Original Contribution

Factors influencing postoperative pain following discharge in pediatric ambulatory surgery patients

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Abstract

Study objective: To identify demographic, intraoperative, and parental factors that influence the postoperative pain experience in ambulatory surgery pediatric patients. We also monitored postoperative maladaptive behavior changes (PMBCs) to investigate the relationship between pain and PMBCs.

Design: Prospective cohort study.

Setting: Discharge period after ambulatory surgery.

Patients: 204 patients ages 1–6 years undergoing ambulatory orthopedic, urology, general surgery, and otolaryngology surgical procedures who were American Society of Anesthesiologists (ASA) physical status I or II.

Interventions: None.

Measurements: We administered telephone questionnaires to parents of ambulatory surgery patients 1–6 years old exploring pain ratings, behavior change ratings, and medication compliance at 2–3 days and 1–2 weeks after surgery. Pain and behavioral change scores were obtained using the Parents Postoperative Pain Measure (PPPM) and Post-Hospital Behavior Questionnaire (PHBQ). Parental medication compliance was defined as parents who followed the discharge instructions for pain medication administration.

Main results: For our cohort, 69% of patients experienced pain after 2–3 days and 17% after 1–2 weeks post-discharge. PMBCs were reported in 55% after 2–3 days, and in 15% after 1–2 weeks. In addition, PMBCs occurred in the absence of pain (PPPM = 0) at rates of 20% and 5% at 2–3 days and 1–2 weeks after surgery, respectively. Female sex, anesthesia duration, and otolaryngology procedures correlated with higher postoperative pain (PPPM) scores in univariate and multivariate analysis. Intraoperative medications did not correlate with PPPM or PHBQ scores. Higher pain scores were associated with parents who were compliant with discharge instructions for pain medications.

Conclusions: Many pediatric patients experienced short-term pain and PMBCs after ambulatory surgery, but these largely resolved by 1–2 weeks following discharge. Patient sex, anesthesia duration, and surgical procedure influenced postoperative pain and/or PMBCs. Furthermore, PMBCs were associated with, but not solely a manifestation of, postoperative pain.

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Keywords: Pediatric postoperative pain Postoperative maladaptive behavior Pediatric ambulatory surgery Pain medications

1. Introduction

Children may experience pain and maladaptive behavioral changes in the days and weeks after surgery, which importantly contribute to the overall postoperative experience [1–3]. After surgery, 44–93% of pediatric patients have been reported to experience postoperative pain [1, 3,4]. In addition, over half may exhibit new maladaptive behaviors two weeks following discharge, and in 20% of children, these can persist for up to six months [5]. Poor control of postoperative pain may contribute to maladaptive behavioral changes and is associated with patient or family dissatisfaction, perioperative morbidity and potentially have long term effects on the child’s emotional and cognitive well-being [2, 6–9].

Management of postoperative pain may be particularly challenging in ambulatory surgery patients, as parents and caretakers must oversee the majority of the recovery period. In younger children who may not be able to adequately express their pain, this may be even more challenging. Several factors are known to influence the postoperative pain experience, including patient age, sex, and presence of pre-operative anxiety.

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Specific surgical subspecialty and type of operative procedure within each subspecialty could also play important roles in influencing postoperative pain in pediatric patients. For example, in pediatric patients, myringotomy with tube placement led to much less postoperative pain than tonsillec tomy (another otolaryngology procedure), as well as less pain when compared to circumcision and inguinal hernia repair [12]. The duration of postoperative pain also varied among procedures, with tonsillec tomy causing a longer duration of pain than orthopedic or inguinal hernia repair [13].

In addition to differences attributable to procedure-specific variations, the choice of anesthetic agents or adjunct medications and parental factors can also affect the postoperative pain experience. In pediatric patients undergoing inguinal hernia repair, use of intravenous ketorolac and supplemental local anesthesia more effectively reduced the severity of post-discharge pain, compared to caudal anesthesia alone [14]. In tonsillec tomy patients, paracetamol in combination with codeine was significantly more effective than the combination of paracetamol and ibuprofen in reducing postoperative pain [15]. However, a comprehensive analysis of the effects of intraoperative anesthetic and analgesic agents on post-discharge pain has not been performed in pediatric patients. Specific parental factors that have been identified to affect postoperative pain control include ability of parents to accurately evaluate pain and compliance with discharge instructions related to pain medication use [16,17].

Maladaptive behavioral changes – such as in eating, sleeping and separation anxiety – can also occur during the postoperative period [18]. Postoperative maladaptive behavior changes (PMBCs) have many different contributing factors, of which postoperative pain has been suggested as an important contributor, and possibly a causal factor [19,20]. Other important factors include age, child temperament, ethnicity, emotional disturbances and anxiety, which have also been shown to increase the incidence of postoperative maladaptive behavior changes [19–21].

The purpose of this study was to characterize factors that influence postoperative pain in healthy pre-school age children during the two weeks following ambulatory surgery, and to examine the relationship between PMBCs and pain in this patient cohort. We hypothesized that intraoperative factors including type of surgical procedure and anesthetic management are important factors influencing postoperative pain and PMBCs in pediatric ambulatory patients.

2. Methods

This study was approved by the Columbia University Medical Center Institutional Review Board, and informed written consent was obtained from parents of all participants.

2.1. Patient criteria

This study examined postoperative pain management in female and male patients ages 1–6 years undergoing ambulatory surgery in orthopedic, urology, general surgery, and otolaryngology (OTO) procedures. All American Society of Anesthesiologists (ASA) physical status I or II patients who stayed ≤23 h in the Post-anesthesia Care Unit (PACU) were included in the study. Exclusion criteria included patients with ASA physical status III or above, patients who were admitted as inpatients for recovery, patients transferred to the Pediatric Intensive Care Unit, or any patients with conditions that would affect pain expression or sensation. We approached all eligible patients for participation in the study and obtained consent from parents.

2.2. Data collection

Perioperatively, patient demographics, premedication received, and intraoperative data were collected on the day of surgery and confirmed by review of the anesthesia records. After discharge, parents/caregivers were interviewed by telephone using the PPPM, PHBQ, and a questionnaire focused on pain medication management to understand post-discharge pain management. The pain medication management telephone questionnaire specifically queried adherence to pain medication regimen. These interviews were conducted at both 2–3 days and 8–12 days, as per parent availability, after discharge from the PACU. Responses recorded at 2–3 days were considered short-term follow-up and responses at 8–12 days (denoted 1–2 weeks) were considered late follow-up.

2.3. Pain and behavior measure tools

The PPPM is a 15-item questionnaire, each item corresponding to a score of 1 if positive. Thus, total scores range from 0 to 15. This tool has been shown to be reliable between raters and is well-validated [21,22]. It was originally validated for children age 7–12 years who had undergone surgery based on examining relationships between parent-report and child-rated pain, but has also been validated for children aged 1–6 years with good internal consistency [21,23]. In our study, a PPPM score of 0 was interpreted as no pain. Scores of 1–4, 5–9, and ≥10 were defined as mild, moderate, and severe pain, respectively. The PHBQ, originally developed and validated in 1986, is a widely used questionnaire to score behavioral changes in children after hospitalization. The 27-item questionnaire has questions in six subcategories: apathy and withdrawal, aggression toward authority, general anxiety, separation anxiety, eating disturbance, and sleep anxiety [24]. The PHBQ items were scored on a 5-point Likert scale grading how much the child exhibits a behavior postoperatively compared to a baseline (1 = much less than before, 3 = same as before, 5 = much more than before). Each item rated by parents as a 4 or 5 contributed one point to the overall PHBQ score, ranging from 0 to 27. A score above 0 signifies the presence of maladaptive behavioral changes.

2.4. Pain medication

All medications were expressed as milligrams per kilogram, and opioid medications (fentanyl, hydromorphone, remifentanil, and morphine) were converted to total morphine equivalents in dose per kilogram using the following conversion factors: 0.1 for fentanyl, 5 for hydromorphone, 0.05 for remifentanil, and 1 for morphine.

2.5. Statistical analysis

Patient demographics that were examined as potential factors affecting PPPM and PHBQ scores included age, sex, and insurance status. Intraoperative variables that were examined included total dose of intraoperative drugs, duration of anesthesia, and type of surgery. Lastly, pain medication compliance was defined as adherence to discharge instructions regarding use of pain medications at home in a subset of patients (n = 119) who had received medication prescription of pain medications and discharge instructions for pain medications. Patients who were not prescribed pain medications (n = 82) were grouped in a separate category.

Patients undergoing otolaryngology, plastics, orthopedic, urology and general surgery procedures were recruited. Due to the relatively small sample sizes for many of the surgical subgroups, a total of three groups of surgical procedures were included in the analysis, denoted “OTO,” “Gen/Uro,” and “Others.” OTO procedures consisted of all tonsillectomy and adenoidectomy/tonsillectomy procedures. The second group consisted of general surgical and urological procedures as a single group (Gen/Uro), given overlapping procedures such as inguinal hernia repair. Plastic surgeries, orthopedic surgeries, and myringotomies (when performed alone) were grouped into a single category as “Others.”

In univariate analyses, we used two-sample t-tests or ANOVA to compare PPPM and PHBQ scores between different groups and used
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