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Contents

Anesthetic and analgesic approaches for pediatric myringotomies: a retrospective chart review

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162

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INTRODUCTION

Myringotomy with tympanostomy tube insertion is a common and frequently performed pediatric procedure in the ambulatory case setting. Due to its short duration, there is a wide variation in practice with respect to intravenous access (IV), airway technique, and analgesic strategies. While general anesthesia (GA) is often the more prevalent modality, concerns remain regarding postoperative pain, emergence agitation, and duration in the postanesthetic care unit (PACU).[1,2] Multimodal analgesia may reduce these risks, however, there are no routine standardized protocols to determine practice patterns. Myringotomies are also increasingly being done in minor procedure rooms to improve efficiency, reduce surgical wait times and reduce the environmental impact and cost.[3,4] This retrospective audit aims to characterize current anesthetic and analgesic practices for pediatric myringotomies at our institution and to evaluate perioperative outcomes, to enable us to develop a standardised bundle to optimise patient care and streamline surgical workflow.[5]

METHODS

We conducted a retrospective chart review of pediatric patients (<18 years) who underwent myringotomy with tympanostomy tube insertion as the sole procedure at a tertiary care pediatric hospital between January 1, 2022, and Dec 31, 2024. This project was approved by the institutional ethics committee with a waiver of consent. Variables collected included demographics, ASA status, preoperative medications, anesthetic technique, IV access, airway management, intraoperative adjuncts, surgical and operating room duration, postoperative analgesia requirements, PACU duration, and adverse events. Descriptive statistics were used to summarize practice patterns and outcomes. Continuous variables were reported as means with standard deviations for normally distributive data or medians with interquartile ranges for non-normally distributed data, as appropriate. Categorical variables were reported as frequencies and proportions.

RESULTS

Data analysis included 150 pediatric patients (62% male, 38% female; average age 5.19 years) undergoing elective bilateral myringotomy with tube insertion. Median ASA classification 2 (42.5%). Fifteen cases required preoperative medications (oral midazolam, acetaminophen). Induction was primarily inhalational. Average anesthetic care was 41 minutes, average surgical time was 14 minutes, and average OR time was 23 minutes. Airway management predominantly involved mask ventilation, with 33 uses of supraglottic airways. Of the 150 cases 121 IVs were established intraoperatively. Intranasal fentanyl and rectal acetaminophen were administered in cases with no IV access. Ketorolac IV, rectal acetaminophen, and antiemetics were variably used at the anesthesiologist's discretion. PACU times averaged 51 minutes (Stage 1) and 38 minutes (Stage2). Adverse events were minimal (11.13%)—emesis (4), agitation (11), desaturation (1). Pain scores were predominantly 2 with 55% reporting scores <4. Opioids used in 98% of cases and antiemetics in 97%.

DISCUSSION

In this single centre quality audit of 150 pediatric myringotomy cases, we demonstrate that current anesthetic management is safe and effective, with favourable postoperative pain control, low adverse event rates, and efficient PACU recovery. However, substantial variability exists in the use of anesthetic and analgesic adjuncts, suggesting opportunities for protocol standardization in this low-risk population. Developing evidence-informed standard of practice, such as, administration of preoperative medications and IV insertions may optimize perioperative efficiency, analgesia, and resource utilization while maintaining patient safety and comfort. The data supports development of various QI and randomized controlled studies to update anesthesia practice for myringotomies.

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Availability and completeness of pediatric anesthesia information on children's hospital websites: a website content analysis in Canada and the United States

Submission ID

150

AUTHORS

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INTRODUCTION

Hospital websites are a key source of perioperative information for families preparing for a child's surgery and are often consulted well before any in-person or virtual preoperative assessment. For many caregivers, these sites represent the first and most accessible point of contact for understanding what anesthesia involves, how to prepare their child, and what to expect on the day of surgery. When this information is incomplete, unclear, or difficult to find, it can contribute to preoperative anxiety, misinterpretation of instructions, and suboptimal preparedness.[1] Despite the growing reliance on hospital websites as trusted and authoritative sources of guidance, the extent, consistency, and completeness of anesthesia-related information provided by children's hospitals remain poorly characterized. We therefore aimed to systematically map pediatric anesthesia–related information available to patients and families on children's hospital websites in Canada and the United States, and to describe how comprehensively key perioperative domains are addressed across institutions.

METHODS

We conducted a cross-sectional environmental scan and descriptive content analysis of public, family-facing perioperative information on the websites of major pediatric hospitals in Canada and the United States. We systematically identified all tertiary pediatric centers in Canada and a broad sample of U.S. children's hospitals using searches of national pediatric hospital listings and the U.S. News & World Report "Best Children's Hospitals" database,[2] including at least one major pediatric center per state and additional nationally ranked sites. Two independent reviewers examined each website using a checklist covering 10 clinically relevant predefined domains: preoperative information, fasting guidance, day-of-surgery information, pre-anesthesia clinic contact, consent process/forms, pain management, procedural sedation, child-life resources, parent presence for induction, and interpreter or

multilingual services. “Yes,” “Partial,” or “No” responses were scored 2, 1, 0, respectively, generating a 0-20 website robustness score. Discrepancies were resolved by a third reviewer.

RESULTS

Eighty-eight hospital websites were analyzed (16 Canada, 72 U.S.). Hospitals consistently included core preparatory information, but gaps were observed in several domains. Website robustness scores ranged from 4 to 20, with a median of 14 (IQR 11–16). Only 12/88 (13.6%) hospitals demonstrated consistently strong coverage (score ≥18), while 7/88 (8.0%) had very limited content (score ≤8). Core orientation content was common, including preoperative general information (95.5%) and day-of-surgery information (89.8%). In contrast, key anesthesia-related domains were frequently incomplete or absent, including consent information (36.4%), procedural sedation (38.6%), and policies on parental presence for induction (22.7%). Although interpreter services were widely listed (94.3%), anesthesia-specific materials in languages other than English were uncommon (13.6%).

DISCUSSION

Across North America, most pediatric hospitals provide essential anesthesia information online, but the completeness and usability of content vary widely. Core perioperative instructions are nearly universal, but key domains such as fasting guidance and contact details are inconsistent. Standardizing website content could enhance family preparedness, reduce preoperative anxiety, and promote equitable access to perioperative education.[1] Family-centered best practices include step-by-step multimedia guides, multilingual resources, and direct preoperative contact options. While core information is commonly presented, more detailed and consistently structured online anesthesia materials could help to more adequately support families before surgery.

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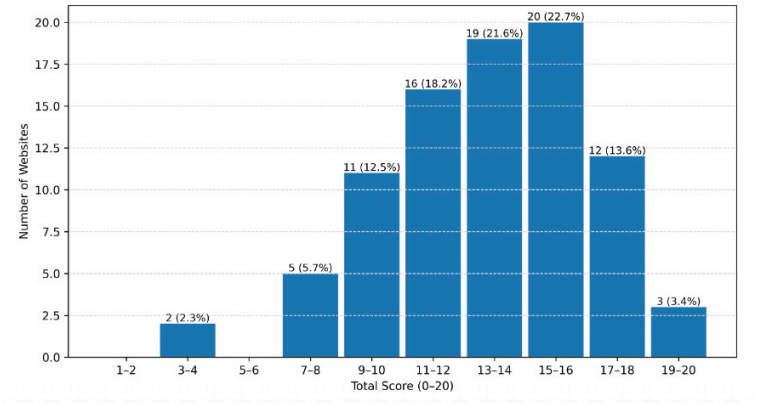
Table Domain coverage of caregiver-facing pediatric anesthesia information on hospital websites

Domain	Yes	Partial	No
Child-life / preparation resources	83/88 (94.3)	3/88 (3.4)	2/88 (2.3)
Consent process/forms	32/88 (36.4)	3/88 (3.4)	53/88 (60.2)
Day-of-surgery information	79/88 (89.8)	4/88 (4.5)	5/88 (5.7)
Fasting guidelines	62/88 (70.5)	5/88 (5.7)	21/88 (23.9)
Interpreter / multilingual services	83/88 (94.3)	3/88 (3.4)	2/88 (2.3)
Pain management / acute pain services	44/88 (50)	7/88 (8)	37/88 (42)
Parental presence for induction (PPI)	20/88 (22.7)	2/88 (2.3)	66/88 (75)
Pre-anesthesia / pre-admission clinic	53/88 (60.2)	6/88 (6.8)	29/88 (33)
Pre-operative general information	84/88 (95.5)	2/88 (2.3)	2/88 (2.3)
Procedural sedation	34/88 (38.6)	8/88 (9.1)	46/88 (52.3)

Presence of clear caregiver-facing content across the ten domains of the website robustness framework among included pediatric hospital websites (N = 88). Values are presented as n (%).



Dexmedetomidine use in adolescent idiopathic scoliosis surgery: a scoping review of evidence and research gaps

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215

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INTRODUCTION

Posterior spinal fusion for adolescent idiopathic scoliosis is associated with substantial postoperative pain, opioid exposure, and early recovery barriers. Dexmedetomidine offers sedative and analgesic-sparing effects that may align well with enhanced recovery pathways, yet its use in this specific population is not well defined. Current perioperative practice is often extrapolated from adult cohorts or mixed paediatric populations, limiting applicability to adolescent scoliosis surgery. We conducted a scoping review to map the evidence for dexmedetomidine in adolescent idiopathic scoliosis posterior spinal fusion and to identify actionable gaps that should shape future trials and protocol development.

METHODS

We performed a scoping review in accordance with PRISMA-ScR guidance. Studies were eligible if they evaluated dexmedetomidine administered intraoperatively and/or postoperatively in adolescent idiopathic scoliosis patients undergoing posterior spinal fusion, with any comparator or usual-care pathway. We extracted study design, sample size, dosing strategy (bolus/infusion, timing, duration), co-interventions within multimodal analgesia or enhanced recovery protocols, and reported outcomes (pain metrics, opioid consumption, length of stay, mobilisation, postoperative nausea and vomiting, neuromonitoring-related outcomes when reported, and perioperative adverse events). Evidence was synthesised descriptively to characterise the range of practice and outcomes and to delineate methodological limitations and inconsistencies. As this review involved published data only, research ethics approval was not required.

RESULTS

The search identified 926 records; 34 underwent full-text review and 7 studies met inclusion criteria (2 prospective randomised trials; 5 retrospective cohort studies). Dexmedetomidine

was most commonly delivered as an intravenous bolus and/or infusion, with substantial heterogeneity (e.g., bolus doses around 0.4 μg/kg and infusions continued up to 24 hours). Across studies, dexmedetomidine use was associated with improved postoperative analgesia and reduced opioid requirements; several studies also reported shorter hospitalisation and earlier mobilisation within enhanced recovery contexts. Reported haemodynamic adverse effects (bradycardia, hypotension) were uncommon, generally mild, and clinically manageable.

DISCUSSION

In adolescent idiopathic scoliosis posterior spinal fusion, the available literature supports dexmedetomidine as a promising adjunct for opioid-sparing analgesia without evidence of increased perioperative risk. Interpretation is limited by small sample sizes, predominantly single-centre designs, short follow-up, and marked heterogeneity in dosing and timing. Notably, although dexmedetomidine has been explored as an additive to regional or local infiltration techniques in adult surgical populations, no studies in adolescent scoliosis surgery have evaluated its use beyond systemic administration. This represents a clear evidence gap. Multicentre randomised trials are required to standardise exposure and define the role of dexmedetomidine within enhanced recovery pathways.

REFERENCES

Nil.

Early impact of a code neurotrauma pathway on neurotrauma care: a one-year institutional experience

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106

AUTHORS

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INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of injury-related morbidity and mortality in children (1-3). Prompt neurosurgical interventions (4) and optimal neuroprotective care are associated with improved morbidity and mortality (5). Waiting for imaging results is one of the largest sources of non-value-addedtime (NVAT) in pediatric TBI (5); NVAT accounts for approximately one third of trauma patient's emergency department (ED) length of stay (LOS) and is associated with worse neurological outcomes in severe pediatric TBI (5). An institutional multi-source needs assessment was conducted to identify areas for improvement in reducing NVAT, including ED LOS, time to CT imaging, neuroprotective care measures and communication. This quality improvement (QI) initiative aimed to identify areas of weakness and design interventions to improve neurotrauma care for pediatric patients presenting with isolated severe TBI, aligned with established trauma benchmarks.

METHODS

Following the needs assessment, a standardized care pathway (Code Neurotrauma) was developed and implemented in December 2024 to expedite evaluation and intervention for severe TBI patients. The Intervention group consisted of pediatric patients with isolated severe TBI (GCS <8 with a history of head trauma) presenting to the trauma bay from December 2024-Dec 2025. Outcomes assessed included ED LOS, neuroprotective care bundle compliance, time to intubation, time to CT imaging, time to disposition, time to operating room (OR) arrival, and time to craniotomy start. Intervention Subgroups consisted of All Activations (all patients in whom the Code Neurotrauma pathway was activated) and Missed Activations (patients who met inclusion criteria but in whom the pathway not activated). The control group consisted of patients who presented with isolated severe TBI to

the trauma bay from 2021-2022. Statistical analyses were performed utilizing unpaired t-tests and chi-squared analyses.

RESULTS

Compared to Control (n=13), the Intervention group (n=11) had a significantly shorter ED LOS (min)(Intervention: 22.82+11.41, Control: 37.90+17.5, p=0.002), time to imaging (min) (Intervention: 30.30+12.12, Control: 46.5+13.15, p=0.007), 75% neuroprotection adherence (Intervention: 91%, Control: 13%, p=0.008), and 100% neuroprotection adherence (Intervention: 55%, Control 13%, p=0.01). Subgroup analysis revealed a significant difference between All Activations (n=7) and Control in ED LOS(min) (All Activations: 19.29+9.83, Control: 37.90+17.5, p=0.007), time to imaging (min) (All Activations: 24.71+9.93, Control: 46.5+13.15, p<0.001), 75% neuroprotection adherence (All Activations: 100%, Control 13%, p=0.007), and 100% neuroprotection adherence (All Activations: 57%, Control: 13%, p=0.001). There was a significant difference between All Activations and Missed Activations (n=4) in time to imaging (min) (Missed Activations: 43.33+1.15, All Activations: 24.71+9.93, p=0.003) (Table 1).

DISCUSSION

Implementation of a standardized Code Neurotrauma pathway significantly reduced ED length of stay, expedited CT imaging, and improved adherence to neuroprotective measures for pediatric trauma patients with isolated severe TBI. Benefits were greatest with pathway activation, underscoring the importance of consistent use. Limited sample size and few operative cases may explain the absence of significant differences in time to OR arrival and craniotomy start. Ongoing data collection is required to clarify downstream effects following CT imaging.

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Table 1. Outcomes

Outcome	Control (n = 13)	Intervention (n = 11)	All Activations (n = 7)	Missed Activations (n = 4)	p-value (C vs I)	p-value (C vs AA)	p-value (C vs MA)
ED LOS, min	37.9 (17.5)	22.82 (11.41)	19.29 (9.83)	29 (12.7)	0.002*	0.007*	0.243
Time to Intubation, min	11.5 (1.29)	17.8 (5.81)	17 (7.81)	20‡	0.189	0.189	NA
Time to Imaging, min	46.5 (13.5)	30.3 (12.12)	24.71 (9.93)	43.33 (1.15)	0.007*	<0.001*	0.003*
Time to Disposition, min	81.54 (30.63)	81.64 (54.39)	86 (65.69)	74 (33.66)	0.996	0.87	0.698
Time to OR Arrival, min	75.17 (42.27)	70 (8.49)	70 (8.49)	NA	0.789	0.79	NA
Time to Craniotomy Start, min	102.33 (46.84)	94 (16.97)	94 (16.97)	NA	0.727	0.727	NA
75% Neuroprotection Adherence, %	38	91	100	75	0.008*	0.007*	0.165
100% Neuroprotection Adherence, %	8	55	57	50	0.01*	0.001*	0.819

Abbreviations: C = Control, I = Intervention, AA = All Activations

* Statistically significant

‡ Single observation; SD not applicable

Early postoperative bleeding and hospital utilization following adenotonsillectomy with and without myringotomy in children

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120

AUTHORS

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INTRODUCTION

Adenotonsillectomy/tonsillectomy (AT/T) is a common pediatric surgery, most often performed for obstructive sleep-disordered breathing/obstructive sleep-apnea (OSA), recurrent infections or both.[1] Concurrent myringotomy and tube (MT) placement is frequently performed for recurrent otitis media (OM), often related to adenoidal hypertrophy and associated with OSA, potentially increasing perioperative risk. Elective AT/T is a leading driver of post-discharge healthcare utilization, most notably post-discharge emergency department (ED) visits and hospital readmissions. A provincial health administrative data (HAD) analysis from 2002-13 showed 12.4% of children presented within 30 days with postoperative complications; most commonly pain, airway infection, dehydration, and bleeding,[2] with AT/T having the highest urgent readmission rate among common pediatric ambulatory surgeries (2.7% vs 1.5%).Given recent advances in pediatric tonsillectomy-related guidelines,[3,4,5] we used updated provincial HAD to describe hospital visits within 15 and 30 days following AT/T with/without MT. We hypothesized that concurrent MT would be associated with higher post-operative hospital utilization.

METHODS

After research ethics board approval, we conducted a retrospective, population-level cohort analysis of HAD via consolidation and integration of routinely collected provincial data which includes information related to hospital admissions, ED visits, physician billing claims, prescription medications, and population demographics. The cohort included publicly

funded health insurance eligible pediatric patients >1 month to <18 years undergoing their first AT/T with or without MT (primary exposure) and discharged directly home in fiscal years 2005 to 2022. The primary outcomes were reported frequency of death and risk of all-cause emergency department visits and hospital readmission and the commonly associated diagnoses for presentation (pain, dehydration, respiratory symptoms, and bleeding) within 15 days of the index surgery. Secondary outcomes were identical to those described above but allocated to a 16–30-day time interval after surgery. Postoperative bleeding was classified as Class II (seen in ED with/without hospital admission for observation) and Class III (underwent surgery). Data was described as a frequency, mean (SD), median (IQR) or proportion. Categorical and continuous variables were compared using chi-square tests and one-way analysis of variance, respectively. A p value <0.05 achieved statistical significance. A convenience sample-size was utilized.

RESULTS

Among 248,406 children, cohorts were divided between AT/T with (n=123,739) and without MT (n=124,667). Children with MT were younger (mean [SD] 3.63 [2.77] vs 7.57 [4.28] years), more often male (61.3% vs 49.2%), and more frequently ASA I–II (92.5% vs 84.1%). Socioeconomic quintiles and rural residence were similar. Most cases were same-day surgery (85.1%), with a one-day median length-of-stay. Surgical indications were airway obstruction, recurrent infections or OM. Overall 30-day ED visits and readmissions were 11.9% and 2.3%. Within 15 days after surgery, MT was associated with fewer ED visits (6.1% vs 13.4%) and readmissions (0.8% vs 3.1%), but higher ED visits (3.0% vs 1.4%) and readmissions (0.4% vs 0.2%) (all p<0.0001, Table-1) within 16-30 days after surgery. Bleeding events were less common with MT (p<0.02). Early revisits reflected pain, infection and bleeding while later visits were for respiratory complications and fever. Mortality was rare (N=7), all early postoperatively.

DISCUSSION

This large Canadian pediatric AT/T cohort, spanning nearly two decades, shows that although post-discharge ED visits and readmissions following AT/T have declined modestly after implementation of guideline-informed strategies (in 2014-2019), diagnoses related to pain, respiratory infection and bleeding persist. Unexpectedly, concurrent MTs were associated with lower early revisit rates but higher later hospital revisits, predominantly due to fever and respiratory-related complications, compared with AT/T alone. Future health administrative data analyses should examine how hospital-, provider- (surgeon and anesthesiologist), and patient-level factors contribute to variability in post-discharge hospital revisits to inform targeted care strategies.

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Table 1. Reported reasons for hospital visits and deaths within 15 and 16-30 days following adenotonsillectomy with/without myringotomy, years 2005 to 2022 (N=248,406)

Outcome	Adenotonsillectomy with Myringotomy and Tubes N (%) (n=123, 739)		Adenotonsillectomy without Myringotomy and Tubes N (%) (n=124, 667)	
	Within 15 days of surgery	Within 16-30 days of surgery	Within 15 days of surgery	Within 16-30 days of surgery
All cause ED visit	7,526 (6.1)	3,709 (3.0)	16,748 (13.4)*	1,688 (1.4)*
All cause readmission	1,051 (0.8)	456 (0.4)	3,888 (3.1)*	205 (0.2)*
Any death	†1-5	0 (0.0)	†1-5	0 (0.0)
£Any class II bleed; Blood transfusion	1,448 (1.2) †1-5	64 (0.1) †1-5	7,925 (6.4)** 61-65 (0.0)*	95 (0.1)** †1-5
£Any class III bleed; Blood transfusion	119 (0.1) 0 (0.0)	†1-5 0 (0.0)	1,158 (0.9)** 27 (0.0)*	†13-17** 0 (0.0)
§Pain	967 (0.8)	135 (0.1)	3,862 (3.1) *	86 (0.1)*
Respiratory Infection ŦUpper airway Lower airway	2,036 (1.6) 957 (0.8)	1,578 (1.3) 812 (0.7)	2,371 (1.9)* 561 (0.4)*	461 (0.4)* 253 (0.2)*
Volume depletion	512 (0.4)	80 (0.1)	1,775 (1.4)*	36 (0.0)*
Nausea +/- vomiting	337 (0.3)	104 (0.1)	1,373 (1.1)*	53 (0.0)*
Fever	810 (0.7)	309 (0.2)	959 (0.8)*	103 (0.1)*
Abnormal Breathing	252 (0.2)	197 (0.2)	245 (0.2)	77 (0.1)*
Persisting Airway Obstruction	51 (0.0)	8 (0.0)	386 (0.3)*	10 (0.0)
Asthma	174 (0.1)	198 (0.2)	116 (0.1)*	99 (0.1)*
Change in LOC	†1-5	†1-5	†4-8	0 (0.0)
‡Follow-up care	219 (0.2)	33 (0.0)	620 (0.5)*	26 (0.0)
^Other complications	1,443 (1.2)	48 (0.0)	7,904 (6.3)*	66 (0.1)
Medication related complications	217 (0.2)	110 (0.1)	706 (0.6)*	38 (0.0)*

*P-value < 0.0001 or **P-value < 0.02 when comparing AT/T-with MT to AT/T-without MT 15 and 16-30-day outcomes; 7 deaths in total were reported; †Small cell sizes (<6 patients) are suppressed; §Pain includes otalgia; ‡Follow-up care includes examination after treatment and specifically related to surgery; ŦUpper airway infection includes croup/epiglottitis, tonsillitis, pharyngitis, and unspecified upper respiratory infection; £Class II bleed is defined as going to the ED with or without admission to hospital while class III bleed underwent surgery; ^Other complications include those related to procedure, surgical and medical care.
Note: ED=emergency department; LOC=level of consciousness; Colored rectangles correspond to rank order of indications: Red=1st, Yellow=2nd and Green =3rd.

Evaluating transfusion rates in pediatric patients undergoing major elective hip surgery: a retrospective chart review

Submission ID

158

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INTRODUCTION

We aim to establish a multidisciplinary prehabilitation program for elective varus-derotation osteotomy (VDRO) patients, including comprehensive nutrition and management of iron-deficiency anemia. VDRO, a surgical procedure to prevent or address hip displacement, is a lengthy procedure, with a 10-25% incidence of blood transfusion [1]. Patients are often medically complex and require multidisciplinary care. Malnutrition, including anemia, contributes to morbidity in these patients but is rarely highlighted by the perioperative team [2]. Estimates of iron-deficiency anemia in Canadian children range from 12-64%, and medically complex children are at higher risk [3]. Additionally, while patient blood management (PBM) programs are standard in adult care, their implementation in pediatrics remains limited [4]. Preoperative anemia raises the risk of mortality for pediatric patients and influences surgical outcomes, such as the need for blood transfusion and length of hospital stay [5]. PBM programs to address anemia preoperatively may improve surgical outcomes in VDRO patients.

METHODS

Following ethics approval, we conducted a retrospective analysis on a cohort of VDRO patients over a 2.75-year period. All patients aged 0-18 years who have undergone VDRO and/or a pelvic osteotomy were evaluated for inclusion. Those who had undergone a surgical intervention or received a nutritional intervention containing iron within the previous three months were excluded. A standard extraction form in Research Electronic Data Capture (REDCap) was piloted and iteratively adjusted for efficiency and feasibility. Each patient's medical chart was reviewed by two independent extractors in CST Cerner. Summary statistics were calculated and logistic regression models were built using RStudio (v 4.4.1). The primary outcome was the percentage of patients who were transfused during the

perioperative period. Secondary outcomes included perioperative hemoglobin values and hospital length of stay.

RESULTS

Ninety-one patients underwent surgery between March 2022 and December 2024. Patients were 53% (n=48) female, with a mean age of 7.4 +/- 4.1 years. Patients underwent bilateral VDRO (n=31, 34%), unilateral VDRO (39, 43%), pelvic osteotomy (n=19, 21%) or proximal femur osteotomy (n=2, 2%). Their primary medical diagnoses were cerebral palsy (n=45, 50%) and developmental dysplasia of the hip (n=21, 23%). The mean weight Z-score was -0.9 +/- 2.0. Seventy-eight patients (86%) had intraoperative blood gas and hemoglobin measurements; the mean first hemoglobin was 11.3 +/- 1.4 g/dl. Ten (13%) patients had a hemoglobin value under 10 g/dl. Fourteen (15%) patients required an intraoperative blood transfusion, and 11 (12%) required a postoperative blood transfusion, with half (n=5, 46%) occurring within 24 hours of surgery. Lower first intraoperative hemoglobin values were associated with intraoperative blood transfusion (OR 0.59, 95% CI 0.36-0.89, p=0.018). Length of hospital stay was 18.1 +/- 22.8 days.

DISCUSSION

Patients with lower initial intraoperative hemoglobin levels had an increased risk of intraoperative blood transfusion. These patients present for surgery in suboptimal condition, impacting perioperative management and morbidity. While existing literature supports this observation, presenting our institutions' data is essential to validate its relevance and to develop a targeted prehabilitation program. We are currently prospectively recruiting VDRO patients to receive comprehensive nutrition an management of iron deficiency anemia. We will case-match our retrospective and prospective cohorts to determine if this intervention reduces the incidence of blood transfusion during the perioperative period.

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Table 1: Summary statistics of patients who underwent varus-derotation osteotomy (VDRO) surgery at a tertiary pediatric hospital between March 2022 and December 2024. Values are reported as counts (percentages) or medians with standard deviation and range.

	Total (N = 91)
Primary medical diagnosis	
Cerebral Palsy	45 (50%)
GMFCS I*	0 (0%)
GMFCS II*	4 (9%)
GMFCS III*	3 (7%
GMFCS IV*	12 (27%)
GMFCS V*	25 (56%)
No GMFCS listed*	1 (2%)
Developmental Dysplasia of the Hip	25 (28%)
Other	21 (23%)
Age (years)	7.4 +/- 4.1 (0.5-17.5)
Sex (female)	48 (53%)
ASA physical status	-
I	16 (18%)
II	19 (21%)
III	51 (56%)
IV	5 (6%)
Weight Z-score on date of surgery**	-0.9 +/- 2.0 (-6.7-4.2)
Surgical time (hours)	4.1 +/- 1.4 (1.0-9.2)
Hospital length of stay (days)	18.1 +/- 22.8 (1-215)
First blood gas hemoglobin value in the operating room***	113.4 +/- 14.3 (59-141)
Patients with first blood gas hemoglobin less than 100 (g/L)***	10 (11%)
Epidural use during surgery	77 (85%)
Vasopressor use during surgery	42 (46%)
Tranexamic acid use during surgery	76 (4%)
Estimated blood loss (ml/kg)	7.2 +/- 7.6 (0-32.8)
Lowest temperature during surgery (degrees C)	35.4 +/- 0.9 (32.4-37.3)
Intraoperative transfusion	14 (15%)
Post-operative transfusion	11 (12%)
Within the first 24 hours of surgery****	5 (46%)

*Percent of patients with cerebral palsy by GMFCS, **Missing data on 6 participants, ***Percent of those transfused postoperatively, ****Missing 13 patients. GMFCS: Gross Motor Function Classification System

Lessons learned from the design and implementation of pediatric transfusion camp: a national pediatric transfusion medicine curriculum for subspecialty pediatric trainees

Submission ID

144

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INTRODUCTION

Transfusion medicine is a core competency in pediatric anesthesiology, particularly in perioperative bleeding, massive hemorrhage, and blood conservation strategies. However, pediatric transfusion education remains variable and is often extrapolated from adult practice, despite significant differences in physiology, dosing, and transfusion-related risks[1,2] Children experience higher rates of transfusion-related adverse events including errors (e.g., delayed transfusion, over transfusion, wrong product), many of which are preventable through improved clinical decision-making[1]. We aimed to address this gap by adapting the established adult, evidence-based *Transfusion Camp*[3] into a national pediatric transfusion curriculum. We describe the design, implementation, and lessons learned from *Pediatric Transfusion Camp* to support Canadian pediatric subspecialty trainees managing pediatric transfusion scenarios.

METHODS

Pediatric Transfusion Camp was developed using Kern's six-step approach to curriculum design and principles of constructive alignment. Curriculum content was informed by a national multidisciplinary Delphi consensus study identifying core pediatric transfusion medicine topics[4]. Educational modalities included didactic teaching and facilitated case-based seminars using a modified team-based learning approach, with emphasis on pediatric-specific considerations including weight-based dosing, neonatal and infant care, pediatric algorithms and guidelines, and evidence-based blood conservation strategies. A national multidisciplinary steering committee comprised of Canadian pediatric anesthesiologists, hematologists, intensivists, and emergency physicians adapted the adult *Transfusion Camp* content to pediatric contexts using a standardized case-development template. Knowledge assessment was performed using the Pediatric Transfusion Knowledge Test, which was designed and validated using robust psychometric testing methodology and demonstrated strong alignment with core Delphi-derived competencies[5].

The pilot *Pediatric Transfusion Camp* program was delivered virtually from September 2024 to May 2025 using synchronous and asynchronous formats to 28 participants, including 13 pediatric anesthesiology fellows. Learner knowledge assessments and feedback informed iterative curriculum refinement. Ongoing reflection across Kern's framework identified key design and implementation insights.

RESULTS

Key lessons emerged at each stage of curriculum development (Figure 1). Problem identification highlighted the importance of accurately characterizing pediatric-specific transfusion risks and the impact of underreporting adverse events on educational priorities. Constructive alignment between learning objectives, educational strategies, and assessment supported targeted curricular refinement. Standardized objectives and case-development templates facilitated multidisciplinary collaboration while enabling context-specific adaptation to perioperative blood management scenarios. With support from *Transfusion Camp* and Canadian Blood Services, national virtual delivery was feasible and enabled participation across four Canadian universities. Pediatric subspecialty trainees reported high engagement and perceived relevance to clinical practice. Case-based seminars were particularly well-suited for anesthesia-specific topics such as perioperative anemia, massive hemorrhage, and transfusion reactions. Learners reported improved confidence in interpreting blood bank investigations and managing transfusion-related clinical scenarios. However, performance on rare, complex, and high-stakes transfusion scenarios highlighted the need for additional exposure and complementary educational strategies.

DISCUSSION

Lessons learned from the national design and implementation of *Pediatric Transfusion Camp* demonstrate how a structured curriculum framework can support scalable, multidisciplinary education while enabling specialty-specific adaptation. Incorporating

perioperative anesthesia contexts required deliberate alignment of learning objectives, case design, and faculty expertise. Key insights included the benefits and limitations of virtual delivery, which enhances accessibility but restricts experiential learning, and the need for repeated exposure or simulation for rare, high-stakes transfusion scenarios. Collectively, these lessons provide transferable guidance for integrating multidisciplinary medical curricula across diverse clinical and educational settings, including transfusion medicine, anesthesiology, and other perioperative disciplines.

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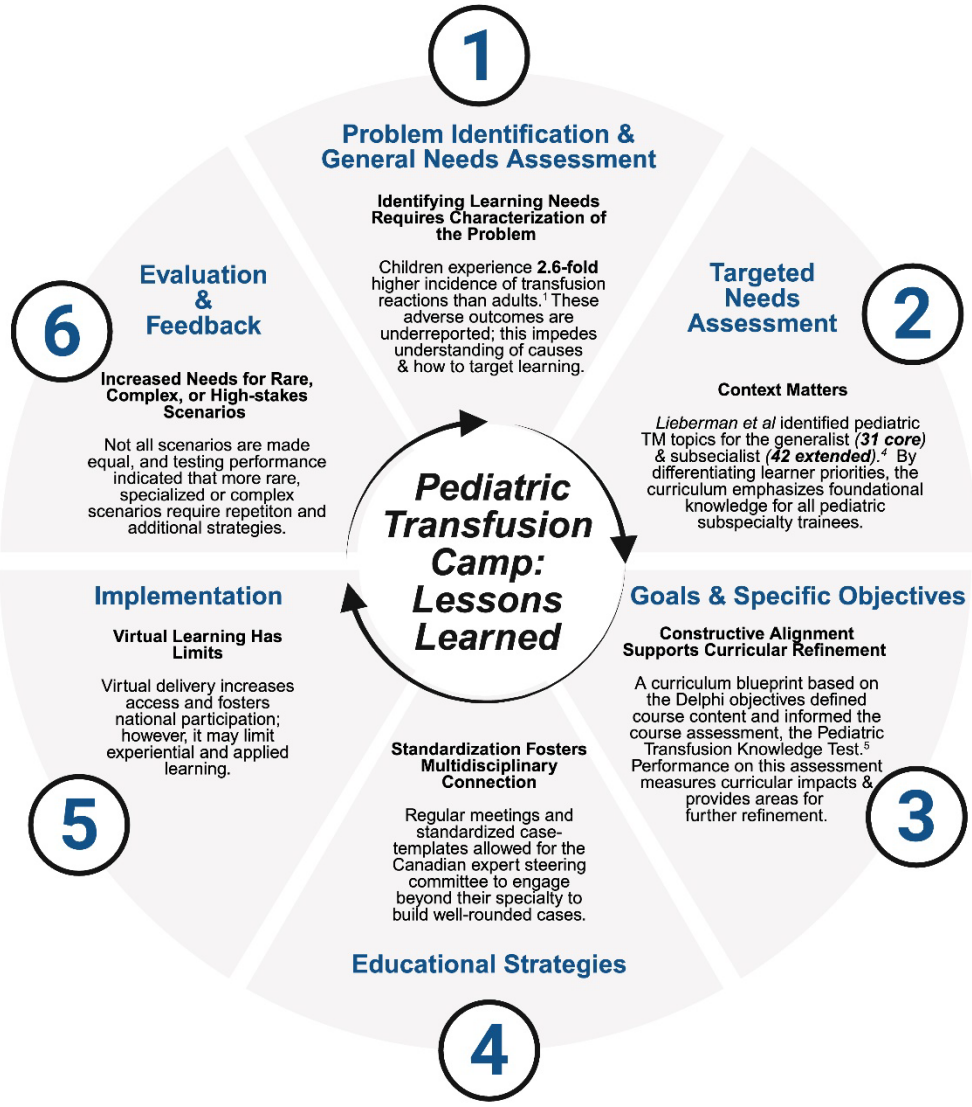

TM: Transfusion Medicine

Figure 1. Lessons learned in designing and implementing *Pediatric Transfusion Camp*
Kern's six-step approach to curriculum design was used to adapt and implement *Transfusion Camp* for the pediatric context. This figure summarizes key insights and lessons learned at each stage of curriculum development, highlighting considerations relevant to the integration of multidisciplinary medical curricula. This includes content adaptation, case design, educational modalities, and delivery strategies that are applicable across diverse clinical and educational contexts, including transfusion medicine and anesthesiology within increasingly multidisciplinary perioperative environments. Created in BioRender. Zuna, I. (2026) https://BioRender.com/skc5xxb

Figure 1

Major hemorrhage in children: a scoping review of evidence and knowledge gaps

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132

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INTRODUCTION

Major traumatic hemorrhage is a leading cause of avoidable death in children and is associated with higher mortality rates than in adults [1]. The reasons for this disparity remain poorly understood, largely due to limited pediatric-specific evidence. Current pediatric resuscitation practices are predominantly extrapolated from adult data, including definitions of major hemorrhage, transfusion protocols and ratios, and the use of hemostatic adjuncts [2,3]. This scoping review evaluates the existing literature to identify key knowledge gaps that hinder the standardization of care for major pediatric traumatic hemorrhage.

METHODS

A systematic search of MEDLINE, EMBASE, Cochrane Library, Google Scholar, CINAHL, and LILACS databases (1946–2025) was conducted. Studies involving pediatric patients (<18 years) with actual or anticipated blood transfusion following trauma were included. Two reviewers independently screened titles, abstracts, and full texts, with data extracted on study characteristics, major hemorrhage/transfusion definitions, resuscitation strategies, coagulopathy management and outcomes. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines were followed [4]. Risk of bias was assessed with the Newcastle-Ottawa Scale and Cochrane Risk of Bias 2 tool.

RESULTS

10,960 abstracts were screened, with 159 studies included. Most were observational cohort studies (154/159), predominantly retrospective (136/159), with two randomized-controlled-

trials. Overall, 3,530,658 children were included. Most studies (134/159) were conducted in North America, with 76 single-center and 15 in military settings. Most participants were male (63.4%), and blunt trauma predominated. Study quality was moderate (median Newcastle–Ottawa Scale score 7, range 4–9), largely due to confounding factors including survival bias. Despite substantial heterogeneity, pediatric-adjusted trauma prediction tools, including the Shock Index and the Pediatric Age-Adjusted (SIPA) demonstrated good prediction of transfusion requirement. In contrast, pediatric massive hemorrhage protocols lacked standardization, with inconsistent use of viscoelastic testing and limited evaluation of adjunctive therapies (e.g., tranexamic acid). Higher transfusion volumes and coagulopathy were associated with increased mortality and complications including thromboembolic events, acute kidney injury, and infection, while care in a certified pediatric trauma center reported lower mortality and complications.

DISCUSSION

The evidence base for major pediatric traumatic hemorrhage is fragmented and predominantly of low quality. Five critical knowledge gaps were identified that currently impede the standardization of care: (1) variable performance of trauma severity scoring systems; (2) lack of standardized pediatric massive transfusion protocols; (3) limited comparative evidence for resuscitation fluids; (4) heterogeneous transfusion-related outcomes; and (5) inconsistent use of coagulopathy monitoring and adjunctive therapies. This review provides a foundation for clinicians developing major hemorrhage protocols and underscores the urgent need for high-quality pediatric-focused research to establish evidence-based management strategies.

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Repeat neuroimaging in children with epilepsy, autism spectrum disorder, global developmental delay, and cerebral palsy under general anesthesia: a study to investigate rate of new significant neuroimaging abnormalities, adverse anesthesia events, and family experience

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186

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INTRODUCTION

Magnetic resonance neuroimaging (nMRI) is frequently repeated in children with autism spectrum disorder (ASD), global developmental delay (GDD), epilepsy, and cerebral palsy (CP), despite a low incidence of new abnormalities found on these scans and guidelines discouraging repeat imaging. These studies strain both MRI and anesthesia resources, and the provincial diagnostic yield of repeat nMRI for these conditions is unknown[1-4]. Children often require general anesthesia to complete these studies, which though generally safe, still has risks. There are also negative impacts on patients such as fasting requirements and negative impacts on their families including out of pocket expenses, travel, and lost work hours[5]. This study evaluates the diagnostic yield, adverse anesthesia events, and family impact, including burdens and expectations, of repeat nMRI under general anesthesia in these populations.

METHODS

We conducted a mixed methods study consisting of two parts:
1) Retrospective chart review of all children (17 years or younger) who received repeat nMRIs over the past 10 years at two provincial hospitals for the investigation of ASD, GDD, epilepsy, CP with at least one scan under general anesthesia to determine the rate of significant neuroimaging abnormalities and the rate of adverse anesthesia events such as emergence

delirium and post-anesthesia nausea or vomiting.
2) IN PROGRESS: Prospectively interview parents/caregivers/guardians of children receiving the above neuroimaging during the students' work period assessing validated patient satisfaction scores, travel time and distance, missed days of work, and out of pocket expenses.

Data analysis was performed using SPSS statics software (version 28). Data were summarized with counts, percentages, means, and standard deviations. Chi-square tests and likelihood ratio tests were used to test for associations in count data between variables of interest. The retrospective data analysis included descriptive statistics, and the future prospective data analysis will include thematic analysis. Data collected from Sunrise Clinical Manager (SCM), Picture Archiving and Communication System (PACS), Montage, and Radiology Information System, (RIS) included: demographics, nMRI scan dates, imaging reports, anesthetic records, and post-anesthetic records.

RESULTS

The retrospective analysis showed that 32.4% of repeat nMRIs were ordered contrary to guideline recommendations, and 69.1% did not reveal new clinically relevant findings, suggesting limited utility of repeat imaging. On the initial scan, patients with CP as a study indication were more likely to have significant findings (N=7, 100%) than those with other indications (N=83, 57.2%; p=0.042), indicating potentially greater utility in this population. On the second scan, patients with a study indication of CP were more likely to undergo repeat nMRI against guidelines (N=6, 66.7%) compared with those with other indications (N=39, 27.3%; p=0.020). Additionally, among second scans, patients with a study indication of GDD were more likely to have significant findings (N=24, 40.7%) than those with other indications (N=33, 24.7%; p=0.048), suggesting potential increased utility for this indication. Adverse anesthesia events were uncommon; emergence delirium (7.6%) and nausea or vomiting (0.9%) were most frequent, supporting anesthetic safety.

DISCUSSION

Improved physician adherence to imaging guidelines is essential to optimize resource use, minimize patient risk, and reduce burden. To limit unnecessary imaging, nMRI requests for ASD, GDD, epilepsy, and CP should include thoughtful assessment of anticipated diagnostic value and impact on management. Repeat nMRI for CP was more often ordered contrary to guidelines, indicating that CP imaging requests require careful consideration. The system cannot rely solely on radiologists during protocoling, especially when requests provide minimal indication. Preliminary prospective data suggest that travel from rural areas to provincial imaging centers and time off work contribute to family burden from nMRI.

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Use of virtual reality as an educational tool to alleviate preprocedural anxiety in the pediatric population: a systematic review and meta-analysis of RCTS

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139

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INTRODUCTION

Preprocedural anxiety among children undergoing medical procedures is a major concern (50-75%) for the parents and the child, which leads to discomfort, poor cooperation, emergence delirium and long-term problems like post-traumatic stress disorder.[1,2] It is often multifactorial and can be driven by fear of pain, unfamiliarity with the hospital environment, parental separation, and limited understanding of the procedure.[2] Many nonpharmacological interventions like parental presence during induction, pre-procedure tour, and audiovisual/play therapy distraction have been used with mixed results. Over the years, Educational Virtual reality (VR) has emerged as a more interactive and engaging approach to reduce anxiety. This novel tool can familiarize children with the healthcare environment and visually demonstrate the procedures in a child-friendly manner for preparedness for the procedure.[3,4] Our systematic review aims to evaluate the effectiveness of virtual reality as an educational tool for reducing preprocedural anxiety in pediatric patients undergoing a range of healthcare interventions.

METHODS

This study was registered in PROSPERO (1269203). An expert librarian conducted the systematic literature search from January 2012 to November 2025, covering the following databases: OVID Medline, OVID EMBASE, Google Scholar, and PubMed. Two reviewers independently screened randomized controlled trials (RCTs) comparing the effectiveness of a virtual reality headset versus a control in reducing preprocedural anxiety in children aged 4 to 17 undergoing a medical procedure. The control group included either the standard medical practice or a different non-pharmacological method to reduce anxiety. The intervention groups should have used the Virtual reality headset as an educational tool, not as a distraction. The data were extracted from the studies and summarized using

Standardized Mean Difference (SMD) and 95% confidence intervals (CIs). We used a frequentist inverse-variance random-effects meta-analysis to evaluate the existing evidence for virtual reality as an educational tool for reducing anxiety. Sensitivity and meta-regression analyses were conducted to explore heterogeneity across subgroups. The risk of bias was assessed using the Cochrane ROB-2 tool, and the certainty of the evidence was assessed using the GRADE approach.

RESULTS

A total of twelve RCTs with 1128 patients were included in the systematic review, comprising 567 patients (50.3%) in the intervention group and 561 patients (49.7%) in the control group. Of these, 7 studies involving 699 patients (intervention group: n=348, 49.8%; control group: n=351, 50.2%) were included in the meta-analysis. These patients underwent various medical procedures, including elective surgery, venipuncture, dental extraction, circumcision, and MRI scans. Although the patients' baseline characteristics and clinical profiles were similar across both groups, the anxiety assessment tools varied across the studies. The findings indicated that educational virtual reality substantially reduced preprocedural anxiety compared with control groups (SMD: 2.08; 95% CI: 1.02–3.15; I^2 = 97%; p = 0.0001) (Figure). Compared with controls, the probability of having less anxiety after VR intervention is 99.99% for a Z-score of 3.83. Sensitivity and meta-regression analyses of the various subgroups did not alter the pooled estimates.

DISCUSSION

This systematic review and meta-analysis demonstrate that educational virtual reality may significantly reduce preprocedural anxiety in pediatric patients undergoing various medical procedures compared with the control group. All studies included were of moderate to high quality, but the certainty of evidence was low. VR may familiarize pediatric patients with the health care setting and enhance their understanding of the procedure. However, further RCTs with adequate power and standardized anxiety assessment tools are warranted to confirm these findings.

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Figure Forest plot showing the impact of virtual reality on anxiety scores. Comparison of the anxiety scores baseline versus postintervention between the virtual reality and control group. Panel of meta-analysis forest plots displaying the Standard Mean Difference (SMD) for anxiety scores. The SMDs for each included study are plotted. A pooled estimate of overall SMD (diamonds) and 95% confidence intervals (represented by the width of the diamonds) summarizes the effect size using the random-effects model. CI = confidence interval; IV = Inverse Variance statistical method.