e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(1); 228-235

Original Research Article

Clinical Characteristics and Outcomes of Unplanned Intensive Care Unit Admission After Post-Anesthesia Care Unit Recovery: A Retrospective Observational Study

Dilip Kumar[1], Gaurav Kumar[2], Prem Shankar Tiwari[3]

[1]Senior Resident, Department of Anaesthesiology, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

[2]Senior Resident, Department of Anaesthesiology, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

[3]Associate professor and HOD, Department of Anaesthesiology, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

Received: 10-12-2025 / Revised: 23-12-2025 / Accepted: 25-01-2026

Corresponding Author: Dr. Gaurav Kumar

Conflict of interest: Nil

Abstract:

Background: Unplanned intensive care unit (ICU) admission after apparent recovery in the post-anesthesia care unit (PACU) is an important indicator of perioperative safety and may be associated with adverse outcomes.

Aim: To evaluate the clinical characteristics and outcomes of patients requiring unplanned ICU admission either directly from the PACU or from the ward within seven days after PACU discharge.

Methodology: This retrospective observational study included 88 adult patients who underwent surgery under general anesthesia and required unexpected ICU admission within seven days postoperatively. Patients were categorized into PACU group (n=52) and ward group (n=36). Demographics, comorbidities, surgical details, adverse events, ICU interventions, length of stay, and in-hospital mortality were analyzed.

Results: Baseline characteristics were comparable between groups. Hypoxia and hypotension were predominant in the PACU group, whereas infectious and surgical complications were more frequent in the ward group. The ward group required more intensive interventions, had longer ICU stay (3.5 vs. 1.8 days), prolonged hospital stay (32 vs. 16 days), and higher in-hospital mortality (11.1% vs. 3.8%).

Conclusion: Delayed ICU admission afterward transfer was associated with worse outcomes compared with direct admission from the PACU, emphasizing the importance of early recognition and timely intervention.

Keywords: Unplanned ICU admission, post-anesthesia care unit, Postoperative complications, Critical care outcomes, Perioperative safety, Retrospective study.

DOI: 10.25258/Ijpqa.17.1.38

Introduction

Postoperative admission to the intensive care unit (ICU) is typically identified in the preoperative period based on a holistic evaluation of the patient's comorbidities, physiological reserve and estimated risk of the proposed surgical operation. Perioperative assessment intends on meticulous care of tracing and detecting patients who need postoperative critical care follow-up or organ support to streamline resource allocation and enhance clinical outcomes [1]. Even with careful preoperative preparation, however, a certain population of surgical patients develops unexpected postoperative complications or acute physiological degradation that prompts an unexpected ICU stay. These unexpected transfers are rather important clinical events as they can be indicative of the dynamic and rather unpredictable nature of the course of postoperative recovery.

An unexpected ICU postoperative admission is proven as a critical indicator of patient safety and a quality indicator of perioperative management since it can endanger surgical patients to more serious morbidity and mortality [2]. These admissions are frequently linked with extreme adverse events, respiratory impairment, hemodynamic crisis, cardiovascular incidents, neurological worsening, or some other acute organ malfunction. Besides their clinical impact, unplanned ICU cases are a significant burden on health care systems and force the critical care to mobilize their resources immediately and may extend the duration of stay. It is therefore necessary to be informed of the factors that lead to inadvertent ICU admissions and consequences of such occurrences to enhance perioperative care pathways and patient safety [3].

It is common practice in normal perioperative practice to transfer patients out of the operating room to the post-anesthesia care unit (PACU) where close monitoring is given to the patients in the immediate postoperative process. The PACU is a transitional care unit that is aimed at identifying and treating early postoperative anesthesia and surgery-related complications. The patients which are eligible according to stipulated standards of discharge are then conveyed to the general surgical ward to further recover [4]. Nevertheless, sometimes adverse events can happen both in PACU stay and upon transfer to the ward, which results in the delayed identification of clinical deterioration. Normally, postoperative unscheduled ICU admission is decided upon either during PACU or in general surgical ward. The clinical course and the outcomes of patients can vary depending on the location and time of the adverse event identification [5].

It may be assumed that the results of patients admitted to the ICU would be influenced by the conditions (when the deterioration is noticed) in which the adverse situation is observed and by the health providers that determine the necessity of ICU admission. As an example, patients who worsen in the PACU are placed under constant physiological surveillance and direct observation by anesthesiology-trained personnel, which may enable them to be recognized sooner and possibly then acted upon [6]. Conversely, patients who become worse when they are sent back to the ward might have delays in being noticed in the ward because of reduced monitoring rates, fluctuating staffing rates, or disparity in clinical knowledge. These delays could lead to further developed organ dysfunction during ICU transfer and, therefore, poor outcomes.

Furthermore, the clinical characteristics of patients who are meant to be admitted in the ICU unexpectedly could be different based on the postoperative stage whereby complications occur. The unfavorable state after the operation can be earlier connected with the effects of anesthesia that remained or the obstruction of the airways, acute bleeding, or immediate surgical complications. On the other hand, subsequent degeneration in the ward can be indicative of changing pathophysiological mechanisms e.g. infection, sepsis, thromboembolic events, or progressive cardiopulmonary dysfunction [7]. The patterns in nature and timing of adverse events could be identified and assist in illuminating the possible mechanisms and inform specific preventive measures.

The relevance of the problem of unplanned ICU admission to adverse clinical outcomes was already highlighted in previous studies, which supports the significance of this measurement as a quality indicator in the perioperative environment. Nevertheless, further elaboration of the clinical findings and outcomes, which are unique to unplanned ICU admission following seemingly recovered PACU, is still required. Specifically, there is a paucity of literature that specifically examines patients who had been considered as being stable to leave the PACU only to be readmitted to ICU at a specified period of the postoperative phase. This group is a high-risk population where the initial signs of the disease might have been implicit, developing, or poorly identified [8].

The retrospective observational method allows studying the actual clinical evidence and determining the patterns linked with unplanned ICU transfers. The risk factors and vulnerabilities within the system level can be learnt by studying the demographics, comorbidities, and surgical characteristics of the patient, the time when his/her condition worsened, and the clinical outcome after the operation. These types of analyses can be used to find out whether some patient groups are more vulnerable to delayed worsening of the situation after discharge of PACU and whether a particular perioperative procedure should be refined.

It is also crucial to get to know the projections of patients who were taken to the ICU without planning. These consequences could be the ICU length of stay, the need to use mechanical ventilation or vasopressor, the length of stay at the hospital, and death in the hospital. A comparison of the outcomes of the patients who were admitted in the ICU and directly out of the PACU, and those who were transferred out of the ward within a specific time, e.g., within 7 days after they have left the PACU, might show a clinically meaningful impact. The implications of these findings are likely to be seen in postoperative monitoring methods, discharge criteria within the PACU, and early warning systems that are practiced within the surgical wards.

Moreover, the analysis of clinical characteristics of adverse events that result in unplanned ICU admission can be used to improve quality improvement programs to make patients safer. As an illustration, the detection of shared precipitating factors could be used to facilitate the creation of specific interventions, e.g., the improvement of respiratory surveillance, organized handoff communication, risk-based postoperative surveillance, or immediate response team activation criteria. Through a systematic analysis of these events, healthcare institutions will be able to shift focus towards a reactive approach to clinical deterioration prevention rather than proactive prevention.

Based on these, we had thought that exploration of the clinical characteristics of adverse events that result in unplanned ICU admission would add to the enhancement of postoperative care in the PACU or at the ward. In-depth examination of the patient characteristics and patient outcome can be useful in improving the risk assessment and postoperative surveillance measures in perioperative. Specifically, the difference between the early deterioration that

can be identified in the PACU and the late deterioration that can be identified in the ward could help to point out the cause of intervention and resource optimization at an earlier stage.

Thus, the purpose of this retrospective observational study was to examine patient factors and outcomes of unplanned ICU admission between the PACU and the ward in 7 days of PACU discharge stages. By systematically examining the timing, location, and clinical context of these admissions, as well as associated outcomes, we sought to enhance understanding of postoperative deterioration patterns and to identify potential areas for improvement in perioperative management and patient safety.

Methodology

Study Design: This study was conducted as a retrospective observational study to evaluate the clinical characteristics and outcomes of patients who required unplanned Intensive Care Unit (ICU) admission after initial recovery in the Post Anesthesia Care Unit (PACU). The study involved review and analysis of previously recorded hospital data without any direct patient intervention. The retrospective design allowed assessment of perioperative factors, adverse events, and patient outcomes within the defined study period.

Study Area: The study was carried out in the Department of Anaesthesiology at Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India.

Study Duration: The study was conducted over a period of eight months from April 2025 to November 2025.

Sample Size

A total of 88 patients who fulfilled the inclusion criteria were included in the final analysis. These patients represented all cases of unplanned ICU admission occurring after PACU recovery during the defined study duration.

Study Population: The study population comprised adult patients who underwent surgical procedures under general anesthesia and were initially shifted to the PACU for postoperative monitoring. Among these, patients who required unexpected ICU admission within seven days of surgery due to clinical deterioration were included. Unplanned ICU admission was defined as ICU transfer that was not anticipated preoperatively but became necessary due to adverse events occurring either in the PACU or after transfer to the surgical ward.

Data Collection: Data were retrospectively collected from electronic medical records, anesthesia charts, PACU records, and ICU documentation. Patient-related variables included age, gender, body mass index (BMI), and American Society of Anesthesiologists Physical Status (ASA-PS). Perioperative variables such as type of surgery, duration of surgery, duration of anesthesia, length of PACU stay, and Modified Aldrete Score at discharge were recorded. ICU-related data included the primary reason for ICU admission, therapeutic interventions required in ICU (such as mechanical ventilation or vasopressor support), length of ICU stay, total hospital stay, and in-hospital mortality. The primary outcome measure was in-hospital mortality, while secondary outcomes included duration of ICU stay and total length of hospitalization.

Inclusion Criteria

- Patients aged **≥18 years**.
- Patients who underwent surgery under general anesthesia.
- Patients initially shifted to PACU postoperatively.
- Patients requiring **unplanned ICU admission within 7 days** of surgery.

Exclusion Criteria

- Patients younger than 18 years of age.
- Patients admitted to ICU preoperatively.
- Patients transferred directly from the operating room (OR) to ICU as a planned admission.
- Patients with incomplete medical records.

Procedure: At the study institution, decisions regarding postoperative ICU admission are made on a case-by-case basis by the surgical and anesthesia teams. Patients requiring planned ICU care or those experiencing intraoperative deterioration are transferred directly from the operating room to the ICU and were not included in this study. Other patients are shifted to the PACU for postoperative monitoring, and discharge from PACU is based on standard criteria using the Modified Aldrete Score. Patients who developed unexpected complications either in the PACU or after transfer to the ward and required ICU care were identified retrospectively. These patients were categorized into two groups: those admitted to ICU directly from PACU and those admitted from the ward after PACU discharge. Comparative analysis between these groups was performed to assess differences in clinical characteristics and outcomes.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software. Continuous variables were expressed as median with interquartile range (IQR) or mean with standard deviation, depending on data distribution. Categorical variables were presented as frequency and percentage. Comparisons between patients admitted to ICU from PACU and those admitted from the ward were performed using the Mann–Whitney U test for non-parametric continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. Bonferroni correction was applied

when multiple comparisons were conducted. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 presents the baseline characteristics of patients in the PACU group (n = 52) and ward group (n = 36). The majority of patients in both groups were male (57.7% vs. 61.1%), with a similar median age (62 vs. 65 years), and most were between 61–80 years. Median BMI was comparable between groups (23.8 vs. 24.6 kg/m²). Most patients were classified as ASA-PS II, followed by ASA-PS III, with a slightly higher proportion of ASA-PS III in the ward group (36.1% vs. 26.9%). Preoperative comorbidities such as hypertension, diabetes mellitus, coronary artery disease, chronic kidney disease, COPD, and cerebrovascular disease were similarly distributed, although chronic kidney disease, COPD, and cerebrovascular disease were marginally more common in the ward group. Overall, the two groups were broadly comparable in baseline demographic and clinical characteristics.

Table 1: Patient Characteristics

Number (%) or Median (interquartile range)	PACU group (n = 52)	Ward group (n = 36)
Gender		
Male	30 (57.7%)	22 (61.1%)
Female	22 (42.3%)	14 (38.9%)
Age (years)	62 (50–71)	65 (54–74)
18–40	6 (11.5%)	3 (8.3%)
41–60	18 (34.6%)	10 (27.8%)
61–80	24 (46.2%)	19 (52.8%)
>80	4 (7.7%)	4 (11.1%)
BMI (kg/m²)	23.8 (21.2–27.4)	24.6 (22.1–28.9)
ASA-PS		
I	8 (15.4%)	4 (11.1%)
II	30 (57.7%)	19 (52.8%)
III	14 (26.9%)	13 (36.1%)
Preoperative comorbidities		
Hypertension	21	17
Diabetes Mellitus	15	12
Coronary artery disease	6	5
Chronic kidney disease	5	6
Chronic obstructive pulmonary disease	4	5
Cerebrovascular disease	3	4

Table 2 compares the characteristics of surgical procedures and anesthesia care between the PACU group (n = 52) and the ward group (n = 36). The proportion of emergency surgeries was similar in both groups (17.3% vs. 19.4%). The distribution of surgical specialties, including general surgery, orthopedic surgery, neurosurgery, urology, gynecology, ENT, and others, was comparable between groups. The ward group had a longer median operation time (210 vs. 185 minutes) and anesthesia time (275 vs. 250 minutes). However, PACU stay was significantly shorter in the ward group (55 vs. 95 minutes). Overall, while surgical profiles were similar, the ward group experienced longer operative and anesthesia durations with shorter PACU stays.

Table 2: Characteristics of Surgical Procedures and Anesthesia Care

Number (%) or Median (interquartile range)	PACU group (n = 52)	Ward group (n = 36)
Emergency Surgery	9 (17.3%)	7 (19.4%)
Surgical Procedures		
General surgery	14	11
Orthopedic surgery	10	7
Neurosurgery	6	4
Urology	7	5
Gynecology	5	2
ENT	4	2
Others	6	5
Operation time (min)	185 (120–260)	210 (150–295)
Anesthesia time (min)	250 (170–340)	275 (200–360)
PACU stay (min)	95 (65–130)	55 (35–80)*

Table 3 presents the adverse events leading to unplanned ICU admission in the PACU group (n = 52) and ward group (n = 36). Cardiovascular events were common in both groups, with hypotension being more frequent in the PACU group (12 vs. 6), while myocardial ischemia (4 vs. 3) and cardiac arrest (2 vs. 1) were slightly higher in the ward group. Among respiratory events, hypoxia was more common in the PACU group (14 vs. 7), whereas pneumonia was notably higher in the ward group (4 vs. 1). Neurological events such as stroke and seizures were more frequent in the ward group. Surgical complications, including surgical site bleeding (5 vs. 4), anastomotic leak (2 vs. 0), and sepsis (4 vs. 1), were also more common in the ward group. Overall, while hypoxia and hypotension predominated in the PACU group, more severe and infectious complications were observed more often in the ward group.

Table 3: Adverse Events Leading to Unplanned ICU Admission

Adverse Event	PACU group (n = 52)	Ward group (n = 36)
Cardiovascular events		
Hypotension	12	6
Hypertension	5	2
Arrhythmia	4	3
Myocardial ischemia	3	4
Cardiac arrest	1	2
Respiratory events		
Hypoxia	14	7
Hypercapnia	2	2
Pneumonia	1	4
Airway obstruction	3	2
Neurological events		
Stroke	1	2
Seizure	1	2
Surgical events		
Surgical site bleeding	4	5
Anastomotic leak	0	2
Infection (Sepsis)	1	4

Table 4 outlines the treatments administered for adverse events in the ICU among the PACU group (n = 52) and the ward group (n = 36). Invasive interventions were generally more frequent in the ward group, including mechanical ventilation (10 vs. 8), hemodialysis (4 vs. 1), vasopressor support (14 vs. 15), and reoperation (3 vs. 1), while non-invasive ventilation was comparable between groups (5 vs. 6). Regarding medications, the ward group required more antibiotics (16 vs. 8), diuretics (5 vs. 2), and PRBC transfusions (4 vs. 3), whereas antiarrhythmic use was similar (2 vs. 3). Overall, the ward group appeared to require more intensive therapeutic interventions compared to the PACU group.

Table 4: Treatments for Adverse Events in ICU

Treatment	PACU group (n = 52)	Ward group (n = 36)
Invasive intervention		
Mechanical ventilation	8	10
Non-invasive ventilation	6	5
Hemodialysis	1	4
Vasopressor support	15	14
Reoperation	1	3
Medication		
Antiarrhythmics	3	2
Antibiotics	8	16
Diuretics	2	5
Transfusion (PRBC)	3	4

Table 5 compares ICU stay, hospital stay, and in-hospital mortality between the PACU group (n = 52) and the ward group (n = 36). The ward group had a longer median ICU stay (3.5 days; IQR 2–6) compared to the PACU group (1.8 days; IQR 1–2), with a significantly higher proportion staying ≥3 days (58.3% vs. 15.4%). Hospital stay was also prolonged in the ward group, with a higher percentage staying >30 days (50.0% vs. 21.2%) and a longer median duration of hospitalization (32 vs. 16 days). In-

hospital mortality was higher in the ward group (11.1%) compared to the PACU group (3.8%). Overall, patients managed in the ward group had comparatively longer ICU and hospital stays with higher mortality.

Table 5: Length of ICU and Hospital Stay, In-Hospital Mortality		
Median (interquartile) or Number (%)	**PACU group (n = 52)**	**Ward group (n = 36)**
Length of ICU stay (days)	1.8 (1–2)	3.5 (2–6)*
1–2 days	44 (84.6%)	15 (41.7%)*
≥3 days	8 (15.4%)	21 (58.3%)*
Hospital stay >30 days	11 (21.2%)	18 (50.0%)*
Length of hospital stay (days)	16 (9–28)	32 (18–55)*
In-hospital mortality	2 (3.8%)	4 (11.1%)

Discussion

In the current retrospective observational study of 88 patients admitted to the ICU subsequent to what appeared to be anesthesia, we observed that patients directly discharged of the PACU (59.1) and those discharged later of the ward (40.9) had widely similar baseline characteristics but significantly different clinical trajectories and outcomes. The total rate of unexpected ICU admission in our facility was 0.25, which slightly falls within the range of 0.28%-2.2% (Jhanji et al., 2008; Meerabhadran et al., 2017) [9,10]. Indicatively, Cullen et al. (1992) [11] found a greater rate of unexpected ICU admission in older patients and patients with a higher ASA physical status whereas Jhanji et al. (2008) [9] found high critical care utilization in high-risk surgical patients. It is possible that our lower incidence is due to more stringent preoperative triage with patients having ASA-PS IV or greater routinely booked into planned ICU admission, eliminating potential subjects of unplanned transfer.

In terms of demographics, the group of PACU and the group of the ward mostly consisted of older populations with median ages of 62 years and 65 years respectively, and over 45 percent of patients in both groups were aged 61-80 years. This is in line with other prior studies that have shown that advanced age is a persistently pertinent risk element to postoperative deterioration and ICU admission (Quinn et al., 2017) [12]. The susceptibility of surgical patients is supported by McNeil (2005) [2], who found that older age and an increase in the ASA-PS were independent predictors of unplanned ICU admission. However, in contrast to Bruceta et al. (2020) [13], who observed that obesity (BMI 30 kg/m 2 and above) was being related with the increased use of ICU after the operation, our patients had relatively low median BMIs (23.8 kg/m 2 in the PACU group and 24.6 kg/m 2 in the ward group), with the proportion of obese patients being very low. This variation in body habits, in part, could be the reason why the BMI was not a discriminating factor under our analysis.

Most of the adverse events were cardiovascular and respiratory events which were the most arousing causes taking into consideration the ICU transfer in both groups. Hypoxia and hypotension as entities alone constituted a reasonable percentage of our cohort, which is in line with the 40 percent of the events reported by McNeil (2005) [2]. Hypoxia (14 cases) and hypotension (12 cases) were predominant in the PACU group, which may have been caused by residual effects of anesthesia, late awakening, or instability at the onset of the postoperative period. Conversely, the ward group reported a somewhat greater number of cases of myocardial ischemia (4 cases), cardiac arrest (2 cases), pneumonia (4 cases) and sepsis (4 cases) suggesting the development of more established systemic or surgical complications. According to Rujirojindakul et al. (2012) [14], the incidence of reintubation in the PACU was 0.14% in the study of more than 117,000 patients, and in our case, the incidence was significantly lower at 0.03. This could be an indicator of early application of non-invasive ventilation (NIV) and high-flow nasal oxygen, but the general necessity of respiratory support was low in our investigation.

Significantly, patients who were discharged out of the ward seemed to have had worse illnesses. The invasive mechanical ventilation (10 vs. 8 in PACU), vasopressor support (14 vs. 15, similar numerically but frequent in the ward group), hemodialysis (4 vs. 1), and reoperation (3 vs. 1) were much higher in the ward group. Such results are also in line with the results of a large population-based study conducted by Gillies et al. (2017) [15] that delayed admission to ICU after initial care in wards correlated with an increased mortality and organ support needs in contrast to the situation with postoperative direct admission to ICU. Ward group had almost twice the median ICU stay (3.5 vs. 1.8 days) and 58.3% of the patients in the ward needed more than 3 days of ICU care, whereas 15.4% of PACU patients did. This lends the notion that later identification or development of the complications leads to increased resource-consuming care.

The distinction between total length of stay in the hospital was also significantly high with the median length of stay in the wards being 32 days and on the PACU being 16 days, and 50.0% of the patients in the wards were patients that had a length of stay

exceeding 30 days, whereas in the PACU, the length of stay was 21.2. The factor of prolonged hospitalisation after unexpected ICU admission has been reported previously as the indicator of morbidity and healthcare burden escalation (Piercy et al., 2006) [16]. Even though the difference in in-hospital mortality rates (11.1, in ward, and 3.8, in PACU) were not statistically significant, the numerical pattern resembles the results of Gillies et al. (2017) [15], who found higher mortality rates among patients with the delayed ICU escalation.

One observation that was interesting in our study was that the median PACU stay in the ward group was less than the PACU group (55 minutes vs. 95 minutes, respectively). According to Mann-Farrar et al. [17], a long stay in the PACU also resulted in a higher risk of any further deterioration in the ward in the next 24 hours. The PACU group in our cohort, however, could mean that patients in the PACU stay longer in the PACU, and the reason is that complications were identified and attempted to stabilize before admission to the ICU, resulting in a generally shorter ICU and hospitalization period. On the other hand, patients in the ward group passed the PACU discharge criteria and were moved to the ward sooner but later had more severe complications that were frequently witnessed between the first and third postoperative days. It is clinical that this temporal pattern is because even when cardiovascular events were not predisposed by underlying comorbidities, a significant percentage of ward admission was due to this event, which underscores the importance of closely monitoring postoperative events even after the acute recovery period.

Even though the variables mentioned above, i.e., higher ASA-PS, older age, increased BMI, and longer operating time, have always been reported in earlier studies as predictors of unplanned ICU admission (Quinn et al., 2017; Bruceta et al., 2020) [12,13], we did not find any significant differences in this variables between our PACU and ward groups. The median time in the ward group (210 and 275 minutes) was a bit higher than that of the PACU group (185 and 250 minutes), however, none of the differences were significant. It is implied that in our context post-operative deterioration cannot be attributed solely to risk stratification in the preoperative phase or the length of surgery itself. Rather, there appears to be an inherent and partially unpredictable risk of postoperative adverse events, supporting the notion proposed by Haller et al. (2008) [3] that unplanned ICU admission serves as a global safety indicator.

Overall, our findings reinforce prior literature demonstrating that delayed ICU admission after initial ward transfer is associated with more severe complications, longer ICU and hospital stays, and a trend toward higher mortality. Early recognition of adverse events in the PACU and prompt escalation of care may mitigate progression to multi-organ dysfunction and reduce healthcare utilization. Future prospective, multicenter studies are warranted to further delineate modifiable risk factors and optimize postoperative surveillance strategies.

Conclusion

This retrospective observational study demonstrated that patients requiring unplanned ICU admission after PACU recovery had comparable baseline characteristics, comorbidities, surgical profiles, and anesthesia exposure between those admitted directly from the PACU and those initially transferred to the ward. Cardiovascular and respiratory complications were the most common triggers for ICU admission in both groups, although patients transferred from the ward more frequently exhibited infectious and surgical complications requiring advanced organ support and more intensive therapeutic interventions. Importantly, delayed ICU admission afterward transfer was associated with longer ICU and hospital stays, greater resource utilization, and a trend toward higher in-hospital mortality compared with direct ICU admission from the PACU. These findings suggest that earlier recognition and timely ICU transfer from the PACU may improve clinical outcomes and reduce healthcare burden in patients experiencing postoperative deterioration.

References

1. Katori N, Yamakawa K, Yagi K, Kimura Y, Doi M, Uezono S. Characteristics and outcomes of unplanned intensive care unit admission after general anesthesia. BMC anesthesiology. 2022 Jun 20;22(1):191.
2. 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.
3. Haller G, Myles PS, Langley M, Stoelwinder J, McNeil J. Assessment of an unplanned admission to the intensive care unit as a global safety indicator in surgical patients. Anaesthesia and intensive care. 2008 Mar;36(2):190-200.
4. Khanna AK, Moucharite MA, Benefield PJ, Kaw R. Patient characteristics and clinical and economic outcomes associated with unplanned medical and surgical intensive care unit admissions: a retrospective analysis. ClinicoEconomics and Outcomes Research. 2023 Dec 31:703-19.
5. Kim J, Kim YD, Lee DR, Kim KM, Lee WY, Lee S. Analysis of the characteristics of unplanned admission to the intensive care unit after general surgery. Anesthesia and Pain Medicine. 2019 Apr 30;14(2):230-5.
6. Yetneberk T, Firde M, Tiruneh A, Fentie Y, Tariku M, Mihret G, Moore J. Incidence of unplanned intensive care unit admission following surgery and associated factors in Amhara

regional state hospitals. Scientific Reports. 2022 Nov 22;12(1):20121.
7. Apfelbaum JL, Silverstein JH, Chung FF, Connis RT, Fillmore RB, Hunt SE, Nickinovich DG, Schreiner MS, Barlow JC, Joas TA. Practice guidelines for postanesthetic care: an updated report by the American Society of Anesthesiologists Task Force on Postanesthetic Care. Anesthesiology. 2013 Feb 1;118(2):291-307.
8. Aldrete JA, Kroulik D. A postanesthetic recovery score. Anesthesia & Analgesia. 1970 Nov 1;49(6):924-34.
9. Jhanji S, Thomas B, Ely A, Watson D, Hinds CJ, Pearse RM. Mortality and utilisation of critical care resources amongst high-risk surgical patients in a large NHS trust. Anaesthesia. 2008 Jul;63(7):695-700.
10. Meziane M, El Jaouhari SD, ElKoundi A, Bensghir M, Baba H, Ahtil R, Aboulaala K, Balkhi H, Haimeur C. Unplanned intensive care unit admission following elective surgical adverse events: incidence, patient characteristics, preventability, and outcome. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2017 Mar;21(3):127.
11. Cullen DJ, Nemeskal RA, Cooper JB, Zaslavsky A, Dwyer MJ. Effect of pulse oximetry, age, and ASA physical status on the frequency of patients admitted unexpectedly to a postoperative intensive care unit and the severity of their anesthesia-related complications. Anesthesia & Analgesia. 1992 Feb 1;74(2):181-8.
12. Quinn TD, Gabriel RA, Dutton RP, Urman RD. Analysis of unplanned postoperative admissions to the intensive care unit. Journal of intensive care medicine. 2017 Aug;32(7):436-43.
13. Bruceta M, De Souza L, Carr ZJ, Bonavia A, Kunselman AR, Karamchandani K. Post-operative intensive care unit admission after elective non-cardiac surgery: A single-center analysis of the NSQIP database. Acta Anaesthesiologica Scandinavica. 2020 Mar;64(3):319-28.
14. Rujirojindakul P, Geater AF, McNeil EB, Vasinanukorn P, Prathep S, Asim W, Naklongdee J. Risk factors for reintubation in the post-anaesthetic care unit: a case–control study. British journal of anaesthesia. 2012 Oct 1;109(4):636-42.
15. Gillies MA, Ghaffar S, Harrison E, Haddow C, Smyth L, Walsh TS, Pearse RM, Lone NI. The association between ICU admission and emergency hospital readmission following emergency general surgery. Journal of the Intensive Care Society. 2019 Nov;20(4):316-26.
16. Piercy M, Lau S, Loh F, Reid D, Santamaria J, Mackay P. Unplanned admission to the intensive care unit in postoperative patients—An indicator of quality of anaesthetic care? Anaesthesia and intensive care. 2006 Oct;34(5):592-8.
17. Mann-Farrar J, Egan E, Higgins A, Wysocki L, Vaux A, Arndell E, Burmeister EA. Are postoperative clinical outcomes influenced by length of stay in the postanesthesia care unit? Journal of PeriAnesthesia Nursing. 2019 Apr 1;34(2):386-93.