control study

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Abstract

Background & objective: Appropriate decisions regarding admission of potential patients to intensive care unit (ICU) postoperatively are considered very important for the patient care**.** We evaluated the reasons and the risk factors for postoperative ICU admissions in our hospital.

Methodology: This is a case-control study, that was done at Security Forces Hospital, Riyadh, during the period from July 2019 to December 2019. We included all patients who needed ICU admission postoperatively in the study as cases. The controls were the patients who had any surgical procedure during the same study period. Patients' demographics, ASA status, medical co-morbidities and operation details were recorded. We then did univariate and multivariate logistic regression to analyze the data. A p-value of less than 0.05 was considered as significant.

Results: We enrolled a total of 140 patients in the study, with 46 cases and 94 controls. In univariate analysis, age, ASA status, presence of hypertension, diabetes, ischemic heart disease, respiratory disease, renal dysfunction and neurological abnormalities were found to be statistically significant predictors for postoperative ICU admission. In multivariate analysis, ASA status and perioperative neurological abnormalities were the most significant risk factors for ICU admission.

Conclusion: ASA status and presence of neurological abnormalities are the most significant risk factors associated with ICU admission in the postoperative period.

Key words: Risk factors; ICU; ICU admission; Postoperative period; ASA status

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1. Introduction

Patients with high risk co-morbidities or who undergo high risk surgical procedures, represent a substantial proportion of intensive care unit (ICU) admissions in most of the developed countries.[1]

There are multiple perioperative factors which contribute to morbidity or mortality in this group of patients. The priority for admission to an ICU needs to be given to the patients who will get the most benefit from the highest level of perioperative care.[2] Appropriate decisions regarding admission of potential patients after having surgery are therefore, considered very important for the patient care, although to identify such patients very accurately might not be easy. Among others, the human factors would always play a part in such decisions. There is

always a potential either to underuse or overuse the critical care resources.[3] A study in the United Kingdom showed that patients who underwent high risk surgical procedures comprised only 12.5% of the surgical admissions to hospitals but more than 80% of mortalities; while fewer than 15% of these patients were admitted to an ICU after the surgery.[2]

This study evaluated the reasons and the risk factors for postoperative ICU admission in our hospital.

2. Methodology

This case-control study was conducted at Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia during the period between July 2019 to December 2019. Institutional ethical committee approval was taken. Cases were defined as the patients who required postoperative ICU admission within 24 h after surgery during the study period. Controls were the patients who did not require ICU admission following a surgical procedure during the same study period. We excluded patients who came to operating room (OR) from ICU and pediatric patients (aged under 16 y). Data were identified and collected by retrospective review of OR list, ICU admission sheets and anesthesia charts electronically. Data included demographics of the patients, the type of anesthesia, surgical procedure, duration of surgery, ASA classification and associated medical co-morbidities. All data were entered and analyzed in SPSS version 26.

Numerical data are represented as mean and categorical data are represented as percentages. Univariate analysis was done to assess individual risk factors for postoperative ICU admission. We then constructed a final model where multivariate logistic regression was used to assess risk factors for postoperative ICU admission. A $p < 0.05$ was considered as significant.

3. Results

A total of 140 patients were included in our study. Among them, 46 (32.9%) were cases vs. 94 (67.1%) as controls in the ratio of 1:2. Mean age of patients was 54.95 years. 56 (40%) of patients were females and 84 (60%) were males. Most of the patients belonged to ASA class 3 [58 (41.4%)] followed by ASA 2 [53 (37.9%)], then ASA 4 [21 (15%)] and ASA 1 being 8 (5.7%). The most common surgeries in both groups were neurosurgical proedures with 17 (36.9%) in cases vs. 36 (38.2%) in controls followed by general surgery 17 (36.9%) vs. 32 (34.04%) respectively and followed by others as 12 (26%) vs. 26 (27.65%) respectively. The distribution of cases and controls among surgical risk groups is shown in Figure 1.

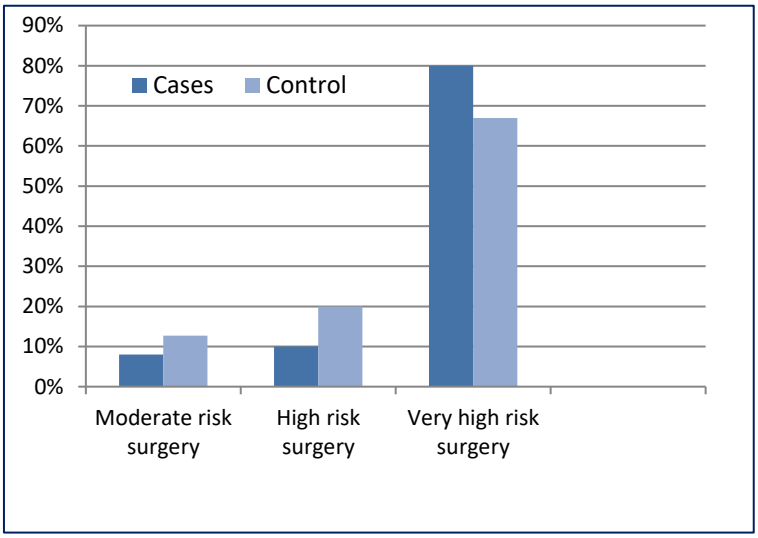

Figure 1: Distribution of cases and controls in different risk surgeries

Among cases, 41 (89%) patients had GA followed by 4 regional blocks/neuraxial blocks and one sedation only. Among controls, 81 (86%) patients had GA followed by 6 cases of regional, 6 neuraxial block and one sedation only. Thirty-four (74%) of cases were known hypertensive vs. 37 (39.3%) in controls.

Table 1: Comparison of risk factors for ICU admission

Variable	Cases 46 (32.9%)	Controls 94 (67.1%)
GA	41 (89)	81 (86)
regional blocks/neuraxial blocks	4 (8.7)	12 (12.5)
sedation only	1 (2.17)	1 (1)
Hypertension	34 (74)	37 (39.3)
Diabetes	32 (69.5)	44 (47)
respiratory diseases	10 (21.7)	40 (42)
Mechanical ventilation	13 (28)	

Table 2: Common reasons for postop ICU admission

Reason for admission	N (%)
neuro-observation	17 (36.9)
cardiovascular monitoring	13 (28.2)
sepsis	9 (19.5)
intraoperative cardiac events	2 (4.5)
prolonged surgery	2 (4.5)
intraoperative arrest	1 (2)
Diabetic ketoacidosis	1 (2)
increased O_2 requirement postoperatively	1 (2)

Thirty-two (69.5%) of cases were diabetic vs 44 (47%) among controls. Thirteen (28.2%) of cases had known ischemic heart disease compared to 7 (7.4%) in controls. Ten (21.7%) of cases had respiratory diseases vs. 40 (42%) in controls. Thirteen (28%) of the patients among cases were ventilated in ICU (Table 1).

Table 2 shows the most common reasons for ICU admission among cases was for neuro-observation 17 (36.9%) cases followed by requirement for cardiovascular monitoring 13 (28.2%), sepsis 9 (19.5%), intraoperative cardiac events 2 (4.5%), prolonged surgery 2 (4.5%), intraoperative arrest 1 (2%), Diabetic ketoacidosis 1 (2%) and increased Oxygen requirement postoperatively 1 (2%).

In univariate analysis, the risk factors for ICU admission included age (p-value, 0.004), ASA class (p-value, 0.00), hypertension (p = 0.00), DM (p = 0.012), IHD (p = 0.002), respiratory diseases (p = 0.018), renal dysfunction (p = 0.004), neurological abnormality (p = 0.00). We then constructed a final multivariate logistic regression; we found ASA (p = 0.028) and presence of neurological disease or abnormality (p = 0.012) as risk factors for postoperative ICU admission as shown in Table 3.

Table 3: Multivariate logistic regression for risk factors of postoperative ICU admission

Characteristics	Unadjusted Odds ratio	Adjusted Odds ratio	p-value
ASA	4.06 (2.28-7.22)	3.26 (1.13-9.41)	0.028*
Hypertension	4.36 (2.00-9.49)	1.76 (0.57-5.40)	0.32
Diabetes	2.59 (1.23-5.48)	0.69 (0.22-2.12)	0.51
Congestive heart disease	6.48 (0.65-64.19)	3.72 (0.26-51.90)	0.32
Respiratory disease	0.37 (0.16-0.84)	0.39 (0.14-1.12)	0.08
Neurological disease	6.07 (2.45-15.03)	3.84 (1.34-10.99)	0.012*
Surgical severity	0.78 (0.17-3.53)	0.77 (0.09-6.45)	0.81

4. Discussion

Indirect admission to ICU in the postoperative period after initial ward care carries a higher risk of 30-days mortality compared to direct admissions (20.9% vs 12.1%). [4] One of the factors affecting the postoperative ICU admissions is poor triage of high risk patients [2]. There are several risk scoring systems like P-POSSUM (Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity), SORT (Surgical outcome risk tool) or ACS NSQIP (American college of surgeons National Surgical Quality Improvement Program) which help to predict morbidity or mortality in the postoperative period. However, these scores do not predict the severity of postoperative complications, and therefore, the required level of care. [5, 6]

Most clinicians will adjust these scoring systems or criteria on individual clinical judgement and other factors as well. These factors include organisational factors like bed availability, timing etc and non-medical factors like patients' wishes or other related ethical issues [7]. Another important factor to be considered is the occurrence of any perioperative adverse events which has been shown to worsen the postoperative outcome.[5] In our study, perioperative adverse events accounted for about 13% of ICU admission.

In one systematic review, [8] age, anaemia, ASA class, Body mass index (BMI), male gender, obstructive sleep apnoea, bleeding and duration of surgery were shown to be independent risk factors for unplanned ICU admission. Nadal et al in their study also showed that age significantly affects the likelihood of ICU

admission in the postoperative period [9] as was the case in univariate analysis in our study although age was not found to be a significant risk factor in our multivariate logistic regression model. Harrison et al [10] in their study demonstrated that age, female gender, ASA class, presence of cardiac co-morbidities, intraoperative bleeding and length of surgery were associated with an increased likelihood of ICU admission in the postoperative period. Our study also found ASA class and the presence of neurological abnormality as major significant risk factors for postoperative ICU admission. We, therefore, recommend having a specialized ward or unit in the ward where these patients could be moved for close neuro-observation postoperatively. This could avoid the burden on bed occupancy in ICU. There are some limitations to our study. Firstly, it is a case-control study and the sample size was small. This is a single centre study. In conclusion, ASA class and perioperative neurological abnormalities are most significantly associated with ICU admission in the postoperative period.

5. Conflicts of Interest

None

6. Authors' contribution

AUH: Concept, literature search, study design, data collection, data analysis, write up, editing, final approval

UR: Study design, data analysis, write up, manuscript editing, final approval

MY: Literature search, data collection, manuscript editing, final approval

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