A prospective study of clinical and demographic profile of post-operative patients admitted in intensive care units of GMC, Srinagar (SMHS & SSH:ICU)

Dr. Shabir Ahmad Shabir[1], Dr. Shazia Banoo[2], Dr. Ch Abdul Rahoof[3]*, Dr. Rukhsana Najeeb[4], Dr. Hina Bashir[5]

[1]Assisstant professor, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical College Srinagar India.

[2]Post Graduate scholar, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical College Srinagar India.

[3*]Post Graduate scholar, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical College Srinagar India.

[4]Professor & HOD, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical Collage Srinagar India.

[5]Professor, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical College Srinagar India.

***Corresponding Author:** Dr. Ch Abdul Rahoof

*Post Graduate scholar, Department of Anaesthesiology and critical care, pain and palliative medicine, Government Medical College Srinagar India. Mail id: rahoofgmc@gmail.com

Abstract:

Background: Clinico-demographic profile, pre-anesthetic illness of patients, surgical procedure and anaesthetic technique, experience of surgeon and anaesthetist and duration of anaesthesia play a vital role in the development of peri-operative complications and subsequent admission to intensive care unit (ICU). Over 40% admissions in ICU are of postoperative patients.

Aim: To study the clinical and demographic profile, reason for admission, course and outcome of postoperative patients, in our intensive care unit.

Methods: Admission profile of 135 patients in the Intensive Care Units of SMHS and SSH hospital (Associated hospital of GMC Srinagar) was observed over a period of one and half year belonging to various surgical specialities, both elective and emergency admissions were included in the study. Evaluation was done under demographic and clinical parameters.

Statistical Analysis: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A p value of less than 0.05 was considered statistically significant.

Results: The age of study patients vary from 20 to 70 years with mean age of distribution was 47.2±20.97 years. Maximum numbers of study patients were between the age of 41 and 49 years.

Highest numbers of patients (41.5%) were post-surgical with exploratory laparotomy followed by Craniotomy with tumor decompression (12.6%). 58.5% were emergency surgeries while as 41.5% were elective cases. Main reason for ICU admission was haemodynamic unstability (37.8%) followed by Metabolic acidosis with hemodynamic unstability (15.6%) among the study population. 52.6% of patients admitted to our ICU during study period belong to planned group, among which 80.4% were elective surgical patients and 19.6% emergency surgical patients, while as 47.4% of the ICU patients were unplanned, among which 19.6% were elective surgical patients and 67.1% were emergency surgical patients. Mortality in planned group was 35.2% (25/71) and in unplanned group it was 39.1% (25/64). The overall mortality rate was 37.0%.

Conclusion: Thorough preoperative evaluation and preoperative optimization of patients whenever possible can reduce the incidence of unplanned admission to ICU. Early recognition of complications, timely intervention, and timely intensive care admission and monitoring are essential to improve outcomes.

Keywords: Intensive care unit (ICU), Demographic Profile, hemodynamic characteristics, Planned and unplanned admission, Anaesthesia, Mortality.

Introduction:

The practice of anaesthesia has long been associated with potential disasters but now-a-days there has been a significant decrease in the rate of major morbidities and mortalities due to advancement in anaesthetic techniques and skills acquired by anaesthetists. Nevertheless, though uncommon still both morbidities and mortalities have been reported due to anaesthesia and surgery related complications, which lead to intensive care unit admission, observation and further management of these patients.[1]

Clinico-demographic profile, pre-anesthetic illness of patients, surgical procedure and anaesthetic technique, experience of surgeon and anaesthetist and duration of anaesthesia play a vital role in the development of peri-operative complications and subsequent admission to intensive care unit (ICU).[2,3] Over 40% admissions in ICU are of postoperative patients.[4,5]

Patients admitted to ICU after developing a postoperative complication tend to have worse outcomes than those who are planned for postoperative ICU care. Hence, planned postoperative admissions are meant to prevent any anticipated complication, thereby reducing the risk of a poor outcome.[6] An unplanned admission to an intensive care unit which has occurred within twenty-four hours of surgery has been regarded as adverse outcome. Such an unfavorable outcome results from inherent risk factors and combination of coincidences and even misjudgments in the peri-operative period. Multiple factors are known to influence the overall patient outcome and risk of complications; these include extreme age groups, immuno-compromised status of patient, duration of surgery, type and nature of surgery - emergency procedure and unplanned admission.[2,3] Determining these risk factors will help in identifying the patients who are at risk of later deterioration and, therefore, who could be benefitted from planned admission in intensive care unit.

With this background, the present study was undertaken to analyse the Intensive Care Unit Admissions (ICU) from the operating room in a tertiary and teaching hospital. Our own choice of requiring ICU admission as the criterion for entry to the study is, not only a valid indicator of the severity of morbidity but will also provide a useful application to the planning of resources for post-operative care.

Methods:

The present study was conducted in the Intensive Care Units of SMHS and SSH hospital (Associated hospital of GMC Srinagar). These are tertiary care hospitals, providing surgical and ICU facilities to various surgical specialities that is, Neurosurgery, Cardio Vascular Thoracic Surgery (CVTS), Gastrointestinal (GI) Surgery, ENT, Urology, Paediatric and plastic surgery etc. In addition to these Super-specialities, emergency and elective general surgical procedures are also being carried out. It was a prospective hospital based observational study of postoperative patients admitted to intensive care unit and study was conducted over a period of one and half year with effect from September 2020.

All postoperative patients admitted to Intensive care unit (ICU) of SMHS hospital and SSH Hospital (Associated Hospital of GMC Srinagar) were enrolled in the study after taking proper consent.

Inclusion Criteria:
All postoperative patients requiring monitoring or mechanical ventilation in ICU.

Exclusion Criteria:
1. Patients who were already admitted to the intensive care unit before surgery.
2. Patients admitted to intensive care after 48 hours of the surgical procedure.
3. Patients staying in intensive care unit for less than 12 hours (for monitoring only).

Evaluation was done under demographic and clinical parameters.
Data regarding following were recorded:

- Demographic profile (age, gender and residence)
- ASA Physical status
- Nature of Surgery (Elective / Emergency)
- Surgical procedure
- Anaesthetic technique
- Duration of Anaesthesia
- Nature of admission to intensive care unit (Planned / Unplanned)
- Length of Intensive care unit care stay.
- Status of patient in intensive care unit.
- Final outcome of patient.

Results:

A total of 135 patients were included in the study with a mean age of 47.2+20.97 years. Out of all study patients 57.0% were males while 43.0% were females. The main characteristics of patients are summarised in [Table 1].

Table 1: Demographic profile of the study population

Variables	Frequency	%
Male/ Female	**77/58**	**57.0/43.0**
Rural/Urban	**80/55**	**59.3/40.7**
ASAI/II	**41/94**	**30.4/69.6**
(Age) Mean±SD=47.2±20.97 (Years)		

Patients were included from various Department including General Surgery i.e. 97 (71.9%) followed by Neurosurgery 28 (20.7%), ENT 8 (5.9%). One each was from CVTS and Gastroenterology (0.7%) [Table 2].

Table 2: Department wise distribution of study patients

Department	Frequency	%
General Surgery	97	71.9
Neuro surgery	28	20.7
ENT	8	5.9
CVTS	1	0.7
Gastroenterology	1	0.7

Majority of patients underwent exploratory laparotomy 56 (41.5%) followed by craniotomy with tumor decompression in 17 (12.6%), craniectomy in 10 (7.4%), gastrectomy in 8 (5.9%) patients, wide local excision in 5 (3.7%) patients, cholecystectomy and hemicolectomy in 4 (3%) patients each, thoracotomy, thyroidectomy, whipple's procedure in 3 (2.2%) patients each, bronchoscopy and hepatectomy in 2 (1.5%) while the rest 18 (13.3%) underwent various other procedures [Table 3].

Table 3: Distribution of study patients as per type of surgery

Type of Surgery	Frequency	%
Exploratory laparotomy	56	41.5
Craniotomy with tumor decompression	17	12.6
Craniotomy	10	7.4
Gastrectomy	8	5.9
Wide Local Excision	5	3.7
Cholecystectomy	4	3.0
Hemicolectomy	4	3.0
Thoracotomy	3	2.2
Thyroidectomy	3	2.2
Whipples Procedure	3	2.2
Bronchoscopy	2	1.5
Hepatectomy	2	1.5
Others	18	13.3

Among all the study patients admitted in ICU, of which majority i.e. 51 (37.8%) requiring it because of hemodynamic unstability followed by metabolic acidosis with hemodynamic unstability in 21 (15.6%) and Multiple blood transfusion and hemodynamic unstability in 19 (6.7%) patients [Table 4].

Table 4: Reason for ICU admission among study patients

Reason for ICU admission	Frequency	%
Haemodynamic unstability	51	37.8
Metabolic acidosis and hemodynamic unstability	21	15.6
Multiple blood transfusion and hemodynamic unstability	19	14.1
Preoperative low GCS	9	6.7
Type of surgery	8	5.9
Type of surgery and hemodynamic unstability	6	4.4
Preoperative low GCS and hemodynamic unstability	4	3.0
Respiratory acidosis	4	3.0
Bilateral Pneumothorax and respiratory acidosis	3	2.2
Post extubation low SpO2 and respiratory acidosis	3	2.2
Preoperative low SpO2	3	2.2

Bilateral pneumothorax	**2**	**1.5**
Post Pharyngeal bleed	**1**	**0.7**
Respiratory acidosis with hemodynamic unstability	**1**	**0.7**

There were 45 (80.4%) Elective surgery patients compared to 32.9% Emergency surgery patients who were admitted in ICU as planned admission. Unplanned ICU admission was seen in 67.1% (n=53) emergency surgery patients compared to only 19.6% patients who underwent elective surgery [Fig 1].

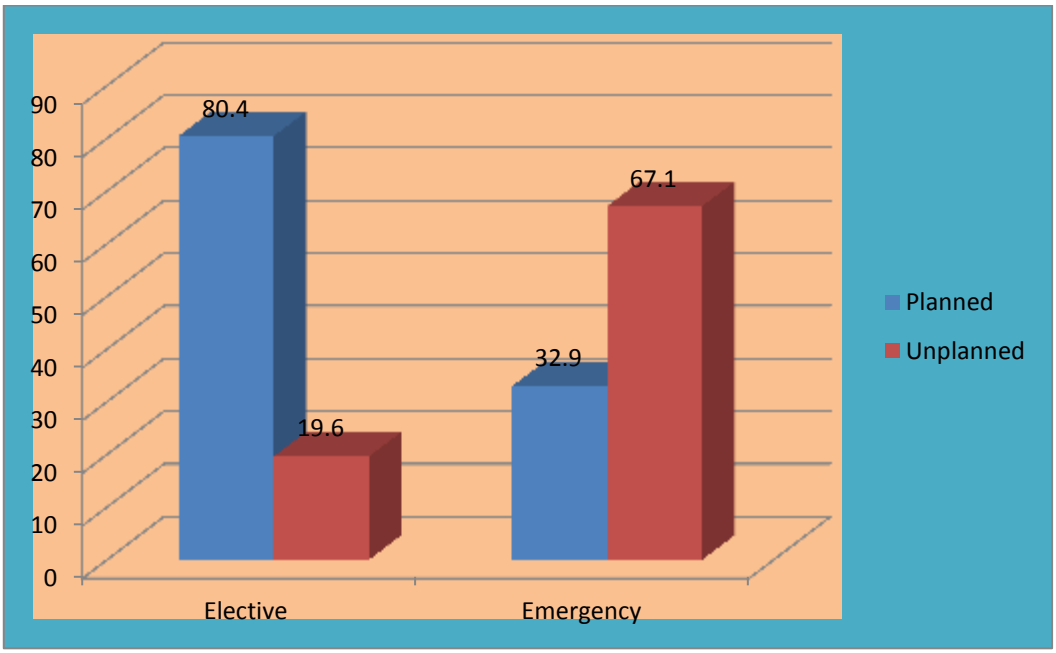

Fig 1: Nature of admission to ICU as per nature of surgery

Mean inotropic support was 56.4+35.4 hours in our study with majority requiring inotropic support for 24-48 hours, 32 (31.7%) needed inotropic support for >72 hours, 15 (14.9%) needed 48-72 hours of inotropic support while 16 (15.8%) patients required <24 hours of inotropic support [Fig 2].

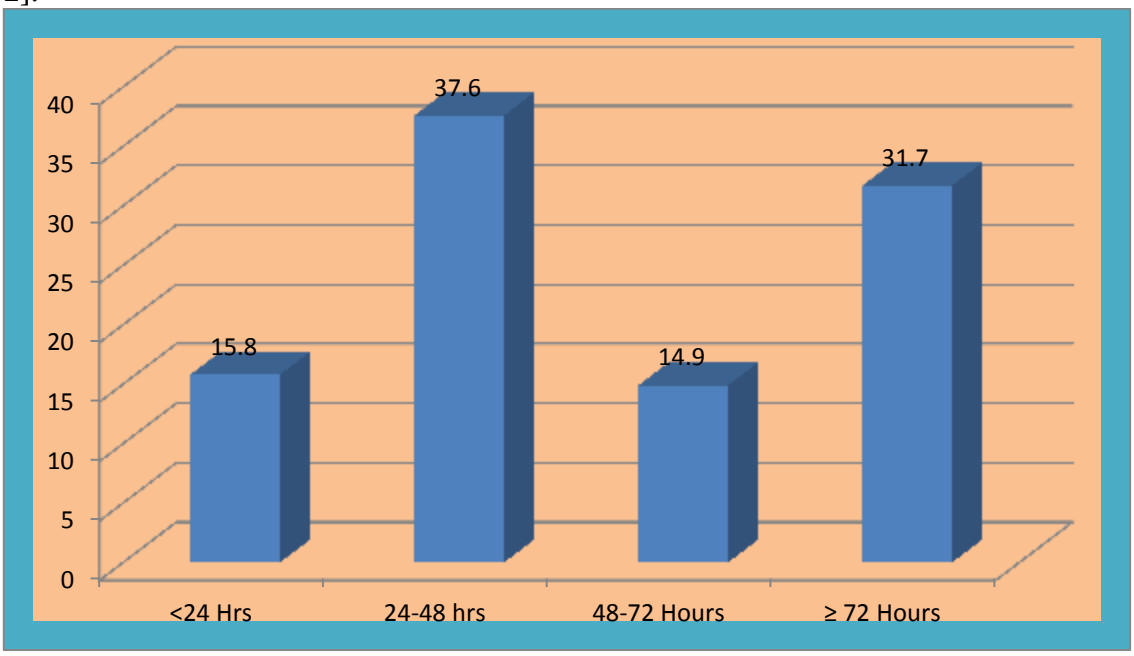

Fig 2: Duration of Inotropic support among study patients on admission in ICU

Out of 135 study patients, 85 (63%) were shifted to ward from ICU while the remaining 50 (37%) expired in ICU [Fig 3].

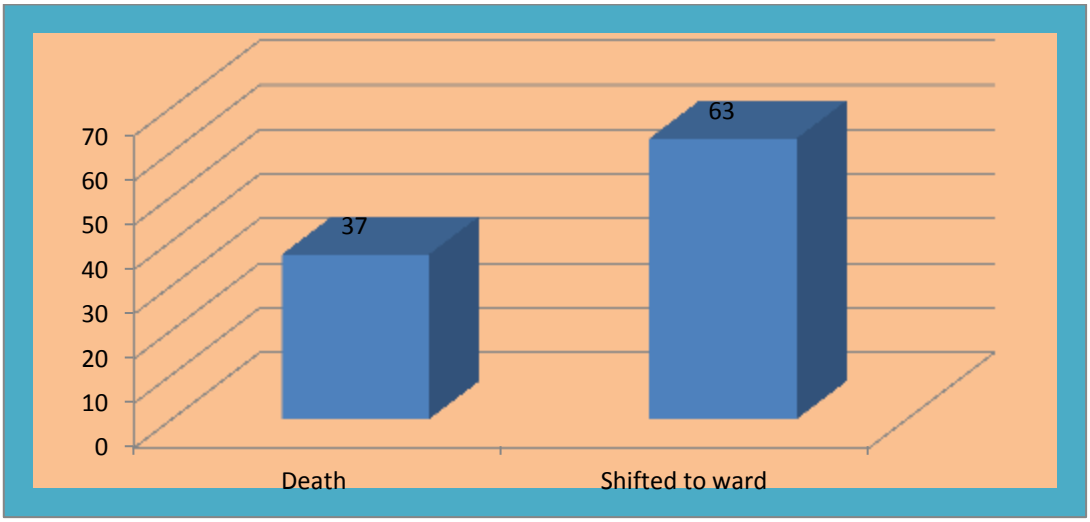

Fig 3: Final outcome of study patients

Discussion:

The intensive care unit (ICU) is a special unit primarily concerned with the care of patients with acute, recoverable, life threatening, critical illness, and injuries, which require constant close non invasive or invasive monitoring and support from specialized equipment and medications, i.e., continuous artificial ventilation, vasopressors, inotropes, and renal dialysis. [7]

Postoperative surgical patients continue to make up a substantial proportion of ICU admissions in most hospitals and these patients are getting more benefitted by thorough monitoring and management in ICU as compared to management in general wards or high dependency areas. [8,9]

In the present study, the average age of patients was 47.2±20.97 years which is lower than reported by a prospective study done in Morocco by **Elyamani R et al., (2021) [10]** (54.64 ± 18.02 years) and by **Phyu Phyu T et al., (2013) [11]** and the majority (69.6%) of the patients were ASA class II group among the study population in our study. These results in accordance with other studies like **Phyu Phyu T et al., (2013) [11]** and **Meziane M et al., (2017) [12]** and suggesting that significant critical incidents may occur in patients with relatively few co-morbidities and in whom clinicians might not expect the occurrence of critical incidents.

Regarding the preoperative ASA class of the postoperative patients admitted to the ICU, a substantial percent of the patients (69.6%) were ASA II in our study planned group. However, in unplanned ICU admissions, ASA II was (41.30%) and causes of their admission to ICU were unanticipated blood loss, hypotension, tachycardia, dysarrhythmias, and pulmonary edema. Although some studies reported that elderly patients with poor physical reserves are more expected to have unplanned ICU admission as concluded by **Rose DK et al., (1996)** and **Leigh JM and Tytler JA (1990).[4,13]**

In our study, it was observed that as compared to the reference population, the rate of postoperative planned and unplanned ICU admission was higher in male patients. The reasons postulated for males having a greater risk are varied, as described by **Meert AP et al., (2017)**, [14] **Ugochukwu O and Jerome A (2010) [15]** and **Satyawan AB et al., (2006)**. [1] Furthermore, men tend to suffer from more severe cardiac and pulmonary diseases as compared to women and so may require more postoperative ICU observation **Meert AP et al., (2017)**. [14]

In our study, general surgery patients (71.9%) were more likely to have ICU admission. This is in accordance with other studies who have concluded that abdominal and trauma surgery patients were more likely to have a ICU care than other patients, **Haller G et al., (2005)** and **Meziane M et al.,**

(2017). [6,12] **Quinn TD et al., (2017)** have also concluded that vascular and thoracic procedures were mostly implicated in the ICU admission. [16]

In our study haemodynamic unstability accounts for 37.8% patients, followed by metabolic acidosis with hemodynamic unstability in (15.6%) patients, multiple blood transfusion with hemodynamic unstability in (14.1%) patients, preoperative low GCS in (6.7%) patients, type of surgery in (5.9%), type of surgery and hemodynamic unstability in (4.4%) patients, were the most common reasons for ICU admissions among the study population. **Rose DK et al., (1996) [4]** also found that haemodynamic unstability events were the main reason for unplanned critical care admissions and ventilator management and other similar results have been found in literature by **Kim J et al., (2019)**.[17] **Quinn TD et al., (2017) [16]** have concluded that the main causes of ICU admission were cardiovascular and respiratory distress requiring intubation. While **Satyawan AB et al., (2006) [1] have** found that persistent tachycardia, major bleeding, and hypotension requiring use of vasoactive drugs were the main reasons leading to ICU care. These findings are supporting our study. There are also other similar findings with **Phyu Phyu T et al., (2013)** and **Haller G et al., (2005)**. [11, 6]

In addition, in our study frequency of ventilator therapy in the ICU was (96.3%), total planned ICU admissions were 52.6%. Among them 80.4% were electively planned and 32.9% were planned from emergency. Total unplanned ICU admissions were 47.4% among them 19.6% were elective cases unplanned admissions and 67.1% were emergency and unplanned admissions. Meanwhile, presence of comorbidities like cardiac disease, hypertension, and trauma were lower in the unplanned than the planned group, probably because clinical experience leads anesthesiologists to predict increased risks of postoperative complications for patients with a history of cardiovascular disease, and accordingly to prepare for ICU

admissions with such patients. These finding are similar to a retrospective study conducted in Korea by **Sim YS, et al., (2015)**. [18]

With respect to type of surgery, it was observed that maximum postoperative admissions were of General surgery (71.9%; 97/135). This observation in our study is accordance the studies conducted by **Satyawan AB et al., (2006) [**1] and **Quinn TD et al., (2017) [16]** where maximum 74.5% of the total number of postoperative ICU admissions had underwent abdominal surgery. In our study, this high percentage from general surgery could be explained due to organized institutional practices, as general surgery constitutes the major chunk our hospital beds and admissions as compared to other specialties.

The characteristics for the planned ICU admissions were not surprising, in our preoperative evaluation, anesthesiologists/surgeon consider variables such as ASA physical status, comorbidities, anticipated major blood loss, anticipated duration of anesthesia, anticipated mechanical ventilation, and airway problems when determining the need for postoperative ICU admission, **Smith G and Nielsen M, (1999), [8] Rose DK et al., (1996),[4] Satwayan AB et al., (2006), [1] Owens WD et al., (1978)**. [19] Intensive care unit is appropriate for patients requiring or likely to require advanced respiratory support, patients requiring support of two or more organ systems, and patients with chronic impairment of one or more organ systems who also require support for an acute reversible failure of another organ. Early referral is particularly important. If referral is delayed until the patient's life is clearly at risk, the chances of full recovery are jeopardised. On the contrary, the reasons for unplanned ICU admission are multifactorial and may be beyond the scope of the anesthesiologist's role in patient care. Unplanned intensive care admission may be a useful indicator of the quality of the overall process of perioperative care. It was found in our study that, among the unplanned ICU admissions, 64% cases were shifted to ICU for postoperative ventilation who had multiple intraoperative surgical and anesthetic events such as long duration of surgery, change of plan of surgery, difficult extubation, postoperative oxygen desaturation (SpO2 <90%), acid base and metabolic derangements.

Inotropes are a double-edged sword; while they improve cardiac output, they also bring other side effects, including arrhythmias, myocardial ischemia, **Sim YS et al., (2015), Pedersen T et al.,**

(1990) [20] and David LR et al., (2020). Among inotropes, norepinephrine and dopamine were relatively safe at lower doses. In the present study around 74.8% of the patients were on inotropic support. Moreover, the average survival time of the inotropic group was significantly shorter than that of the non-inotropic group. These findings are consistent with those of previous studies **Forrest JB et al., (1992),[3] Rose DK et al., (1996) [4] and Owens WD et al., (1978)**.[19] **Kalogeropoulos AP et al., (2014) [21]**examined the association of in-hospital inotrope use with 6-month outcomes in the Evaluation Study of Congestive Heart Failure and Pulmonary Artery Catheterization Effectiveness (ESCAPE) trial and found that in the absence of cardiogenic shock or end-organ hypoperfusion, inotrope use during hospitalization for heart failure is associated with unfavorable 6-month outcomes, regardless of admission systolic blood pressure, cardiac index, or heart failure etiology.

The commonest inotrope used in the present study was noradrenaline followed by dopamine. This is in agreement with the observations of an earlier study that noradrenaline is the commonest vasopressor agent used in septic shock **(Kitai T and Xanthopoulos A, 2020).[22]** Previous observational study on inotrope administration in patients in septic shock noted that dopamine use was associated with increased mortality while norepinephrine did not show a trend towards higher mortality **(Levy B et al., 2015)55**. [23] An Indian study, Comparative study of dopamine and norepinephrine in the management of septic shock by **Agarwal A et al., (2011)**,[24] also reported that norepinephrine was more useful in reversing the hemodynamic and metabolic abnormalities of septic shock compared to dopamine.

There is wide variation in the length of stay in the ICU for postoperative patients. In our present study, the maximum number of patients had ICU stay of 2–5 days, i.e., 37.8% (51/135), which was in accordance with **Okafor UV (2009) [25]** and **Jakobson T et al., (2014)** [26] studies. However, **Satyawan AB et al., (2006) [1]** observed that the maximum percentage of patients had a length of stay <24 h. This difference may be institutional based and may have been influenced in our hospital protocols depended on various protocols and standing orders of the particular hospital. It has been observed that long term outcomes of patients in the term of 28 days' mortality, length of stay, and incidence of adverse events were worse for the unplanned than planned group. However, in our study, a stay > 7 days postoperative was in 32 (23.7%) patients. This variation could be due to ICU stay >7 days the occurrence of different ASA status, preoperative co morbidity, duration of surgery, and surgical difficulty between planned and unplanned group.

Most scoring systems help to estimate the mortality of patients admitted to the ICU. Although the scoring systems were not developed solely for surgical patients, they may be used for postoperative patients and enable risk estimation of those population, **Pearse RM et al., (2012),[26] Minto G and Biccard B (2014),[27] Sobol JB and Wunsch H (2011) [28] and Gilani MT et al., (2014).[29]** The APACHE II, developed by **Knaus WA et al., (1985) [30]** is one of the most common scoring systems. Numerous studies have been performed to show whether high APACHE II scores are related to high mortality, **Khuri SF et al., (2005)** and **Pearse RM et al., (2012)**. [31,26]

In our study we also observed that mortality, length of stay in the ICU, and duration of mechanical ventilation is directly proportional to preoperative ASA status. Although all these scoring systems are helpful for estimating patient prognoses, but each patient behave differently **(Pignaton W et al., 2016)**. [32]

Additional observation in the current study was that 64.8% of planned admissions were discharged to ward and in unplanned group 60.9% (47/90). Mortality in planned group was 35.2% and in unplanned group it was 39.1%. The overall mortality rate was 37.0%. Mortality rates reported in the literature again vary with rate of 14.5% reported by **Piercy M et al., (2006) [33]** in Australia to rates as high as 31% in a Nigerian study by **Minto G and Biccard B (2014)**. [27] This could be due to the patients with unplanned intensive care unit admissions were having a higher ASA status,

more prolonged ICU stays and greater mortality than patients with planned ICU admission. Unplanned ICU patients have poorer health status, higher APACHE scores, and need more cardiovascular pharmacologic support and respiratory ventilatory care in the ICU.

Conclusion:

Thorough preoperative evaluation and preoperative optimization of patients whenever possible can reduce the incidence of unplanned admission to ICU. Early recognition of complications, timely intervention, and timely intensive care admissions and monitoring are essential to improve outcomes. Identification and optimization of these unplanned patients prior to surgical interventions remains difficult. ASA status and unplanned ICU admission should also be routine variables in all anesthesia and surgical audits. Important factors for admission may be grouped into one of the following main categories: first, those that are present prior to surgery that include the co morbid status and age of the patient and the type and urgency of the surgery performed and second, the physiological derangement of the patient at the end of the surgical procedure. High risk postoperative patients should be shifted to intensive care environment following surgery to enable them to have any of a number of evidence based interventions in order to improve their outcome.

Conflict of interest: Nil

Funding: Nil

References:

1. Satyawan AB, Shinde VS, Chaudhari LS. Audit of Intensive care unit admissions from the operating room. Indian J. Anaesth 2006; 50(3): 193-200.
2. Duncan PG, Cohen M. Post operative complications: factors of significance to anesthetic practice. Can J Anesth 1987; 34: 2-8.
3. Forrest JB, Rehder K, Cahalan MK, Goldsmith CH. Multicenter study of general anesthesia. III. Predictors of severe perioperative adverse outcomes. Anesthesiology. 1992 Jan 1;76(1):3-15.
4. Rose DK, Byrick RJ, Cohen MM, Caskennette GM. Planned and unplanned postoperative admissions to critical care for mechanical ventilation. Can J Anaesth 1996;43:333-40.
5. Swann D, Houstin O, Goldberg J. Audit of intensive care unit admissions from the operating room. Can J Anesth 1993; 40:137-41.
6. Haller G, Myles PS, Wolfe R, Weeks AM, Stoelwinder J, McNeil J. Validity of unplanned admission to an intensive care unit as a measure of patient safety in surgical patients. Anesthesiology. 2005 Dec; 103(6):1121-9.
7. Brian HC, Nigel RW. The role of the intensive care unit in the management of the critically ill surgical patients. J R Coll Surg Ednib 1999;444:294-300.
8. Smith G and Nielsen M. ABC of intensive care. Criteria for admission. BMJ 1999;318:1544-7.
9. Nathanson BH, Higgins TL, Kramer AA, Copes WS, Stark M, Teres D. Subgroup mortality probability models: Are they necessary for specialized intensive care units? Crit Care Med 2009;37:2375-86.
10. Elyamani R, Soulaymani A, Hami H. Epidemiology of Cardiovascular Diseases in Morocco: A Systematic Review. Rev Diabet Stud. 2021 Nov 1;17(2):57-67.
11. Phyu Phyu T, Kulkarni AH, Lim KH. Unplanned post-operative Intensive Care Unit admissions. Brunei Int Med J 2013;9:302-6.
12. Meziane M, El Jaouhari SD, ElKoundi A, Bensghir M, Baba H, Ahtil R et al. Unplanned intensive care unit admission following elective surgical adverse events: incidence, patient characteristics, preventability, and outcome. Indian J Crit Care Med. 2017; 21(3): 127-130.

13. Leigh JM and Tytler JA. Admissions to intensive care unit after complications of anaesthetic techniques over 10 years- the second 5 years. Anaesthesia 1990; 45:814-20.
14. Meert AP, Grigoriu B, Licker M, Van Schil PE, Berghmans T. Intensive care in thoracic oncology. Eur Respir J. 2017; 49(5): 1602189. doi: 10.1183/13993003.02189-2016.
15. Ugochukwu O and Jerome A. An audit of intensive care unit admission in a pediatric cardio-thoracic population in Enugu, Nigeria. Pan Afr Med J 2010; 6: 10.
16. Quinn TD, Gabriel RA, Dutton RP, Urman RD. analysis of unplanned postoperative admissions to the intensive care unit. J Intensive Care Med. 2017;32(7):436-443.
17. Kim J, Kim YD, Lee DR, Kim KM, Lee WY and Lee S. Analysis of the characteristics of unplanned admission to the intensive care unit after general surgery. Anesth Pain Med 2019;14:230-235.
18. Sim YS, Lee JH, Chang JH, Ryu YJ. Clinical outcome and prognosis of patients admitted to the surgical ICU after abdomen surgery. Korean Journal of Critical Care Medicine. 2015 Feb 28;30(1):1-7.
19. Owens WD, Felts JA, Spitznagel EL Jr., ASA physical status classifications: A study of consistency of ratings. Anesthesiology 1978; 49:239‐43.
20. Pedersen T, Eliasen K, Henriksen E. A prospective study of mortality associated with anaesthesia and surgery: Risk indicators of mortality in hospital. Acta Anaesthesiol Scand 1990;34:176‐82.
21. Kalogeropoulos AP, Marti CN, Georgiopoulou VV, Butler J. Inotrope use and outcomes among patients hospitalized for heart failure: impact of systolic blood pressure, cardiac index, and etiology. J Card Fail. (2014) 20:593–601. doi: 10.1016/j.cardfail.2014.05.006.
22. Kitai T and Xanthopoulos A. Contemporary management of acute decompensated heart failure and cardiogenic shock. Heart Fail Clin. 2020; 16: 221–30. doi: 10.1016/j.hfc.2019.12.005.
23. Levy B, Bastien O, Karim B, Cariou A, Chouihed T, Combes A, et al. Experts' recommendations for the management of adult patients with cardiogenic shock. Ann Intensive Care. 2015;5:52. doi: 10.1186/s13613-015-0052-1.
24. Agarwal A, Gupta A, Consul S, Shastri P. Comparative study of dopamine and norepinephrine in the management of septic shock. Saudi J Anaesthesia., 2011; 5(2): 162-66.
25. Okafor UV. An audit of unplanned postoperative intensive care unit admissions in Enugu, Nigeria: causes and outcome. SAJCC 2009; 25(1): 16-19.
26. Pearse RM, Moreno RP, Bauer P, Pelosi P, Metnitz P, Spies C, Vallet B, Vincent JL, Hoeft A, Rhodes A; European Surgical Outcomes Study (EuSOS) group for the Trials groups of the European Society of Intensive Care Medicine and the European Society of Anaesthesiology. Mortality after surgery in Europe: a 7day cohort study. Lancet. 2012 Sep 22;380(9847):1059-65.
27. Minto G and Biccard B. Assessment of the high-risk perioperative patient. Contin Educ Anaest Crit Care Pain. 2014; 14: 12-17.
28. Sobol JB, Wunsch H. Triage of high risk surgical patients for intensive care. Critical Care 2011, 15: 217.
29. Gilani MT, Razavi M, Azad AM. A comparison of Simplified Acute Physiology Score II, Acute Physiology and Chronic Health Evaluation II and Acute Physiology and Chronic Health Evaluation III scoring system in predicting mortality and length of stay at surgical intensive care unit. Niger Med J. 2014; 55: 144-147.
30. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985; 13: 818-829.
31. Khuri SF, Henderson WG, DePalma RG, Mosca C, Healey NA, Kumbhani DJ, et al. Determinants of long‐term survival after major surgery and the adverse effect of postoperative complications. Ann Surg 2005;242:326‐41.

32. Pignaton W, Braz JR, Kusano PS, Módolo MP, de Carvalho LR, Braz MG, et al. Perioperative and Anesthesia-Related Mortality: An 8-Year Observational Survey From a Tertiary Teaching Hospital. Medicine (Baltimore). 2016; 95: e2208.
33. Piercy M, Lau S, Loh E, Reid D, Santamaria J, Mackay P. Unplanned admission to the intensive care unit in postoperative patients--an indicator of quality of anaesthetic care? Anaesth Intensive Care. 2006; 34(5):592-8.