Postanaesthesia Care Unit Discharge Criteria and Considerations for the Paediatric Patient

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KEY POINTS

- Airway-related complications are the most common cause of unplanned admissions.
- Former preterm infants less than 60 weeks postconceptual age and term infants less than 4 weeks of age should undergo extended postoperative monitoring to assess for apnoea and associated desaturation or bradycardia.
- Malignant hyperthermia-susceptible patients who have received a nontriggering anaesthetic do not require extended monitoring.
- Children undergoing tonsillectomy who are less than 3 years old and those with severe obstructive sleep apnoea require postoperative admission for inpatient monitoring.
- Racemic epinephrine requires extended postoperative monitoring for the recurrence of original symptoms after the drug effect has worn off.
- Nursing-driven discharge protocols provide a safe and efficient method for postanaesthesia care unit discharge.

INTRODUCTION

The postanaesthesia care unit (PACU) encompasses the final stage of perioperative care. It is where patients should return to baseline after anaesthesia and prepare for discharge if indicated. This tutorial aims to summarize current evidence and recommendations for the discharge of paediatric patients in ambulatory settings, discusses common causes of unanticipated admissions, and highlights several medical and surgical conditions that warrant special consideration.

PACU DISCHARGE CRITERIA

The American Society of Anesthesiologists (ASA) Practice Guidelines for Postanesthetic Care state that the purpose of discharge criteria should be to minimize the risk of central nervous system or cardiorespiratory depression after discharge.[1] Two commonly used scoring systems to assess overall readiness for discharge are the Aldrete Score (Table 1) and the Pediatric-Post-Anesthetic Discharge Scoring System (Ped-PADSS; Table 2). The Aldrete Score was developed for adults; therefore, it requires modification for the paediatric population. Ped-PADSS is specifically adapted for paediatrics but focuses on ambulatory surgery. Despite Ped-PADSS

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Characteristic	Scoring System
Activity (motor function)	2 = able to move 4 extremities or same activity level as preoperatively 1 = able to move 2 extremities or reduced activity level compared with preoperatively 0 = no movement of extremities
Circulation (blood pressure)	2 = ±20% of preanaesthesia level 1 = ±20 to 49% of preanaesthesia level 0 = ±50% of preanaesthesia level
Consciousness	2 = fully awake 1 = easily arousable 0 = not responsive
Oxygen saturation (levels are for the adult population and are not specific to paediatrics; please refer to institutional guidelines)	2 = maintains >92% on room air 1 = requires supplemental oxygen to maintain >90% 0 ≤ 90% despite supplemental oxygen
Respiration	2 = breathes deeply, coughs, or cries 1 = dyspnea, tachypnea, shallow breaths 0 = apnoea, requires airway intervention

Table 1. Modified Aldrete Score/Postanaesthesia Recovery (PAR) Score. The maximum score is 10 points. A score of 9 or greater is acceptable for discharge, and a score of 8 may be acceptable if a preoperative blood pressure was not taken. Adapted from[2]

being specific to the paediatric population, the modified Aldrete Score is more commonly used. These 2 scoring systems are detailed below.

The Aldrete Score/Postanaesthetic Recovery Score

The Aldrete Score, also called the Postanaesthetic Recovery (PAR) score, was originally designed to assess recovery in the PACU and readiness for discharge to home or an inpatient unit.[2] Once routine use of pulse oximetry became standard of care, Aldrete revised his scoring system to include oxygen saturation rather than colour index. As ambulatory surgery became more common, ambulatory concerns were added, creating the modified Aldrete Score. The original modified PAR score included the requirement for both spontaneous urination and tolerance of oral fluids for discharge.[2] However, it has been determined that these factors should only be applied in select patients rather than routine requirements.[1]

Many institutions continue to use a variation of the Aldrete/PAR score to assess the return of function in the critical areas of activity (motor function), respiration, circulation (blood pressure), consciousness, and oxygen saturation.[2] These 5 areas are scored from

Characteristic	Scoring System
Bleeding	2 = minimal bleeding at the surgical site (no dressing change) 1 = moderate bleeding at the surgical site (1 or 2 dressing changes) 0 = severe bleeding at the surgical site
Consciousness (activity level)	2 = walks without imbalance or same activity level as preoperatively 1 = walks with assistance or reduced activity level compared with preoperatively 0 = cannot walk or hypotonic
Haemodynamics (heart rate and blood pressure) If child is upset or fighting, use heart rate only.	2 = ±20% of preanaesthesia level 1 = ±20 to 40% of preanaesthesia level 0 = ±greater than 40% of preanaesthesia level
Nausea/vomiting	2 = minimal (no medication needed in PACU) 1 = moderate (vomiting controlled with 1 medication in PACU) 0 = severe (persistent vomiting despite medication)
Pain Use an appropriate pain assessment tool validated for the specific patient population.	2 = yes, pain controlled 1 = no, pain not controlled

Table 2. Pediatric-Post-Anesthetic Discharge Scoring System. PACU, postanaesthesia care unit. The maximum score is 10 points. A score of 9 or greater is acceptable for discharge unless any of the following 3 exclusion criteria are met: (1) the child is experiencing dyspnea or hoarseness, (2) the patient or family requests to meet with the anaesthesiologist, and (3) the anaesthesiologist is required to meet with the patient or family. Adapted from[3,4]

0 to 2 points with a maximum score of 10. In general, a score of 9 or greater is a predictor of successful discharge. Other variables, such as motor function and consciousness, may need to be adjusted for specific paediatric populations, and returning to the preoperative baseline may be a more appropriate means of accessing recovery. One commonly adjusted variable is blood pressure. Some institutions defer a blood pressure measurement in the PACU if the patient is awake or if preoperative blood pressure was not taken due to lack of patient cooperation, a scenario common among paediatric patients.

Ped-PADSS

PADSS was designed to assess readiness for discharge home in the adult ambulatory setting and was later adapted for the paediatric population.[3,4] Ped-PADSS assesses the areas of haemodynamics (blood pressure and pulse), state of awakening (activity level), nausea/vomiting, pain, and bleeding. Each area is scored from 0 to 2 points with a maximum score of 10, with a score of 9 or greater predicting appropriateness for discharge, like the Aldrete Score. In contrast to the Aldrete Score, Peds-PADSS assesses pain.[2-4] This requires the use of paediatric pain assessment scales, which can be chosen based on age, language, and cognitive ability. Zielinski et al provides a review of the 10 most commonly used pain assessment scales for children in the postoperative period,[5] several of which are briefly reviewed in ATOTW 289.

PACU DISCHARGE PROTOCOL

Due to the significant growth of outpatient surgical procedures and the large number of children who need care, many institutions have implemented nursing-driven discharge protocols to help meet the needs of increasing patient volume. A study by Moncel et al evaluated the use of the Ped-PADSS for safety and efficiency as a nursing-driven discharge protocol for paediatric day surgery patients.[4] PACU discharge to home required a Ped-PADSS score of 9 or greater, the absence of dyspnea or hoarse voice, no parental request to see the supervising anaesthesiologist, and no request (by other staff) for the anaesthesiologist to see the patient or family before discharge. Within 1 hour in the PACU, 97% of children were found to meet discharge criteria, and 99% met the criteria within 2 hours.[4] No children discharged home using the Ped-PADSS protocol were readmitted at a 2-day follow-up.[4] These findings demonstrated that paediatric day surgery patients can be safely discharged home within 1 hour after arrival to the PACU by nurses using a validated discharge criteria protocol. Additionally, use of the Ped-PADSS significantly decreased the length of PACU stay, suggesting that the routine use of a discharge protocol may increase efficiency with a higher turnover of PACU beds.[4]

REASONS FOR UNANTICIPATED POSTOPERATIVE ADMISSION

Unanticipated admission after surgery in paediatric patients is uncommon. Nevertheless, knowledge of risk factors for unanticipated admission is important because it aids in the identification of patients at increased risk of PACU complications. A recent study that evaluated the incidence of unanticipated postoperative admissions at a paediatric tertiary care hospital found the rate of unanticipated admissions at 0.97%.[6] Although this is less than 1% of patients, these events should not be disregarded. Table 3 summarizes the causes of unanticipated admission. Airway-related complications were the most common cause of both morbidity and unanticipated

Reasons for Unanticipated Admission and Examples	Percentage of Admissions
Anaesthetic	46%
Postoperative hypoxia	
Inadequate pain control	
Postoperative nausea and vomiting	
Airway complications	
Surgical	34%
Complication	
Excessive bleeding	
Inadequate pain control postdischarge	
Medical	11%
Treatment of new medical condition	
Exacerbation of preexisting medical condition	
Not defined elsewhere	
Social	9%
Parent or surgeon request	
Late start operating room	
No home support/no escort	

Table 3. Reasons for Unanticipated Admission following Paediatric Ambulatory Surgery. Adapted from[6]

admission, with postoperative hypoxia accounting for 33% of anaesthetic-related factors.[6] A total of 46% of the admissions were anaesthesia-related and included risk factors of an age of less than 2 years, ASA class 3, presence of obstructive sleep apnoea (OSA), surgical duration of greater than 1 hour, surgery completion after 1500 hours, type of surgery (eg, otolaryngology, orthopaedic, dental), and the occurrence of intraoperative events (eg, laryngospasm).[6] Additionally, the unanticipated admission rate in children with OSA was 89% compared with 41% in children without OSA.[6] Aside from airway and respiratory complications, poor postoperative pain control (24%) and postoperative nausea and vomiting (21%) were common reasons for unanticipated admissions.[6] ATOTW 479 provides an overview of risk factors, mitigation strategies, and treatment options for postoperative nausea and vomiting.

SPECIAL CONSIDERATIONS

Premature Versus Term Infants and Postoperative Apnoea

Newborn and premature infants are at risk for postoperative apnoea. Postoperative apnoea results in desaturation, bradycardia, and, ultimately, cardiac arrest. Prematurity (gestational age of <37 weeks at birth) has been found to be the highest risk factor for postoperative apnoea, with lower gestational age at birth being associated with an increased risk of apnoea.[7,8] Other risk factors include decreased postconceptual age (PCA; less than 60 weeks), decreased weight, history of apnoeic events, history of caffeine use, mechanical ventilation with an endotracheal tube, need for supplemental oxygen, and anaemia.[7,8] Term infants (born at >37 weeks PCA) over 1 month of age have not been found to be at increased risk of postoperative apnoea. In 2015, a large multinational prospective randomized trial was performed to assess neurodevelopmental outcomes after general anaesthesia versus spinal anaesthesia for inguinal herniorrhaphy (General Anesthesia Compared to Spinal Anesthesia Study).[8] One of their secondary outcomes was looking at the incidence of postoperative apnoea in these infants, many of whom were premature. Study findings concluded that regional anaesthesia does not eliminate the risk of late postoperative apnoea (30 minutes up to 12 hours postoperatively), and high-risk infants should undergo extended postoperative monitoring, regardless of anaesthetic technique.[8]

Many institutions follow the American Academy of Pediatrics recommendations that preterm infants less than 50 to 60 weeks PCA and full-term neonates less than 4 weeks of age should be admitted for at least 12 hours of observation or, more practically, overnight monitoring regardless of anaesthetic technique.[9]

As an example, Boston Children's Hospital has established the following guidelines for preterm and term infants:

- Pre-term infants less than 60 weeks PCA require overnight monitoring, regardless of anaesthetic technique.
- Term infants less than 1 month of age require overnight monitoring, regardless of anaesthetic technique.
- Term infants over 1 month of age who did not receive opioids may be discharged after evaluation by an anaesthesiologist once they meet discharge criteria. No specific length of monitoring is required.
- Term infants between 1 and 3 months of age who have received narcotics:
  - Ambulatory cases require a minimum of 2 to 4 hours of observation at the discretion of the attending anaesthesiologist, with overnight observation considered for high-risk infants.
  - Inpatient cases require admission to a monitored bed for a minimum of 12 hours.
- Term infants greater than 4 weeks and younger than 6 months require evaluation from an anaesthesiologist before discharge home.

Malignant Hyperthermia

Malignant Hyperthermia (MH) is a life-threatening, hypermetabolic crisis triggered by volatile anaesthetics or succinylcholine. It is due to a mutation of the ryanodine receptor that is inherited in an autosomal dominant pattern. MH-susceptible patients are those with a personal or family history suggestive of an MH event, even in the absence of a formal MH evaluation. There are also some inherited muscle diseases associated with MH susceptibility. These patients should receive a "nontriggering anaesthetic," which means no exposure to volatile agents or succinylcholine.

The Malignant Hyperthermia Association of the United States recommends patients who receive a nontriggering anaesthetic should undergo a minimum of 1 hour of continuous monitoring in the PACU, with 2 hours of monitoring recommended in patients who will be discharged home.[10] Patients who experienced an episode of MH should be treated and monitored in the intensive care unit for at least 36 hours.[10] By contrast, the Society for Ambulatory Anesthesia and Ambulatory Surgical Care Committee of the ASA released a position statement in 2019 stating that MH-susceptible patients who have undergone a nontriggering anaesthetic technique may be discharged per the usual ambulatory discharge criteria as there is no evidence indicating that an extended stay for postoperative monitoring is necessary.[11]

Tonsillectomy with or without Adenoidectomy

Approximately 250000 paediatric tonsillectomies with or without adenoidectomies are performed annually, making this one of the most common paediatric surgical procedures, with the majority performed as day surgery.[12] As detailed above, paediatric patients with OSA and those undergoing head and neck/airway procedures are at increased risk for anaesthetic complications in the PACU.

Therefore, patient selection matters to identify those who are appropriate for ambulatory surgery and those who are at highest risk for postoperative respiratory compromise. The Society for Ambulatory Anesthesia's paediatric committee position statement defines high-risk paediatric patients with the recommendation for overnight admission for congenital cardiac disease (excluding patent foramen ovale), bleeding or clotting disorders, sickle cell disease, craniofacial anomalies, Trisomy 21, cerebral palsy, neuromuscular disorders, children less than 3 years old, and a body mass index greater than the 95th percentile.[12] The American Academy of Otolaryngology-Head and Neck Surgery explicitly recommends overnight admission to a monitored bed for children undergoing tonsillectomy with or without adenoidectomy less than 3 years old and for those with severe OSA.[13] Patients appropriate for day surgery are generally older children without major medical comorbidities (ASA 1 or 2).[12] However, it is clearly recommended that patients less than 3 years old or with severe OSA or any of the above high risk factors are not ambulatory surgery candidates.[12,13]

Postintubation Croup

Postintubation croup is another possible cause of PACU respiratory distress. It typically presents within 3 hours of extubation as stridor, hoarseness, and barking cough.[14] Postintubation croup is secondary to subglottic oedema and is often related to factors such as a large endotracheal tube, multiple intubation attempts, traumatic intubation, and prolonged intubation, although it can present after short ambulatory procedures.[14] Nebulized racemic epinephrine is a treatment for viral croup and may also be helpful in the setting of postintubation croup if symptoms of respiratory distress are severe. The mechanism of action is local vasoconstriction, which results in a decrease in mucosal oedema. The effect lasts approximately 1 hour and generally abates by 2 hours. It has been postulated that there is an associated rebound phenomenon with its use that makes the condition worse than pretreatment. However, a recent editorial article by Sakthivel et al concluded this is not the case based on a literature review of 10 studies investigating this rebound phenomenon.[15] Regardless, obstructive symptoms may recur once the effects of the racemic epinephrine have worn off, warranting a prolonged duration of monitoring in the PACU after administration.

Boston Children's Hospital has established the following guidelines after racemic epinephrine administration:

- Day surgery patients require 2 to 4 hours of observation before being discharged home. Inpatient admission should be considered if symptoms return or if additional doses of racemic epinephrine are required.
- Dexamethasone should be considered in these patients in consultation with the surgical service.

SUMMARY

It is important for the paediatric anaesthesiologist to be familiar with common postoperative complications and circumstances unique to the care of children in the PACU. In healthy, low-risk patients, nursing-driven discharge protocols provide a safe and efficient method for PACU discharge. Airway-related complications, inadequate pain control, and postoperative nausea and vomiting are the most common anaesthetic-related causes of morbidity and unanticipated admission. The anaesthesiologist must remain vigilant in monitoring patients with OSA or those who have undergone head and neck surgery. There are many special considerations in postoperative care and discharge planning for children. Recommendations in the literature and from professional societies can be helpful when establishing local practice guidelines at your own institution.

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