Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

The severity and duration of postoperative pain and analgesia requirements in children after tonsillectomy, orchidopexy, or inguinal hernia repair

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Keywords
pain; postoperative; analgesia; postoperative; analgesia; measurement; surgery; pediatric; otolaryngologic; orchidopexy; inguinal herniorrhaphy

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Section Editor: Adrian Bosenberg

Accepted 29 August 2011

doi:10.1111/j.1460-9592.2011.03713.x

Summary

Objectives: To provide parents of children with accurate information regarding postoperative pain, its management, and functioning following common surgical procedures.

Background: The increasing prevalence of pediatric day-case procedures demands a more thorough understanding of the recovery profiles associated with these operations.

Aim: To document postdischarge pain profiles, analgesia requirements, and functional limitation in children following tonsillectomy, orchidopexy, or inguinal hernia repair (IHR).

Methods: Following hospital discharge, parents were asked to record their children's pain levels, analgesia consumption, and degree of functional limitation each day until complete recovery. Pain and functional limitation were measured using the Parents' Postoperative Pain Measurement (PPPM) scale and Functional Activity Score, respectively. Significant pain was defined as PPPM ≥ 6.

Results: One hundred and five patients (50, tonsillectomy; 24, orchidopexy; and 31, IHR) were recruited. Median PPPM was always <6 after IHR, ≥ 6 only on day 1 after orchidopexy and persisted through to day 8 after tonsillectomy. Mild or severe functional limitation was observed after all surgeries and persisted for 4, 5, and 4 days after median PPPM < 6 after IHR, orchidopexy, and tonsillectomy, respectively. Combination analgesia was commonly administered after orchidopexy and tonsillectomy but less so after IHR. The general practitioner consultation rate following tonsillectomy was 54%.

Conclusions: After tonsillectomy, children experience significant pain and severe functional limitation for 7 days after surgery. For many children, pain and functional limitation persists throughout the second postoperative week. In children undergoing orchidopexy, paracetamol and ibuprofen provide adequate analgesia. Pain begins to subside after the first postoperative day, and normal activity resumes after 7 days. After IHR, children experience mild pain that can be treated with paracetamol and return to normal functioning after 4 days.

Introduction

Day-case surgery plays a prominent role in pediatric anesthetic practice. Some procedures are invasive and associated with significant postoperative pain, as well as lengthy recovery. While pain management has improved in the early postoperative period when children are still in hospital, research into the recovery profile for children following discharge has been less intensively studied (1,2).

Following day-case surgery, parents assume responsibility for their children's postoperative care (3). Information provided to parents relating to their child's postdischarge pain profiles, analgesia requirements, and return to normal function is important. At present, this information is based more on expert opinion than evidence.

The aim of this study was to evaluate postoperative pain, analgesia requirements, and functional limitation experienced by children who had undergone tonsillectomy, orchidopexy, or inguinal hernia repair (IHR). Families were followed-up for the entire duration of the child's recovery, to gain a more thorough understanding of the recovery profiles after each of these procedures.

Methods

Approval was obtained from the Human Research Ethics Committees at The Royal Children's Hospital (RCH) and Cabrini Hospital, Melbourne. Patients scheduled for tonsillectomy, orchidopexy, or IHR were prospectively identified using the respective hospital's theater booking system. Families were approached on the day of their child's procedure. Parents willing to partake in the study gave their written informed consent.

Children presenting over a 6-month period for tonsillectomy, orchidopexy, or IHR were eligible for recruitment. Six months was deemed an adequate time period to capture 30–50 patients per group and to identify significant trends in key outcomes. Patients were excluded if they had cognitive and/or neurological impairment or came from non-English speaking households. Data were collected between November 2009 and May 2010.

Patient demographic details were recorded. Anesthesia and analgesia were at the anesthetist's discretion. Patients who underwent IHR or orchidopexy left hospital on the same day as their procedure. Tonsillectomy patients were either discharged from hospital in the afternoon on the day of their operation, or admitted to the hospital's 23-Hour Unit for overnight observation, and discharged home the following morning.

Postoperative and discharge analgesic prescription followed existing practice and was not specified by inclusion in the study. Inpatient postoperative analgesia was prescribed by the anesthetist and discharge analgesia by the surgical team.

Following discharge, parents were asked to record their child's pain levels, analgesia consumption, and functional limitation in a Pain Diary. The documents for recording this information were provided while in hospital. Parents were shown examples of how to complete each document, and any questions regarding the study were addressed. Data collected were obtained through a daily telephone call to parents. A suitable time to ring was organized and the duration of each call was approximately 5 min. Day 1 was treated as the day after the child's operation.

Parents were asked to measure their child's pain using the Parents' Postoperative Pain Measurement (PPPM) scale. This scale consists of 15 Yes/No questions (Yes = 1 point, No = 0 points) based on the child's behavior. This pain assessment tool was selected based on the recommendation of a recent systematic review of observational pain measures for children and has been validated in children aged 1–12 years (4). From previous research, clinically significant pain was defined as a PPPM score ≥ 6 (3). Parents completed the questions once in the morning and once in the evening, enabling two pain scores to be collected for each child per day.

Parents were asked to record the degree of functional limitation their child was experiencing as a result of their operation using the validated Functional Activity Score (FAS) (5). This score reflects the extent to which children were able to perform their usual activities during their recovery. This was recorded once daily in the Pain Diary and scored as severe, mild, or no functional limitation.

Complete recovery was defined as a pain score of zero, no functional limitation, no analgesia requirements, and confirmation from a parent that their child had resumed all normal activities.

The Pain Diary was also used to log other comments or concerns parents wished to make regarding their child's recovery as well as any secondary outcomes addressed by this study. Secondary outcomes included need for readmission to hospital, gait disturbance, time taken to return to school/kindergarten, and adverse reactions to pain medication.

Data were stored in an EpiData spreadsheet and analyzed using STATA version 11 (Stata Corp LP, Col-

lege Station, TX, USA). Based on the type of information gathered in this study, simple descriptive statistics were used.

Results

Parents of 107 children scheduled to undergo tonsillectomy ($n = 51$), orchidopexy ($n = 24$), or IHR ($n = 32$) were invited to participate. Two families declined (one tonsillectomy, one IHR). The family of one child who had undergone tonsillectomy could not be contacted after day 11, at which time the child had not returned to full functioning with no pain. Patient demographics are shown in Table 1.

The median PPPM scores following each operation are shown in Figure 1. Following tonsillectomy, day 12 was the first full day that children exhibited a median PPPM score of zero and the first day that no child had a PPPM > 6. Over 50% of children were reported to have a PPPM score > 6 through to the 7th day after surgery and this reduced to just under 20% by day 9 (Figure 2).

The median PPPM score after IHR and orchidopexy returned to zero by day 4 and 6, respectively. At no point was the median PPPM score after IHR ≥ 6. After orchidopexy, the median PPPM score was >6 only on the first morning after surgery.

All operations were associated with functional limitation during the first two postoperative days. Severe functional limitation after tonsillectomy occurred in most patients during the first week of recovery, with 58% of patients still severely limited after 5 days. Not until day 12 did the majority of patients (59%) report returning to full function. After 15 days recovery, seven tonsillectomy patients were still experiencing mild functional limitation (Figure 3).

Children recovering from IHR were mostly able to resume normal activities by the 5th postoperative day. Orchidopexy was associated with greater functional limitation, with 67% of patients still experiencing at least mild limitation 5 days after their operation. By the 7th postoperative day, <15% of children recovering from orchidopexy were reported as still experiencing any functional limitation. No child who underwent IHR or orchidopexy was experiencing functional limitation beyond day 10 (Figure 3).

In patients who underwent tonsillectomy, 75% received multiple analgesics to manage pain. Paracetamol and codeine were the commonest analgesic combination, with 52% of parents using these two drugs as pain relief for their children. Ibuprofen was used less commonly, and 17% of parents gave tramadol or opioids other than codeine to manage their child's pain (Figure 4).

Most parents (64%) administered one analgesic drug to manage their child's pain following IHR. In contrast, in children who underwent orchidopexy, 63% of parents adopted a multimodal approach; paracetamol and ibuprofen were the commonest analgesic combination (Figure 4).

The median number of doses of analgesia administered in the days after surgery followed a similar pattern to the median PPPM scores for each of the three procedures. The majority of children who had undergone IHR received no analgesia after day 3 of recovery, with just one patient receiving analgesia beyond the fifth postoperative day. Both orchidopexy and tonsillectomy patients received a median of three doses of analgesia on each of the first 2 days after surgery. This figure returned to zero by day 4 in the orchidopexy population, while tonsillectomy patients continued to receive multiple daily doses of pain medication throughout the first week of recovery (Figure 5). Most children who underwent tonsillectomy received no analgesia after day 9, although four children continued to receive analgesia after the second postoperative week.

The median time to complete recovery after tonsillectomy was 12 days (Table 2). Over half who underwent tonsillectomy (54%) were taken by their parents to see a general practitioner (GP) during their recovery. The most common reasons for consulting a GP were severe pain and suspected infection. GPs prescribed analgesics including oxycodone, morphine, tramadol, or dextropropoxyphene in 17% of children and antibiotics in 18%. Six children required rehospitalization because of secondary postoperative bleeding and/or severe pain, with one child requiring a second operation to manage post-tonsillectomy bleeding. Other common parental concerns included halitosis (76%), voice change (58%), and constipation (32%).

The median number of days to achieve complete recovery following IHR and orchidopexy was 4 and 7 days, respectively (Table 2). Gait disturbance was common in the days following IHR and orchidopexy, with 63% and 86% of children, respectively, experiencing such restriction. Pain on micturition after IHR or

Table 1 Patient demographics

	Tonsillectomy	Orchidopexy	Inguinal hernia repair
Gender			
Male/female	28/22	24/–	18/13
Age (years)			
Mean ± SD	5.7 ± 2.9	5.6 ± 3.2	4.5 ± 1.9
Weight (kg)			
Mean ± SD	23.5 ± 10.1	26.2 ± 13.7	18.4 ± 5.1

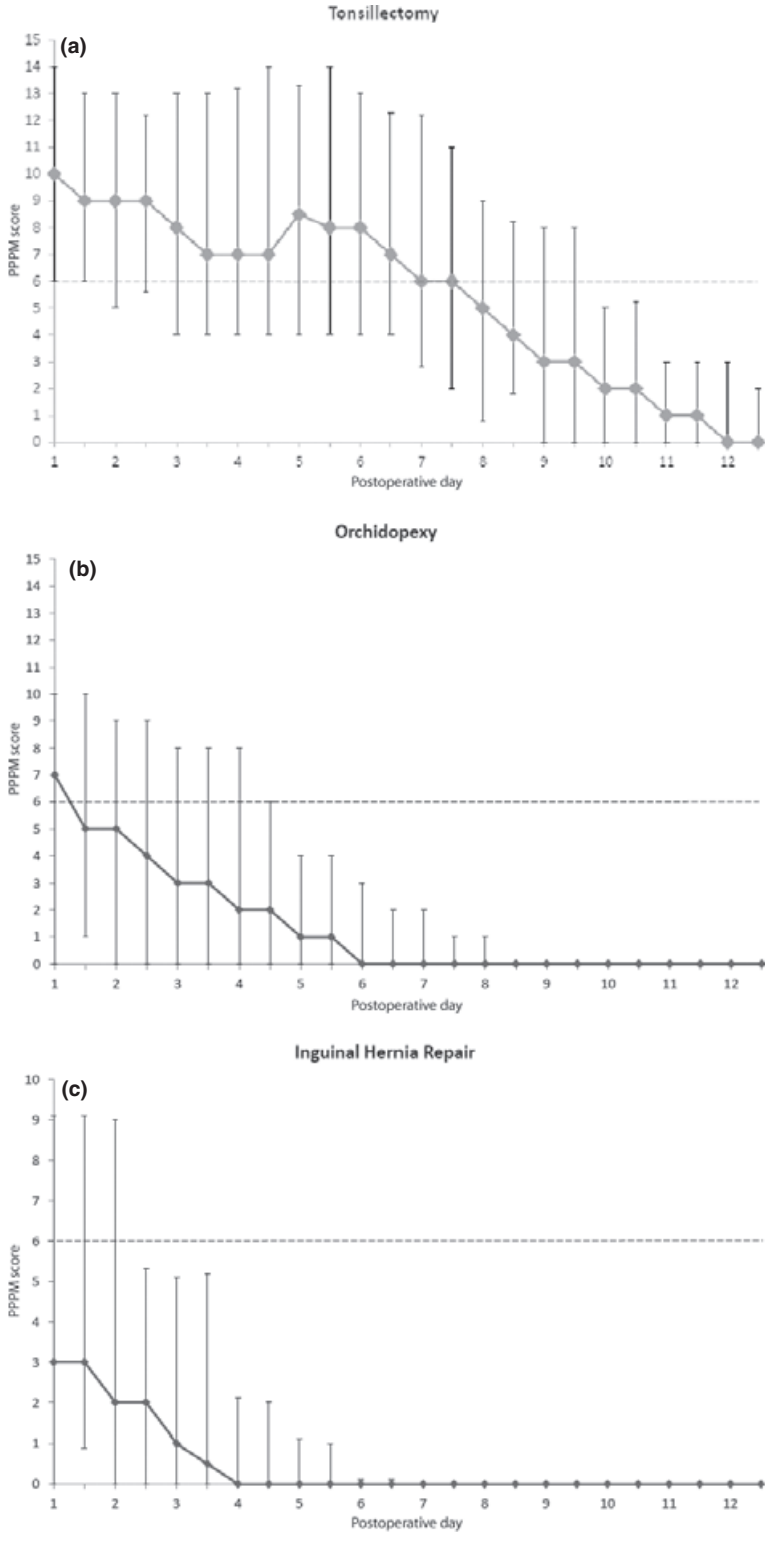

Figure 1 Median Parents' Postoperative Pain Measurement (PPPM) Scores: Days 1–12. Two pain scores are graphed for each day. The first mark represents the AM score, the second mark the PM score. Error bars demonstrate the 90th and 10th centiles. PPPM score ≥ 6 represents clinically significant pain.

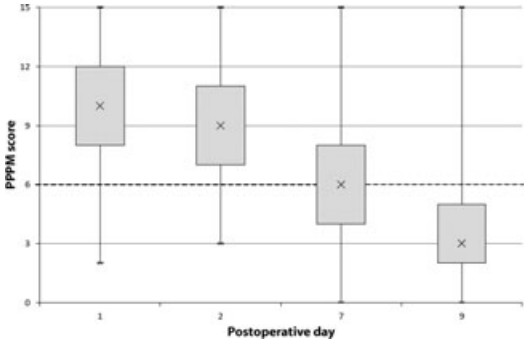

Figure 2 Parents' postoperative pain measurement (PPPM) scores on days 1, 2, 7 and 9 after tonsillectomy. Box represents the 25th to 75th centiles. × = median. Error bars represent the range of the data.

orchidopexy was reported in 27% and 48% of children, respectively.

Discussion

With the increasing number of children undergoing day-surgical procedures, it is essential that we provide accurate information to parents caring for their child in the postdischarge period. Few studies have focused on postoperative pain and analgesia requirements in children following day-surgical procedures. None of these studies directly assessed functional limitation or provided detailed information about the type and duration of analgesia use. We were unable to identify any studies that systematically followed patients after specific surgical procedures through to full recovery. Our study was designed to address these gaps in knowledge in children undergoing tonsillectomy, orchidopexy, and IHR.

After tonsillectomy, most parents reported high pain scores during the first 7 days after surgery, with many patients still experiencing clinically significant levels of pain (PPPM ≥ 6) throughout the second week of recovery.

This study is the first to provide information regarding functional limitation following tonsillectomy. In the 2 weeks after surgery, many children were restricted in their ability to perform their normal daily activities. A number of parents reported limitation beyond this 2-week period. This lengthy period of limitation had a particular impact on school-aged children, who were unable to resume sporting activities.

The need for stronger analgesics, such as tramadol and opioids other than codeine, to manage pain and high pain scores following tonsillectomy suggests that we continue to underestimate and under treat postoperative pain associated with this procedure. Also of note was the high use of codeine, with almost 70% of parents using this drug to treat their child's pain. Up to 10% of patients are unable to gain any pain relief from codeine because of CYP2D6 polymorphism (6). Furthermore, codeine may have contributed to constipation that was reported by 32% of parents. Further research is needed to determine whether stronger opioid analgesia is effective, and the optimum analgesia regimen for managing post-tonsillectomy pain at home.

The use of paracetamol and codeine may be attributable to regulatory and other barriers. In Australia, pediatric preparations of paracetamol, ibuprofen, and codeine are available without prescription, while tramadol and other opioids require a doctor's prescription. In addition, many ear, nose, and throat surgeons advise parents not to administer nonsteroidal anti-inflammatory drugs postoperatively and are reluctant to prescribe opioids other than codeine.

A number of unexpected pain-related outcomes proved to be sources of great anxiety for parents during their child's recovery from tonsillectomy. Refusal to eat or drink, otalgia, and refusal to take oral medications were frequently reported by parents during the course of the follow-up phone conversations. Such pain-related outcomes contributed to 54% of parents consulting their GP during the course of their child's recovery. This is similar to the 60% rate of GP consultations found in the study by Fortier *et al.* (7). These high rates of consultation have been attributed to deficiencies in the information provided to parents regarding the postdischarge recovery course (8) and confirm that current analgesic advice is inadequate.

Inguinal hernia repair was associated with low levels of pain postoperatively. Orchidopexy was associated with greater and more prolonged pain. Our results are consistent with the findings of Ho and Keneally (9), whose study of 90 boys undergoing orchidopexy or IHR found the former procedure to be associated with higher levels of pain at home in the first 24 h after surgery. Saeed *et al.* (10) described 247 boys who underwent orchidopexy as leading a normal active life by 32 h after surgery. This comment, however, was based purely on pain scores, and our results agreed in that the median PPPM score was <6 the evening following orchidopexy surgery. However, functional limitation persisted beyond this time and the FAS was more sensitive than pain scores in detecting this. Using the FAS, our study revealed that most children experienced limitation in performing normal activities for 3 and 6 days after IHR and orchidopexy, respectively.

With regard to analgesia, our findings suggest the use of paracetamol or ibuprofen alone is adequate in

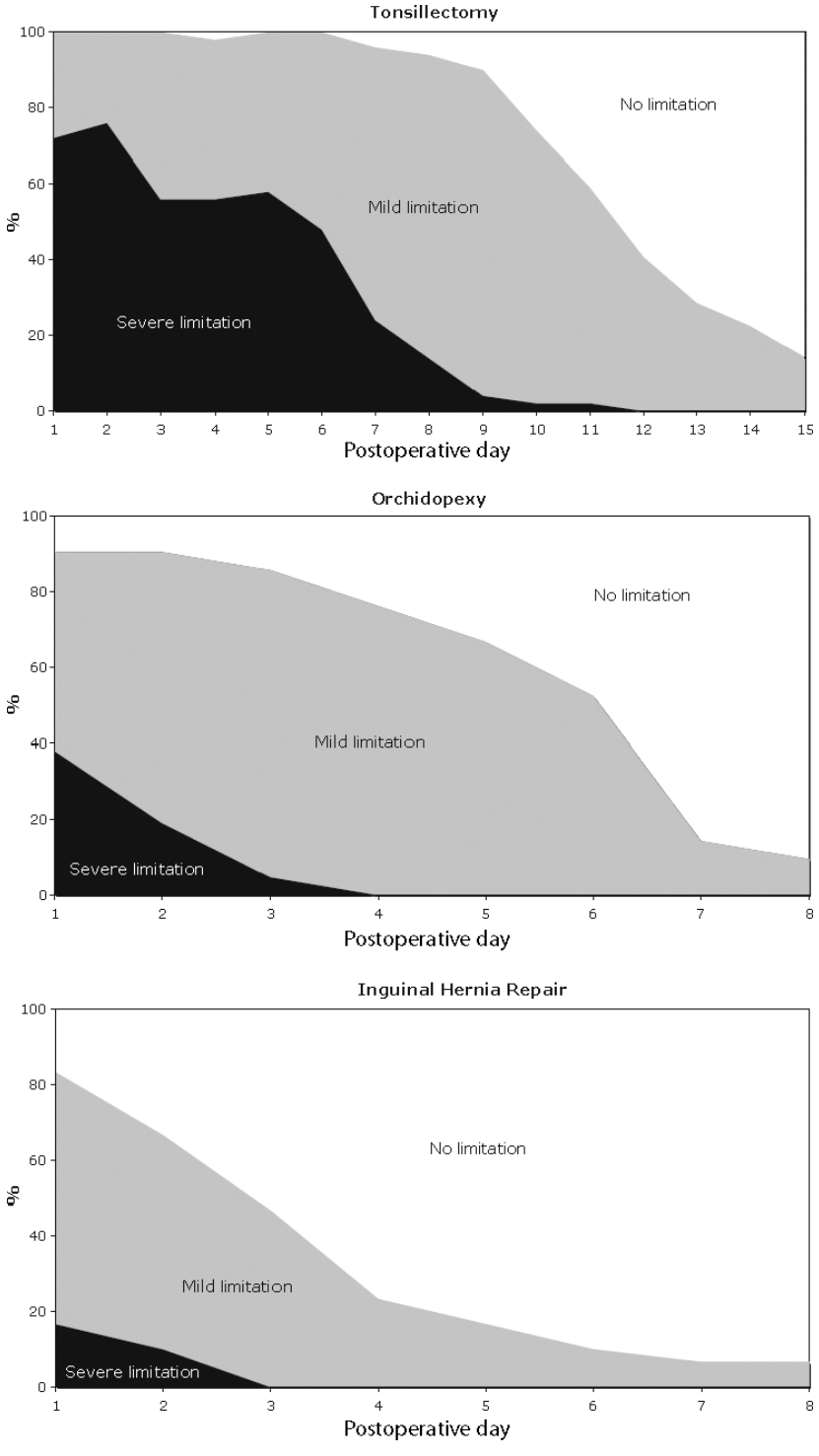

Figure 3 Cumulative percentage of children with no, mild or severe functional limitation following tonsillectomy, orchidopexy, and inguinal hernia repair.

the management of children's pain after IHR and that few require analgesia after the first postoperative day. In contrast, parents used a multimodal analgesia approach in children after orchidopexy. This finding adds to existing evidence that paracetamol alone is insufficient in managing children's pain at home following orchidopexy (9,11).

The main pain-related outcomes reported by parents after IHR and orchidopexy were gait restriction and pain on micturition. These outcomes were rarely a

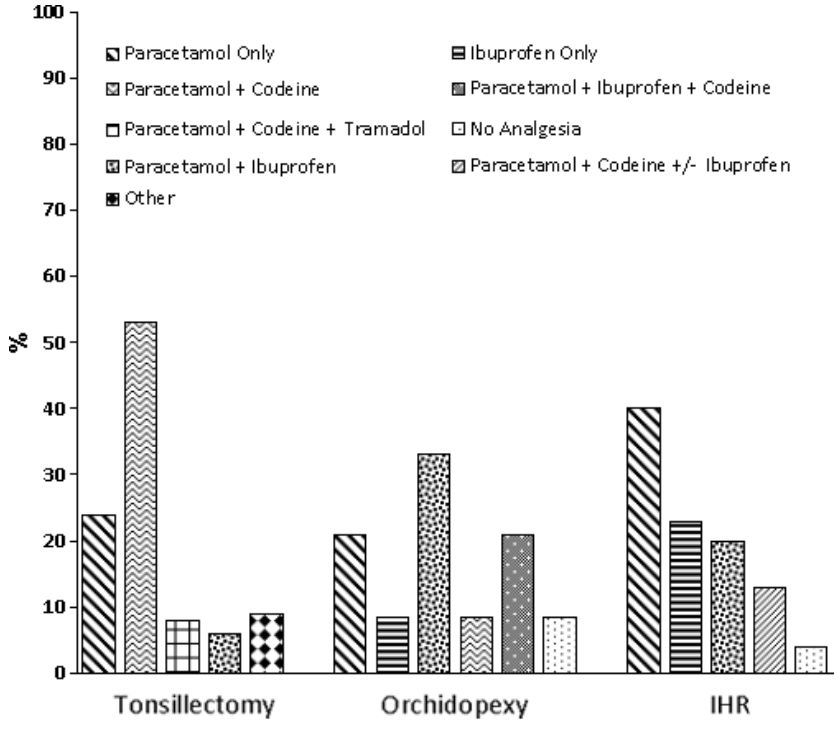

Figure 4 Analgesic usage following tonsillectomy, orchidopexy, and inguinal hernia repair.

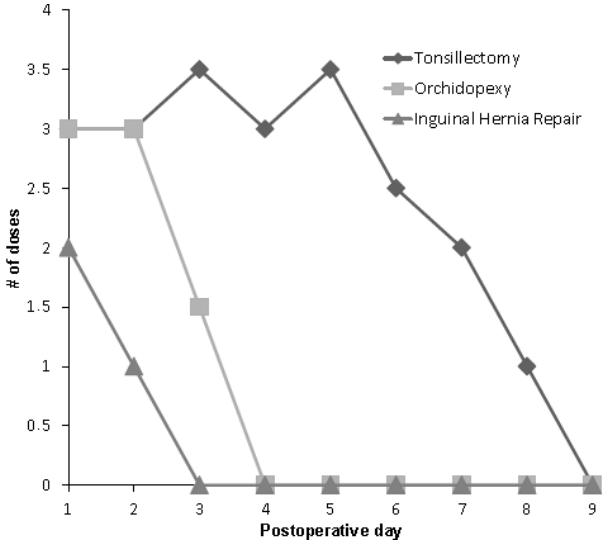

Figure 5 Median number of analgesic doses per day following tonsillectomy, orchidopexy, and inguinal hernia repair. Single or multiple drugs may have been administered by parents with each dose.

source of great anxiety for parents, as most anticipated these given the nature of these urogenital procedures.

A limitation of our study is that pain and functional limitation ratings relied on parent report. The use of observational measures is common in the assessment of pediatric pain, but is considered less powerful than using the 'gold-standard' self-report measures of pain. There is also evidence to suggest that parents underestimate their children's pain (12). The reasons we used an observational measure of pain in our study was because the PPPM score had been validated across the entire age range of children we planned to recruit and that some of the children were nonverbal. In addition, it is usually the parent who makes the decision to administer analgesia. Children may benefit from better parent education with regard to assessing pain in their child and when to administer analgesia at home.

Another limitation of this study is that children from non-English speaking backgrounds and children with developmental delay were excluded. The ability to provide the families of these children with information regarding their child's recovery is of great importance and an ongoing challenge for clinicians. Similar studies in the future should be carried out in these patient populations.

Variations in surgical technique may affect the outcomes addressed in this study particularly after tonsillectomy. Minimal cautery for dissection may, for example, produce different pain profiles to extensive cauterization. Future studies should address whether surgical technique influences postoperative pain and recovery.

Table 2 Summary of results

	Tonsillectomy	Orchidopexy	Inguinal hernia repair
Time until 90% of patients achieved PPPM < 6 (days)	10	5	3
Median time to no functional limitation (days)	12	6	3
Median time to no analgesia administration (days)	9	4	3
Time to complete recovery (days)	12	7	4

PPPM, Parents' Postoperative Pain Measurement.

This study confirms the need to establish procedure-specific postoperative pain profiles after commonly performed day-surgical procedures and the most effective analgesic regimen for that procedure. After IHR, children experience mild pain that can be treated with paracetamol and return to normal functioning after 4 days. In children undergoing orchidopexy, paracetamol and ibuprofen provide adequate analgesia. Pain begins to subside after the first postoperative day and normal activity resumes after 7 days. Significant pain and severe functional limitation after tonsillectomy persist for at least 1 week postoperatively and in some cases continues for up to 2 weeks.

Acknowledgments

The authors wish to acknowledge Jessica Martin from the Murdoch Children's Research Institute for her assistance in the preparation and analysis of the data. This study was supported by the Victorian Government's Operational Infrastructure Support Program. This research was carried out without funding.

Conflict of interest

No conflicts of interest declared.

Appendix 1. The parents' postoperative pain measure

Questions

Does your child...
- Whine or complain more than usual?
- Cry more easily than usual?
- Play less than usual?
- Not do the things s/he normally does?
- Act more worried than usual?
- Act more quiet than usual?
- Have less energy than usual?
- Refuse to eat?
- Eat less than usual?
- Hold the sore part of his/her body?
- Try not to bump the sore part of his/her body?
- Groan or moan more than usual?
- Look more flushed than usual?
- Want to be close to you more than usual?
- Take medication when s/he normally refuses?

Appendix 2. Functional Activity Score

Please tick the appropriate description of your child's degree of limitation in performing his/her regular daily activities
- A. No limitation
- B. Mild limitation
- C. Severe limitation

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