



The Significance of Nursing Care in the Post-anesthesia Care Unit and Barriers to Care

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Abstract

The post-anesthesia care unit (PACU) is the section where the effects of anesthesia are expected to pass following surgery, the patient's vital signs are aimed to be stable, and the prevention of possible complications is aimed. In PACU, patients may encounter many complications after surgery and anesthesia. The most common complications include acute pain, hypoxemia, nausea, vomiting, delirium, hypothermia, etc. It is stated that most of the complications in the post-anesthesia care phase are seen between the first 1 and 5 h. Nursing care is significant in PACU to improve the quality of recovery of patients and to prevent complications that may occur. Nurses must be highly qualified and have knowledge and skills in the treatment and care of patients from different surgeries of varying complexity that require specialized and individualized care. Complications and side effects can be detected early with adequate nursing observation, care, and treatment in PACU, and the incidence of complications, mortality rates, and length of hospital stay can be reduced with timely intervention. However, unexpected increases in patient volume or acuity, prolonged patient stay in the unit, nurses' lack of knowledge and skills in some subjects, lack of staff, excessive workload, communication barriers between surgeons, anesthesiologists, and nurses, the absence of structured information reporting systems, lack of a standard PACU transfer checklist, and inability to allocate sufficient time for nursing care due to heavy administrative burden in addition to psychosocial factors such as high stress, insufficient sleep, and lack of active rest intervals, prevent adequate nursing care in PACU. The existing literature does not offer a comprehensive examination of nursing care in the PACU, the complications arising therein, impediments to nursing care, or recommendations to address these challenges. This review, seeking to elucidate the methodologies of nursing care within the PACU, highlighting its significance, identifying challenges, and proposing solutions, is anticipated to act as a foundational guide for practitioners, administrators, and scholars in the domain, facilitating the resolution of nursing care barriers and enhancing the body of knowledge on this topic.

Keywords Post-anesthesia care unit · Postoperative complications · Nursing care · Perianesthesia nursing · Postoperative period

1 Introduction

Technological and scientific advances in surgical treatment and postoperative care reduce the risk of surgical treatments, improve the treatment and care of patients, and increase the

quality of life. An estimated 234 million surgeries are performed around the world each year, making surgical care an integral part of healthcare [1, 2]. The role of the nurse in the care and treatment of patients at different stages of the surgical process is significant. The surgical process includes pre-operative preparation, intraoperative care, and treatment and care interventions for the patient's recovery after surgery. Intraoperative care is a process that begins with the patients being taken to the operating room and continues until they leave the operating room [2]. In the postoperative period, patients are first admitted to PACU. Since the passing effect of anesthesia is a great source of stress in patients, the PACU environment should be comfortable and safe. PACU is a vital part of hospitals designed to provide post-anesthesia care to

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patients, connected to operating rooms and staffed by anesthesiologists, nurses, technicians, and surgeons [2, 3]. Most of the surgical morbidity and mortality are seen in the postoperative period. Patients come to the recovery unit from the operating room with risks such as airway obstruction, vomiting, tremor, agitation, delirium, pain, and hypothermia. The fact that the most important period in the treatment process of patients is the early and late postoperative period reveals the importance of care in PACU [2, 4].

The post-anesthesia care process covers all levels of care in most institutions, but some institutions offer Phase-I and Phase-II services. In Phase-I, treatment and care are continued until the patient is transferred to another unit in the postoperative period. At this stage, the nurse monitors the airway, oxygen therapy, vital signs, complications, and symptoms [2]. Phase II requires less follow-up, treatment, and observation than Phase I. This stage is generally intended for patients undergoing day surgery [2, 3]. Nursing care in PACU aims to take into account the patient's condition after surgical intervention. This allows healthcare professionals, especially nurses, to identify and repair the needs of patients whose condition is worsening [5]. However, many barriers to nursing care in the PACU have been identified [6–9]. This review elucidates the significance and methodology of nursing care in the PACU, complications that manifest in the PACU's early phase, challenges inherent to nursing care therein, and potential strategies to surmount these challenges.

2 Nursing Care at PACU

PACU nurses provide care to patients in the postoperative period when they are at greatest risk for respiratory and cardiovascular complications during recovery from surgery and anesthesia [10]. The first evaluation begins by evaluating the patient's neurological, airway, respiratory and circulatory status. The initial neurological assessment should focus on the level of consciousness, such as orientation, sensory and motor status, pupillary size, equivalence, and responsiveness. The patient may be awake, drowsy, or asleep. Since hearing is the first returning sense in the unconscious patient, all activities should be explained to the patient from the moment of admission to PACU. If the patient has received regional anesthesia (e.g. spinal, epidural), sensory and motor blockade may still occur, dermatome levels should be evaluated. Patient characteristics such as residual neuromuscular blockade, opioid use, and sleep breathing impairment (e.g., obstructive sleep apnea) affect oxygenation and ventilation. The nurse must be alert for signs of inadequate oxygenation and ventilation. Any signs of respiratory distress require immediate intervention. Pulse oximetry monitoring is a noninvasive way to assess oxygenation and can provide

early warning for hypoxemia. Subcutaneous carbon dioxide (PtcCO₂) and end-tidal CO₂ (PetCO₂) (capnography) monitoring is used to detect respiratory depression in high-risk patients. Volumetric capnography and acoustic respiratory rate monitoring can help detect respiratory distress early. Changes in the initial ECG findings should be noted and evaluated before surgery. Blood pressure should be measured and compared with the previous value. Body temperature, peripheral pulses, capillary vessel filling and skin condition (eg, color, humidity) are evaluated. Any signs of inadequate tissue perfusion require immediate intervention. The urinary system should be evaluated by measuring fluid intake and output and determining fluid balance. Intraoperative fluid totals are part of the report of the physician in charge of anesthesia. Attention should be paid to the presence of all IV lines; all irrigation solutions and infusions; and all outlet devices, including catheters and wound drains. The operation site should be evaluated, and the condition of the dressing, and the type and amount of drainage should be noted. Instructions on incision care should be followed [11].

While the bed is in a flat position in patients with a tendency to hypotension during transport to the PACU, the head-up position should be placed in patients with airway problems. When there is a risk of aspiration, oral bleeding, and vomiting, the patient should be transported in the side-lying position [12]. The patient admitted to PACU should be taken to a stretcher or bed. The patient's dirty operating room apron should be removed and the patient should be dressed in a clean and dry gown. Bed edges should be lifted for patient safety. The PACU nurse should provide individualized nursing care to the patient by taking into account the preoperative patient information according to the type of anesthesia and surgery [2, 13]. (PACU Initial Assessment is given in Table 1) [11, 14].

After the nurse's initial evaluation of the patient and comprehensive body systems examination, it is of great importance in PACU to provide care for possible complications. This is because after general anesthesia and surgery, physiological changes can occur that can affect all body systems, and the general condition of the patient can change rapidly [2, 4]. The resulting physiological changes may cause hemodynamic, respiratory, and thermoregulatory problems. In addition, discontinuation of anesthetic agents, return of the effects of muscle relaxants, and complications due to tracheal extubation may occur. The most common complications include acute pain, nausea, vomiting, delirium, tremors, hypothermia, dry mouth, and hunger [2]. In the study conducted by Koraş-Sözen [15] to evaluate the early complications seen in the postoperative recovery unit (n = 265), 49.4% of the patients developed various complications, followed by pain with a rate of 31.3%, followed by nausea-vomiting with 29%, tremor with 11.5%, hypotension with 8.4%, headache with 7.6%, bradycardia with 3.8%,

Table 1 Initial PACU Assessment

Follow-up	Assessment
Airway Patency Oral or nasal airway Laryngeal mask airway Endotracheal tube with ventilator settings	The assessment of airway patency, respiratory rate, and oxygen saturation must be conducted at regular intervals
Breathing Respiratory rate and quality Auscultate breath sounds Pulse oximetry Capnography or other technology-supported monitoring Supplemental O ₂	Particular attention should be paid to monitoring oxygenation and ventilation
Circulation ECG monitoring: rate and rhythm BP: noninvasive or arterial line Hemodynamic pressure readings (if applicable) Temperature Capillary refill Color, temperature, moisture of skin Apical and peripheral pulses	The monitoring of heart rate, blood pressure, and peripheral vascular indicators must be undertaken routinely Electrocardiographic monitoring devices must be readily accessible
Neurologic Level of consciousness Orientation Sensory and motor status Pupil size and reaction	An evaluation of neuromuscular function must be conducted for all patients administered nondepolarising neuromuscular blocking agents or those with medical conditions associated with neuromuscular dysfunction Periodic assessments of neurological status are warranted
Body temperature	The patient's temperature must be evaluated periodically
Surgical site Dressings and visible incisions Drains: type, patency, and drainage IV assessment: location and condition of sites, solutions infusing	Dressing, drainage and assessment of bleeding must be done periodically as needed
Genitourinary Urine output	The assessment of urine output and voiding must be conducted judiciously, tailored to the specific circumstances of selected patients or procedures
Gastrointestinal Nausea, vomiting Intake (fluids, irrigations) Output (vomit)us) Bowel sounds	A regular evaluation of postoperative nausea and vomiting must be systematically conducted The assessment and management of postoperative hydration are imperative. Certain procedures, which may entail substantial blood loss, may necessitate the administration of additional intravenous fluid therapy
Pain Incision Other	Pain must be assessed periodically
Patient safety needs Patient position Fall risk assessment	The patient's position is evaluated, and the risk of falls is assessed accordingly

hypertension with 2.3%, dyspnea with 2.3%, oliguria with 2.3% and hypothermia with 1.5%. In addition, it is stated that taking the necessary precautions in advance according to the type of surgery and the condition of the patient can reduce complications. In the observational study of Abebe et al. [7], in which the incidence of complications in PACU and related factors were examined, it was stated that the incidence of complications was 54.8% in surgical patients admitted to PACU, and respiratory complications and nausea/vomiting were the most common complications. It was found that female gender, duration of anesthesia > 4 h, and duration of stay in PACU > 4 h were associated with postoperative

complications. It is suggested that field-specific institutional guidelines and protocols should be developed to improve PACU outcomes.

It is stated that half of the complications after anesthesia are seen in the first 1 h and 75% in the first 5 h. Complications in patients during the recovery period are worse than complications during anesthesia. High American Society of Anesthesiologists (ASA) value, emergency procedures, anesthesia lasting 2–4 h, and abdominal and orthopedic surgical procedures have the highest incidence of complications. Complications and side effects can be detected early thanks to nursing observation, care, and treatment in PACU,

and the incidence of complications, mortality rates, and length of hospital stay can be reduced with timely intervention. Complications seen in PACU are respiratory problems, circulation problems, neurological problems, pain, change in body temperature, and nausea and vomiting problems [2] (Table 2 includes complications seen in the early period and nursing approach at PACU) [11, 16].

3 Barriers to Nursing Care at PACU

In transforming PACU into a safe and quality care service for the surgical patient, some obstacles in front of nursing care need to be eliminated. These barriers identified by the literature review are given below.

3.1 The Handover at PACU

The handover report is the interprofessional transfer of critical and essential patient information, professional responsibility, and accountability from one healthcare provider to another [11]. An integral part of the continuity of quality care is the effective transfer of clinical information [17]. The anesthesiologist examines the patient's allergies and related health and medication history, including medications taken or not taken that day. The report also includes specific concerns and/or recommendations regarding the surgery, procedure, or diagnostic test performed, the antibiotic(s) administered, anesthesia and analgesia, any complications or concerns, fluids and volume status given, and the post-anesthesia care plan. The American Association of Nurse Anesthesiology (AANA) Implementation Considerations emphasize that the transition in this process is based on a two-way interaction, preferably face-to-face and that both healthcare professionals should be actively involved in communication [6]. During the transition period, the environment should be free of distractions and interruptions and allow for an open communication platform, including the opportunity to ask and answer questions. In addition, handover reports should be standardized and interactive, enabling one to ask questions and clarify information. The physician in charge of anesthesia should remain at PACU until responsibility for the patient's care is accepted [11].

According to AANA (2019)'s report, studies have shown that an unstructured PACU handover process threatens patient safety, leads to reduced satisfaction among PACU nurses, and reduces the amount of information transferred. It is stated that 80% of serious medical errors are caused by inadequate handover reports. Known causes of incomplete transfers are reported as too many tasks, insufficient time, incomplete patient information, informal handover structure, and a chaotic environment. However, it is stated that clear and complete transfer-based communication supports the

PACU team in maintaining care and achieving the results sought by the patient and family/caregiver [6]. Abebe (2022) stated that according to the review reports of the Anesthesia Closed Claims Project (CCP) database, the leading cause of anesthesia-related malpractice errors is communication breakdowns. Communication problems between clinicians are frequently experienced in operating rooms, PACU, and intensive care units. It is stated that this ineffective communication in PACU affects health care expenses, length of hospital stay, unplanned intensive care unit admissions, mortality, and morbidity [7].

It is noted that a standard PACU transfer checklist focuses on the critical points that need to be addressed for a full transfer and can shorten the duration of the oral report. It is reported that with the use of a standardized form, the skipping of critical points is significantly reduced. Therefore, it is emphasized that a standard tool (Such as SBAR: Situation, Background, Assessment, Recommendation or PATIENT: Patient, Airway, Temperature, Intravenous and Intake/output, End-tidal carbon dioxide, Narcotics, Twitches) should be used in the transition process [6]. A systematic review published in 2013 shows that the implementation of structured handover protocols and interventions to improve communication skills improves patient handover in PACU [18]. Arias-Botero and Padrón-Mercado (2017) determined that while 57% of nurses thought that handover information was of good quality, 26% thought it was incomplete [8]. According to Abebe et al. (2022), the use of a standard checklist is indicated to reduce overall medical errors and the rate of adverse events in PACU [7]. Another study shows that the use of post-anesthesia care tools provides early detection of patients at risk of worsening the condition, improves delivery to surgical ward nurses, and reduces healthcare costs [1].

PACU is an important place for surgery patients to recover. Health professionals working here are required to provide PACU nurses with complete and comprehensive postoperative handover information. A standardized handover model is needed for clinical nurses to improve patient safety management and work efficiency [19].

3.2 Forms used in PACU and Lack of Documentation

According to the results of the studies, record keeping is significant in PACU but the lack of time and training in this regard creates obstacles in record keeping. It is reported that manual records take time and these records are sometimes unreadable, while digital forms are filled out faster, albeit complex, but there are delays in making records due to the lack of computers, and the practice of "cut-and-paste" limits the quality of recorded information. Generally, there is a lack of documentation of information about the intraoperative period, nausea and vomiting, pain assessment, and physician instructions. According to the report of Arias-Botero and

Table 2 Early Complications in PACU and nursing approach

Complications	Nursing approach
Neurological and psychological	The patient's level of consciousness, orientation, memory, and capacity to comply with instructions are appraised An examination is conducted to ascertain the size, responsiveness, and equality of the pupils The patient's sleep/wake cycle, alongside sensory and motor status, are evaluated
Delayed awakening	In instances of altered neurological status, efforts are made to identify the potential causative factor Should a patient who was cognitively alert preoperatively exhibit cognitive deterioration postoperatively, additional assessments are necessitated to exclude hypoxia, delirium, or postoperative cognitive impairment
Urgent agitation	Paramount attention is devoted to assessing respiratory function, given that hypoxaemia is the predominant cause of agitation in the PACU
Delirium	Delayed awakening, commonly attributed to the protracted impact of administered drugs, typically resolves spontaneously over time. If warranted, antagonists may be employed to counteract the effects of benzodiazepines and opioids
Pain and discomfort	Ensuring patient safety is imperative until the patient regains consciousness and exhibits effective communication. This includes monitoring physiological status, ensuring siderails are raised and the call bell is accessible, securing equipment (e.g., IV lines, artificial airways), and verifying allergies The patient's pain status is assessed upon arrival in the PACU and at regular intervals thereafter A pain scale, such as the numerical pain scale, is utilized to gauge the severity or intensity of pain Pain levels are evaluated both at rest and during activities Given that verbal expression of pain may not always be feasible in the PACU, patients are also assessed for alternative indicators of pain, such as restlessness, grimacing, and alterations in vital signs Determinations are made regarding patients experiencing incisional pain, particularly during movement and specific procedures (e.g., removal of drains). Other sources of pain, such as a full bladder, may also be present Patients are consistently involved in the assessment and management of their pain Assessing patients from diverse cultural backgrounds or those who do not speak English may pose challenges. Additional time is allocated to comprehensively understand the pain experiences of these individuals
Respiratory and airway	When administering opioids, the patient is assessed for respiratory depression
Upper respiratory tract Obstruction	To ensure patient safety when opioids are administered in the Post-Anesthesia Care Unit (PACU), a sedation assessment scale, such as the Richmond Agitation and Sedation Scale, is utilized. If the patient shows signs of hypoventilation, immediate emergency protocols are set into motion. Correctly positioning the patient helps facilitate breathing and ensures the airway remains protected. If the patient is unconscious, they are placed in the lateral "recovery" position. This position helps keep the airway clear and minimizes the risk of aspiration in case of vomiting. Once the patient regains consciousness, they are positioned supine with the head of the bed elevated. This helps reduce pressure on the diaphragm from abdominal contents and allows for optimal chest expansion. Oxygen therapy, delivered through a nasal cannula or face mask as per the physician's instructions, is initiated. This aids in clearing out any residual anesthetic gases and meets any increased oxygen demands.
Arterial hypoxemia	Patients are instructed and guided to practice deep breathing and effective coughing or use a spirometer to enhance gas exchange and cerebral blood return. Unless advised otherwise, these exercises are encouraged 10 times every hour while the patient is awake. To allow for comprehensive chest expansion and optimal lung perfusion, the patient's position is adjusted every 1 to 2 h. Assistance is provided to sit in a chair and, if allowed, to stand up. Pain management is ensured through regular and adequate medication. To maintain the integrity of the mucous membranes, thin secretions, and facilitate coughing up of these secretions, hydration is provided either through intravenous fluids or oral intake
Hypoventilation	
Cardiovascular	Vital signs are monitored at 15-min intervals during Phase I or more frequently as needed until stabilization is achieved, with subsequent assessments occurring at less frequent intervals
Hypotension	Deviations such as systolic blood pressure measurements falling below 90 mm Hg or exceeding 160 mm Hg, pulse rates below 60 beats per minute or above 120 beats per minute, and alterations in cardiac rhythm should be promptly communicated to the attending physician
Hypertension	Hypotension, concomitant with a normative pulse rate and warm, dry, and pink integument, is typically attributable to the lingering vasodilatory effects of anesthesia and necessitates continuous observation
Cardiac arrhythmias	In contrast, hypotension accompanied by a rapid or feeble pulse and cold, diaphoretic, pallid skin may be indicative of imminent hypovolemic shock, thereby warranting immediate intervention Electrocardiographic monitoring is advocated for patients with a documented history of cardiac pathology and for geriatric patients undergoing major surgical procedures, irrespective of their cardiac history The apical-radial pulse is meticulously evaluated, and any observed deficiencies or irregularities are duly reported Assessment of peripheral pulses, along with skin color, temperature, and moisture, provides invaluable insights into tissue perfusion
Urinary	To mitigate the incidence of CAUTI, the catheter is expeditiously removed, ideally within 24 h post-operatively, unless medically justified for prolonged utilization. The majority of patients are observed to void within a 6 to 8-h timeframe following surgery. In instances of non-voiding, the suprapubic area is subjected to ultrasonographic scanning or percussion to identify potential signs of bladder distention or fullness
Catheter-associated urinary tract infection (CAUTI)	Patients are provided assurance regarding their capacity to void. Facilitation of voiding may be achieved by aiding the patient in assuming a customary position for urination. Additional facilitative techniques encompass ensuring privacy, auditory stimulation through water flushing, offering oral hydration, or applying warm water over the perineum. Ambulation, particularly to the restroom, and utilization of a commode are also measures employed to promote voiding
Oliguria	In cases where voiding remains unachieved, the healthcare professional may advocate for intermittent catheterization over a period of 6 to 8 h
retention	Owing to the risk of CAUTI, the presence of a full bladder is first ascertained. Perioperative fluid intake is assessed, and bladder fullness is determined through indicators such as discomfort upon palpation Portable ultrasonography is employed to evaluate the bladder for urine volume, serving as a precaution against unwarranted catheterization Should catheterization be deemed necessary, a temporary catheterization is favored over the placement of a permanent catheter to minimize the risk of CAUTI

Table 2 (continued)

Complications	Nursing approach
Temperature changes	Should the patient arrive in the PACU exhibiting normothermia, the temperature is subsequently assessed on an hourly basis
Hypothermia	Conversely, if the patient presents with hypothermia, the body temperature is gauged at 15-min intervals until normothermia is attained
Hyperthermia	A consistent method of temperature measurement is maintained throughout the patient's duration in the PACU
	The patient's skin color and temperature are meticulously evaluated. Potential risk factors for hypothermia or malignant hyperthermia are duly communicated to all members of the perioperative team
	Vigilance is exercised to identify early indicators of inflammation and infection, potentially preceding febrile states, ensuring prompt intervention and treatment of any complications
	To rectify hypothermia, heated blankets and pressurized warm air blankets are employed
	Oxygen therapy, administered either via a nasal cannula or mask, may be utilized to address elevated oxygen demand resulting from shivering
	Resources for the management of Malignant Hyperthermia (MH) are kept readily accessible. The therapeutic approach to MH encompasses the administration of dantrolene (Dantrium), implementation of patient cooling strategies (e.g., the application of ice packs), and rectification of acid–base imbalances
	Adherence to the principles of asepsis is maintained during the care of wounds and intravenous (IV) sites
	Patients are encouraged to engage in deep breathing, coughing, and airway clearance exercises, utilizing a spirometer as necessary
	In the event of hyperthermia, a chest radiograph may be obtained and antipyretic medications may be administered
	Based on the suspected etiology of hyperthermia, cultures from the wound, sputum, urine, or blood may be procured
	Should bacterial infection be identified as the source of hyperthermia, antibiotic therapy is initiated promptly following culture acquisition
	In instances where the body temperature escalates above 39.4 °C (103 °F), measures to induce body cooling may be employed
Gastrointestinal Postoperative nausea and vomiting (PONV)	The patient is inquired about the sensation of nausea, and if present, its intensity is evaluated utilizing either a verbal descriptor or a numerical scale
Hiccups	In instances of vomiting, the volume, characteristics, and color of the emesis are ascertained
Postoperative ileus (POI)	An assessment is conducted for abdominal distension and the presence of bowel sounds
Distension	Given that bowel sounds typically subside or diminish postoperatively, all four abdominal quadrants are auscultated to determine the presence, frequency, and characteristics of the sounds
Delayed gastric emptying	The restoration of normal bowel motility is typically indicated by the passage of gas or feces and the capacity to tolerate oral intake without resultant nausea or vomiting
Constipation	When the patient is designated as nil per os (NPO), intravenous (IV) fluids are administered to sustain fluid and electrolyte equilibrium. Oral fluids are introduced as advised and tolerated, commencing upon the return of the patient's gag reflex, depending on the surgical procedure. Initial oral intake entails clear fluids while potentially continuing IV fluids at a diminished rate. IV fluids are discontinued if oral intake is well-tolerated
	If the patient experiences vomiting while still under the effects of anesthesia, precautions are taken to avert aspiration. The patient is positioned laterally in the recovery position and aspiration equipment is rendered accessible. Interventions for PONV encompass fluid status monitoring and antiemetic medication administration. Prophylactic antiemetics are contemplated for patients with heightened PONV risk. Complementary and alternative therapeutic interventions (e.g., guided imagery, music therapy, aromatherapy, acupuncture) may prove beneficial for PONV management
	Hiccups can typically be alleviated by having the patient breathe into a paper bag, and occasionally, sedatives and tranquilizers may be prescribed to facilitate relaxation and mitigate phrenic nerve irritation. An alternative hiccup remedy involves massaging the earlobes
	Preventive measures for constipation include adherence to bowel protocols, which may incorporate stool softeners and laxatives. Regular assessments are conducted to ascertain the return of peristalsis, and patients are encouraged to expel gas. On subsequent postoperative days, gas pains may intensify. Ambulation and frequent repositioning can offer relief. Positioning the patient on the right side facilitates the ascent of gas along the transverse colon, aiding in its release
	Bisacodyl (Dulcolax) suppositories may be administered to stimulate colonic peristalsis and facilitate the expulsion of gas and feces. Resumption of a regular diet post-return of bowel sounds also promotes the restoration of normal peristalsis. The objective of postoperative ileus (POI) management is symptom alleviation and the restoration of regular gastrointestinal (GI) function. Strategies include bowel rest, discontinuation of solid foods, and gradual reintroduction of diet, commencing with clear liquids and progressively advancing to solid food, with continuous evaluation of oral intake tolerance
	A nasogastric (NG) tube may be necessitated to alleviate gastric pressure, thereby preventing nausea, vomiting, and abdominal distension. Oral care is paramount to maintain the comfort and stimulation of the salivary glands when the patient is NPO or has an NG tube in place
Skin problems	The evaluation of the wound and its dressing necessitates information regarding the nature of the wound, the inserted drains, and the anticipated drainage pertinent to the specific surgical procedure. Postoperatively, the wound is inspected at intervals of 15 to 30 min or as necessitated
Dehiscence	If exudate is observed on the dressing, the characteristics, volume, hue, and scent of the discharge are documented
Surgical site infection (SSI)	The influence of positional changes on drainage is appraised
	A nominal quantity of serous exudate is typical across various wound types. If a drain is inserted, the volume of drainage is assessed and juxtaposed with the anticipated amount. For instance, an abdominal incision accompanied by a drain may exhibit a moderate quantity of serosanguinous drainage within the initial 24 h. Conversely, an inguinal herniorrhaphy is expected to manifest minimal serous drainage
	Generally, drainage is anticipated to transition from bloody (red) to serosanguinous (pink) and ultimately to serous (clear yellow). Purulent drainage may be indicative of a SSI. The drainage should progressively diminish over a span of hours or days, contingent upon the surgical procedure. In instances of wound dehiscence, a sudden efflux of brown, pink, or clear drainage may transpire. Any profuse or atypical drainage or substantial alterations in vital signs warrant reporting to the healthcare professional
	Dressings over skin grafts may be retained for a duration of 3 to 5 days to preclude perturbation of the graft site, thereby fostering graft acceptance. Such dressings may be altered by nurses possessing specialized training
	During the dressing change, the quantity and classification of drains in situ are acknowledged, ensuring avoidance of the drains. The incision site undergoes meticulous examination. The perisutural area may exhibit mild erythema and edema, consistent with an anticipated inflammatory response. Nonetheless, the skin adjacent to the incision should retain its customary coloration and thermal attributes
	In cases where the wound is undergoing primary healing, characterized by scant or absent drainage and absence of drains, a single-layer dressing or no dressing may suffice
	In scenarios where drains are employed, or when there's moderate to significant drainage, or if healing deviates from the primary intention, a multilayered dressing approach is adopted

Padrón-Mercad (2017), 51% of the nurses did not use the recovery scale in patients who came to PACU, the Modified Aldrete Scoring System Scale was the most popular, but 16% of the nurses who applied the scale did not record the scale scores. In addition, it was noted that when the patient is discharged from PACU, some forms cannot be filled out due to time-consuming, such as the surgeon's postoperative recommendations and proof that the recipient understands the care recommendations [8]. In the study of Bowyer and Royse (2016), it is emphasized that to identify patients who may benefit from the timely intervention in the postoperative period, real-time evaluation of patient recovery should be performed, therefore the quality of postoperative recovery should be measured [20]. Niyungeko et al. (2021), in their study (n=82) in which they examined nursing practices in the recovery room, reported that only 47.5% of the nurses knew the nursing protocols used for post-operative patients, and they did not have sufficient information about the different tools used to evaluate the patient's post-anesthesia discharge [5]. Pazar and Yava (2013) examined the effect of the nursing guide application, which was developed for this study and followed up according to the early warning score system (EWSS) in PACU, and found that the use of EWSS and nursing guidelines enabled early detection of complications and earlier interventions. In line with these results, EWSS and nursing guidelines were recommended to be used in the post-anesthesia care unit [21]. Street et al. (2018) examined the use of a post-anesthesia care tool and its effect on nursing assessment, communication, and management regarding patients in PACU and reported that the post-anesthesia care tool provides an increase in the frequency of nursing evaluation, nurses show significant improvement in responding to complications such as pain, nausea-vomiting, hypothermia, and contribute to the recognition of clinical deterioration and transition from PACU to the service. In addition, it was noted that the use of standardized assessment, documentation, and communication procedures at PACU can improve patient safety and quality of care, especially in high-stress clinical areas [22].

3.3 Training Requirement of Nurses at PACU

Nurses need competence in postoperative care to ensure the safe and successful recovery of patients who have undergone surgery. However, there is no consensus on the competence or training required to provide safe, high-quality patient care in PACU [9]. To promote a safe and successful recovery after surgery, the nurse working at PACU must have received special training in postoperative care [23]. Post-anesthesia care should be performed by trained and professional nurses [24]. In a qualitative study conducted with nurses working at PACU, nurses stated that it is important to always

be “one step ahead” after surgery and to be prepared for any eventuality. They stated that they needed to be vigilant, anticipate complications, and be prepared for anything that might happen, meaning “you have to be able to anticipate something before it happens.” In addition, it was stated that nurses should understand the surgeries performed and have advanced knowledge of pharmacology, know the hemodynamic parameters related to the patient, and know that all these affect each other [9]. Similarly, Dejarkom et al. (2014) stated that PACU staff should have excellent skills in detecting postoperative complications for the safety of patients [25]. It was reported that nurses working in PACU have high knowledge and skills in subjects such as follow-up, venous access, and medication management but have deficiencies in cardiovascular and respiratory problems and management of emergencies [8]. In a qualitative study by Dahlberg et al. (2022) based on nurses' perspectives on the competencies of nurses working in PACU in Sweden, it was reported that transferring critically ill patients who need to be treated in the intensive care unit to PACU because there is no room may put the health of patients at risk, since PACU nurses do not have the knowledge or experience to care for such patients. In the same study, it was emphasized that the competence of specialist nurses can be utilized in promoting safe and high-quality care in PACU, supervising recruits, and creating a knowledge base for graduate education [9].

3.4 The Workload of Nurses at PACU

Due to the number of duties and working hours, nurses often mention their workload. According to the surveys, the number of patients per licensed practice nurse per shift is four, and the number of patients per professional nurse is eight. Administrative duties such as document management, drug entries into the system, coordination of admission and discharge of patients, supervision of licensed practice nurses, diet lists, reaching the anesthesiologist when necessary, and liaison between the anesthesiologist and nurse assistants are reported among the reasons for the workload experienced by nurses. Professional nurses report that they do not have enough time to focus on patient care tasks due to heavy administrative duties. Although it has been stated that this situation causes a feeling of disappointment in the professional motivation of nurses, the fact that nurses with senior care responsibilities in PACU have less contact with patients was expressed as contradictory [8].

Kiekkas et al. (2021) examined the skipped nursing care in PACU and its causes and determined that the three nursing care activities most frequently reported by nurses were drug preparation, administration and evaluation of efficacy, patient surveillance and evaluation, and pain-related care. It is reported that these activities are performed significantly

Table 3 Nursing care barriers in PACU and recommendations

Barriers related to nursing care	Recommendations
Ineffective communication between health professionals in PACU [7]	Ensuring direct, face-to-face interactions among healthcare professionals during transitions between PACU and other clinics is vital, along with the active engagement of healthcare professionals in these communications The environment during the transition process should be devoid of distractions and interruptions, fostering an open platform for dialogue. This should facilitate an opportunity for queries to be raised and addressed seamlessly [11]
Unstructured (Non-standard) PACU handover process [6]	Implementation of structured handover protocols (such as SBAR, PATIENT) [19] and interventions to improve communication skills [6, 18]
The unavailability of computers in the PACU hinders the ability to maintain records [8]	The evaluation and documentation of postoperative recovery quality is essential for patient care Utilizing specific measurement tools in the Intensive Care Unit (ICU) to monitor patient care and swiftly identify and address potential complications
Failure to complete assessment tools that indicate the recovery status of patients in the PACU due to the time-consuming nature of these evaluations [8]	The implementation of pertinent scoring systems, such as the Modified Aldrete Scoring System Scale and the Post Anesthesia Discharge Scoring System, for assessing patients' readiness for transition from the PACU to the ward or ICU [29, 30]
Deficiency in knowledge regarding the utilization of measurement tools (such as the Modified Aldrete Scoring System Scale), which are employed to assess patient readiness for discharge post-anesthesia [5]	
Lack of consensus on the competence or training required to provide safe, high-quality patient care in PACU [9]	To enhance the likelihood of a safe and successful recovery post-surgery, nurses in the PACU should undergo specialized training in aspects of postoperative care, including specific surgeries, advanced pharmacology, hemodynamic parameters, potential postoperative complications, etc.[9]. It is imperative that care is administered by professional and proficient nurses [24] Leveraging the expertise of specialist nurses is crucial for ensuring safe and high-quality care in the PACU. These nurses play a pivotal role in mentoring new hires and laying the foundation for postgraduate education [9]
Unexpected increase in patient volume, critical patient admissions to PACU, prolonged hospitalizations, heavy workload due to insufficient number of nurses [8]	Identifying and minimizing skipped nursing care, limiting the number and length of stay of critically ill patients admitted to PACU [8]
Nurses' limited access to prescription medication and lack of physicians in PACU [9]	Implementation and strengthening of a patient safety-oriented risk management model in PACU from the perspective of nursing role [9]
Non-reporting of adverse events in PACU [8]	Enhancing institutional conditions to reduce the incidence of adverse events and guarantee thorough and anticipatory patient management through optimized staffing, targeted training programs, equitable shift distribution, effective management of adverse events, streamlined patient handover procedures, and meticulous documentation of medical information Formulating and implementing institution-specific guidelines and protocols aimed at improving patient outcomes in the ICU [8]
The concept of teamwork in the PACU has not been fully internalized, and there is an absence of a unified approach towards actions in PACU among healthcare professionals [8]	Collaboration between surgeons, anesthetists and PACU staff in patient care [25]

higher in patients coming from the intensive care unit due to their density, the prevalence of skipped nursing care activities was 78.1%, and the three most reported reasons for missed nursing care were the insufficient number of nurses, unexpected increase in patient volume or acuity, and heavy hospitalization or discharge activity. In addition, it was recommended that skipped nursing care should be identified and minimized, and the number of critically ill patients admitted to PACU and the length of stay should be

limited [26]. Similar to the study of Kiekkas et al. (2021), Lalani et al. (2013) stated that although the patients are ready for transfer from PACU, the lack of beds in the wards causes congestion in the PACU, which leads to dissatisfaction among surgeons, nurses, patients, and their families, and that the long stay of patients in PACU increases the workload of nurses and affects the quality of postoperative nursing care [27]. There are other studies in the literature with similar results [10, 28]. In the study of Dahlberg et al.

(2022), it is reported that nurses in PACU are stressed due to high patient flow and fast tempo, which threatens patient safety. It is noted that nurses do not have time to do written instructions or evidence-based practices and deviate from established routines [9].

3.5 Situations that Prevent the Independence of Nurses in PACU

Independence is defined as a sense of freedom in how patient care is planned and the ability to act quickly to meet patient needs. This sense of freedom brings with it a great deal of responsibility to nurses to have sufficient knowledge and to question situations that have the potential to harm the patient. However, several conditions that prevent nurses from working independently are described. One is that nurses only have access to a few common prescription medications, which prevents nurses from meeting patient needs quickly and limits their ability to work independently. Another obstacle is that the shortage of physicians in PACU complicates the work of nurses. That's because nurses have to contact physicians by phone to get prescriptions for medication, which can make a simple task very time-consuming. Nurses complain of medication prescriptions given orally, in addition to the time lost when consulting a physician. Nurses have noted that oral prescriptions are risky, can lead to misinformation or loss of information, and endanger patient safety [9].

3.6 Notification of Adverse Events and Perception of Teamwork at PACU

It has been shown that adverse events that develop in PACU are associated with patient complications. It is noted that low-severity adverse events (phlebitis, pressure ulcers) may result in social punishment if the event is reported, but often it is not taken into account. It is stated that the more severe the adverse events, the more pronounced the need to report the event [8]. Based on these results, it is recommended that a risk management model focused on patient safety should be implemented and strengthened in PACU, especially from the perspective of the nursing role. In addition, it is emphasized that the conditions of the institution (number of staff, training programs, shift distribution, improved adverse event management, patient handover process, recording of medical information, etc.) should be improved to minimize the occurrence of adverse events and ensure comprehensive and proactive management of the patient. Arias-Botero and Padrón-Mercado (2017) reported that another point emphasized by the people interviewed at PACU is teamwork and that the healthcare professionals here stated that "nothing can be done alone". However, in the definitions made, it is stated that PACU is not associated with teamwork, this concept is not internalized in PACU, and a common

action related to PACU is not defined by the employees [8]. Dejarkom et al. (2014), reported that cooperation between surgeons, anesthesiologists, and PACU employees is essential in patient care at PACU [25]. (Barriers to nursing care at PACU and recommendations for these barriers are summarized in Table 3) [29, 30].

4 Conclusion

PACU is an environment where there is continuous circulation of various patients with individual needs in the postoperative period. Nursing proficiency at PACU requires specialized knowledge and proactively working with patients and staff at a fast pace to accept the patient and provide safe, high-quality care. The PACU nurse must have sufficient knowledge and skills in improving nursing care. Based on the results of the studies on the subject, it can be stated that to provide safe and high-quality nursing care in PACU, the training needs of nurses should be met, the newly recruited nurses should be supervised by specialist nurses, standardized handover tools, documentation, and communication procedures should be used. Measurement tools should be used to measure patient care in PACU, to recognize complications that may develop, and to respond quickly. The number of nurses should be increased to reduce the workload of nurses, and measures should be taken to reduce the number of patients admitted to the PACU and the length of stay in the PACU. In addition, situations that prevent nurse independence should be eliminated, a risk management model focused on patient safety should be implemented in PACU, institutional conditions should be improved, and field-specific institutional guidelines and protocols should be developed to improve patient outcomes in PACU. In addition, due to the limited number of studies in the literature on nursing care and situations that hinder care in PACU, it may be suggested that nurses contribute to the literature by conducting research on this subject.

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