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(Abstracts)

Contents

Incidence of Perioperative Respiratory Adverse Events in Pediatric Anesthesia

Wassila Ait Igrine[1], Davinia E. Withington[2]
1 Department of Anesthesia, McGill University, Montreal, Quebec, Canada.
2 Department of Anesthesia, Montreal Children's Hospital, McGill University, Montreal, Quebec, Canada.

Introduction: Respiratory events are responsible for the majority of the perioperative complications in pediatric anesthesia.[1] Unfortunately, little is known of the current pediatric anesthesia complication rates in Canada.[2,3] We aimed to identify the incidence of perioperative respiratory adverse events (PRAE) at our pediatric center and sought to identify associated patient, surgical and anesthetic risk factors.

Methods: Ethics approval was waived by local REB. We conducted a prospective audit of all children receiving anesthesia from December 2018 to June 2019 inclusively. Data was collected through anonymized surveys that were completed by the anesthetist and the recovery room nurse responsible for the patient. The primary outcome was the incidence of any PRAE either during anesthesia or in the recovery room. The events assessed were stridor, laryngospasm, bronchospasm, persistent coughing, airway obstruction, apnea and oxygen desaturation. Data on relevant patient risk factors as well as on anesthetic and surgical management were recorded.

Results: A total of 1903 forms were collected. Analysis was conducted using SPSS 24.0. Incidence of any PRAE was 14.3%. Incidence of any RAE in the OR was 7.8% where 8% of these were classified as severe. Incidence in the PACU was of 6.6%, with 1% of these being severe. Airway obstruction was the most common event and occurred mostly either on emergence or in the PACU. Three multivariate models based on significant patient, anesthetic and surgical factors were built to assess association with the primary outcome. Significant variables identified in each model were used to build a final integrated multivariate model. Variables significantly associated with the outcome were age groups 0-2 years (OR 2.88, 95% CI 1.42 -3.78, P 0.007) and 13-18 (OR 1.99, 95% CI 1.09-3.00, P 0.007), abnormal airway (OR 2.36, 95% CI 1.17-3.56, P 0.01), chronic pulmonary disease (OR 2.31, 95% CI 1.37-5.30 , P 0.004), OSA (OR 2.25 95% CI 1.48-4.00 , P 0.005), URTI (OR 2.1 95% CI 1.44-3.22 , P0.0002), history of PRAE (OR 3.59 95% CI 1.08/8.57 , P0.03), obesity (OR 2.60 95% CI 1.32-5.49 , P 0.006), native airway being protective (OR 0.48 95% CI 0.293-0.796, P 0.001), and urgent procedure (OR1.65 95% CI 1.00-2.71 , P 0.04).

Discussion: Incidence of PRAE at our center is comparable to rates identified in other studies.[4] Here again we observe the importance of patient factors.[5] Notable potentially modifiable risk factors include URTI and obesity. Of interest, while age was traditionally shown to be strictly inversely correlated with the risk of RAE, we found that children older than 13 years were at higher risk compared to the 7-13 years category. This could be a target for improvement. Finally, only one event resulted in unexpected ICU admission, highlighting the overall favorable prognosis of respiratory adverse events.

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Novel use of Continuous Erector Spinae Plane Blocks in Surgery for Adolescent Idiopathic Scoliosis

Allyson Farran[1], Michael Little[1], Florian Rudolph[1], Eric Huang[2], Kyle Stampe[2], Mancho Ng[1]

1 Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, Canada.
2 Department of Surgery, University of Alberta, Edmonton, Alberta, Canada.

Background: Posterior spinal fusion (PSF) for adolescent idiopathic scoliosis (AIS) can cause severe post-operative pain[1]. These patients often have high systemic opioid requirements, which can result in a sequalae of unwanted opioid-related adverse effects[2]. The erector spinae plane (ESP) block is a novel regional anesthesia technique that blocks the dorsal and ventral rami of spinal nerve roots[3]. The utility of this block in pediatrics is relatively new[4], and its efficacy in managing pain following surgery for scoliosis has not yet been described. We sought to determine whether bilateral continuous ESP blocks, when compared to single-shot intrathecal morphine, reduces opioid consumption in the first 72 hours after PSF for AIS. We also compared the frequency of opioid-related adverse effects and numeric rating scale (NRS) pain scores.

Methods: Ethics approval was obtained from the local REB. This was a before-after cohort study that compared a historical group of 31 consecutive patients receiving single-shot intrathecal morphine (5mcg/kg) to a prospectively matched cohort of 25 patients receiving bilateral continuous ESP blocks (bupivacaine 0.1% infusion at 0.5-1ml/hr, bolus dose of 7ml every 90min). ESP block catheters were placed under direct visualization by the surgeons at the end of surgery, and remained in-situ for 72 hours. Both groups also received gabapentin (5mg/kg), ibuprofen (10mg/kg), and acetaminophen (15mg/kg), and either morphine or hydromorphone via patient-controlled analgesia.

Results: Patients receiving continuous erector spinae plane blocks used significantly less opioids compared to those receiving intrathecal morphine at 48 and 72 hours post-operatively (28.5mg ± 13.5 vs 43.6mg ± 20.2, $p = 0.007$ at 48h; 29.5mg ± 13.6 vs. 47.9mg ± 23.0 at 72h, $p = 0.002$), but not at 24 hours. There were no significant differences in numeric rating scale pain scores. The continuous erector spinae plane blocks also had a lower incidence of nausea and vomiting (68% vs 90%, $p < 0.05$), as well as pruritis (20% vs 52% $p < 0.05$).

Discussion: This study found that continuous bilateral ESP blocks in PSF for AIS resulted in significantly less opioid consumption at 48- and 72- hours compared to a retrospective cohort of intrathecal morphine. The continuous ESPBs also resulted in fewer opioid-related adverse effects, including PONV and pruritis. Interestingly, the reduction in opioid consumption did not translate to reduced NRS pain scores. This may simply reflect a compensatory increase in the use of PCA opioids by the ITM group to achieve similar levels of analgesia. Given that this is a relatively new technique in pediatrics, the optimal dose of local anesthetic has not yet been established. Further characterization of the ideal loading volume, infusion rate, and concentration of local anesthetic used for continuous ESP blocks would be a valuable next step.

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Point of Care Ultrasound (PoCUS) for Obstructive Sleep Apnoea Screening in the Pediatric Population – A Systematic Review

Donogh Burns[1], Aditya Trivedi[5], Vincent Chan[2], Mandeep Singh[2,3,4]

1 Department of Anesthesia and Pain Medicine, The Hospital for Sick Children, Toronto, Ontario, Canada.
2 Department of Anesthesiology and Pain Management, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.
3 Toronto Sleep and Pulmonary Centre, Toronto, Ontario, Canada.
4 Department of Anesthesiology and Pain Management, Women's College Hospital, Toronto, Ontario, Canada.
5 Department of Chemistry, McMaster University, Hamilton, Ontario, Canada.

Introduction: The diagnosis of obstructive sleep apnea (OSA) has important clinical significance in the pediatric perioperative context. The gold standard of polysomnography is a limited and expensive resource. A recent systematic review and meta-analysis in adults identified several parameters which correlate well with OSA diagnosis. The objective of this systematic review was to evaluate the usefulness of surface airway ultrasound as a perioperative point-of-care ultrasound (PoCUS) tool for OSA screening in the pediatric population and identify potential areas for future research.

Methods: Ethics approved was not applicable because the study did not involve human or animal research.

This systematic review was registered with Prospero ID: CRD42020216252. A search of major electronic databases including Medline, Embase, and others was conducted from inception to November 2020. Inclusion criteria were observational cohort studies and randomized controlled trials involving surface ultrasound (US) imaging directly relating to OSA or US imaging of upper airway structures with a known association with OSA in the pediatric population (0-18 years) . Article screening, and data extraction were conducted by two independent reviewers. Mean age, gender, BMI, study setting, US parameters (index test) and reference measures were collected. An evaluation was made of the correlation between US parameters and OSA diagnosis using sleep study (reference standard), other reference measures relating to severity of symptoms or measures validating US parameters.

Results: Of the initial 8,499 screened articles, 12 articles (8 airway, 4 non-airway) evaluating 1,237 patients were included.

Three studies examined correlation between US measurements and OSA diagnosis defined by Apnea Hypopnea Index (AHI) as measured by polysomnography. Lateral pharyngeal wall thickness (LPW) was positively correlated with either the severity or presence of OSA in all three of these studies and total neck thickness (TNT) with AHI in one of the studies.
Three studies examined the relationship between carotid intimal media thickness (cIMT) and AHI, with no significant correlation found. One study examined the relationship between cIMT and a clinical diagnosis of Adenotonsillar Hypertrophy and found a statistically significant association.

Four studies compared US measurements of tonsil volume preoperatively with the pathological specimens of resected tonsils with good correlations found between the measured volumes in

each study.
One study examined the adenoid tonsils and found a strong correlation between the adenoid thickness on US and the extent of adenoid-posterior nostril occlusion (EANC) based on electronic nasopharyngoscopy.

Discussion: The studies included in this review exhibit considerable heterogeneity in terms of the structures examined by US and the correlated parameters. There is insufficient data currently to recommend any specific US measurements to reliably diagnose pediatric patients with OSA. This is an area of increasing interest, with most of the included studies published in the past three years. This systematic review highlights areas for future larger scale studies to pursue.

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Retrospective Audit of Paediatric Spine Surgeries: A Quality Improvement Initiative

Cindos Barakat[1,2], Ushma Shah[1,2], Niveditha Karuppiah[1,2], Raju Poolacherla[1,2], Herman Sehmbi[1,2], Brynn Charron[2], Kathleen Lynch[3], Susan Carter[3], Abi Kandasamy[3]

1 Department of Anesthesia and Perioperative Medicine, London Health Science Centre, London, Ontario, Canada.
2 Schulich School of Medicine and Dentistry, London, Ontario, Canada.
3 London Health Sciences Centre, London, Ontario, Canada.

Introduction/Background: Chronic postsurgical pain (CPSP) is known to occur in 20% of children after major surgery. (1) CPSP is associated with prolongation of recovery, higher risk of postsurgical infection and psychological distress. (1) Pediatric spine surgeries are commonly associated with higher rates of chronic pain and longer post-operative recovery. (2) Protocoled peri-operative management, such as with ERAS, can improve perioperative care. (3,4) The purpose of this review is to audit the hospital stay of pediatric patients who underwent spine surgery at a children's hospital to evaluate the baseline function and assess for areas of improvement.

Methods: Ethics approval was waived by the local REB. This is a retrospective chart review of all paediatric spine cases at a children's hospital between Jan 1st 2018 to December 31st 2019. Data collected included 1) demographic profile, 2) medical comorbidities, 3) surgery, 4) post-operative pain scores & opioid consumption, 5) duration of hospital & ICU stay 6) adjuvant drugs, 7) physiotherapy goals and day achieved and 8) post-operative complications. This is the part 1 of a PDSA cycle.

Results: Total cases reviewed in this study were 67. Table 1 summaries the results. Average duration of hospital stay was 6.7 ± 2.1 days, with an average of 1.2 ± 0.83 days spent in ICU. Average opioid consumption was 0.50 ± 0.52 mg/kg on POD 0, 0.71 ± 0.67 mg/kg on POD 1, 0.31 ± 0.32 mg/kg on POD 2, and 0.13 ± 0.14 mg/kg on POD 3. For multimodal analgesia, all patients were prescribed acetaminophen (79% scheduled), 99% ibuprofen (53% scheduled) and 33% gabapentin. For rehabilitation goals, the average number of post-operative days to be able to sit at edge of bed was 1.3 ± 0.7, sitting for >20 min was 3.0 ± 1.4, ambulate ~10 m was 3.4 ± 1.3 and ascend/descend 3 steps was 4.5 ± 1.5. Analysis of the pain scores was complex due to variations in documentation style and frequency.

Discussion: Complex pediatric spine surgery needs a multidisciplinary approach to manage perioperative pain which in turn improves patient outcomes, while reducing hospital stay and costs. The hospital stay at our institution is 1-2 days greater than others. Institutions without ERAS protocol have a length of stay at 5.7 days, in comparison to our 6.7 days; additionally, those with ERAS protocols have lengths of stay at 4 days.(4) The barriers to early discharge have been identified as variable postoperative analgesic prescription, late mobilization and physiotherapy goal achievement. We would benefit from the development of standardized post-operative pain management protocol and early mobilization to facilitate recovery and early discharge. The next PDSA cycle will introduce postoperative spine care bundle which will target pain and symptom management and early physiotherapy.

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Table 1. Results. Total cases reviewed were 67. *Outliers were removed due to extended duration of stay due to comorbidities not associated with spine surgery.

Gender				**Age**			
	M	**F**			**Years**		
Total	24	42		Average	13± 3.1		
Percent	35%	64%					
Most Responsible Diagnosis							
	Idiopathic Scoliosis	**Neuromuscular disorder**	**Trauma**	**Tumor**	**Congenital Scoliosis**	**Spondylolisthesis**	**Neurofibromatosis**
Total	40	8	7	3	3	3	3
Percent	61%	12%	11%	4.5%	4.5%	4.5%	4.55%
ASA						**Surgical Levels**	
	1	**2**	**3**	**4**			Percent
Total	1	14	39	13		**<4**	16%
Percent	2%	21%	58%	19%		**>3**	84%
Hospital Stay			**ICU Stay**	**ICU Stay**		**Remained Intubated**	
	Days			**Days**			
Average	7.3 ± 5.4		**Average**	1.9 ± 5.1		**Total**	6
Average (outliers removed)*	6.7 ± 2.1		**Average (outliers removed)***	1.2 ± 0.83		**Percent**	9%
Opioid Consumption							
	POD 0	**POD 1**	**POD 2**	**POD 3**			
Morphine Equivalents in mg/kg	0.54 ± 0.62	0.81 ± 1.0	0.44 ± 1.2	0.27 ± 1.2			
Morphine Equivalents in mg/kg (outlier removed)	0.50 ± 0.52	0.71 ± 0.67	0.31 ± 0.32	0.13 ± 0.14			
Adjuvants							
	Acetaminophen	**Ibuprofen**	**Gabapentin**				
Total	67	66	22				
Scheduled	79%	53%	100%				
PRN	13%	47%					
Physiotherapy							
	Sitting at Edge of bed	**Sitting >20 min**	**Ambulate ~10 m**	**Ascend/Descend 3 Steps**			
Average Post Operative Day	1.3 ± 0.7	3.0 ± 1.4	3.4 ± 1.3	4.5 ± 1.5			

Retrospective Review of Ambulatory Continuous Adductor Canal Catheters in Adolescents Undergoing Reconstructive Knee Surgery

Jennifer Dvorak[1,2], Adam Spencer[2,3], Andrew Walker[1], Lisa Phillips[4], Ryan Endersby[3], Kaleigh Peters[5]
1 Department of Anesthesia, Foothills Medical Centre, Calgary, Alberta, Canada.
2 Department of Anesthesia, Alberta Children's Hospital, Calgary, Alberta, Canada.
3 Department of Anesthesia, South Health Campus, Calgary, Alberta, Canada.
4 Department of Orthopedics, Alberta Children's Hospital, Calgary, Alberta, Canada.
5 Faculty of Nursing, University of Calgary, Calgary, Alberta, Canada.

Introduction/Background: Pediatric knee reconstruction is known to be a painful procedure requiring multimodal analgesia, including regional techniques to provide adequate postoperative pain control.[1] To provide prolonged postoperative analgesia pediatric anesthesiologists are inserting continuous peripheral nerve block (CPNB) catheters and using delivery systems such as electronic or elastomeric pumps to infuse local anesthetic over 24 to 72 hours.[2] Ambulatory continuous peripheral nerve block catheters (CPNBs) have proven to be feasible and safe for pediatric patients, however there is little data on ambulatory adductor canal blocks (ACBs) in this population.[3] We present a retrospective audit in pediatric patients to evaluate the efficacy of ambulatory continuous ACBs placed after reconstructive knee surgery using the catheter-over-needle technique (CON).

Methods: Ethics approval was obtained from the local REB**.** Retrospective data was collected on all pediatric patients who received an ambulatory continuous ACB after reconstructive knee surgery between March 2017 and May 2020 at a tertiary care pediatric hospital. Catheters were placed under ultrasound guidance using the CON technique as described here.[4] Catheters were intended to remain in place for up to three days. Data obtained included demographic information, duration of hospital stay, numerical pain scores (NRS) at rest, with movement and opioid use on postoperative days 1-3, complications related to the catheter, emergency department visits and hospital readmissions. Data was analyzed using descriptive statistics and presented as mean (standard deviation) or frequency (percentage) unless otherwise specified.

Results: Sixty-eight patients (age 13-17) were discharged home with a continuous ACB *in situ*; 80.9% on the day of surgery. 60.3% and 36.5% patients had their catheters in place until POD 2 and POD 3 respectively. Median NRS pain scores were ≤3 at rest and ≤5 with activity on postoperative days 1-3. Median opioid use was ≤5mg oral morphine equivalents per day with 31% of patients using no opioids from postoperative days 1-3. There were no serious complications such as LAST or long-term neurologic deficits. Readmission to hospital was limited to one patient for uncontrolled pain post-catheter removal.

Discussion: This study was designed as an initial retrospective audit on the use of postoperative ambulatory ACBs at our institution. We did not design our study to detect an *a priori* defined effect size. Despite our sample size, our audit suggests that in our cohort of pediatric reconstructive knee surgery patients the use of ambulatory ACBs is a feasible analgesic modality that resulted in clinically acceptable postoperative pain scores and minimal opioid use. Leakage around the catheter puncture site was limited to one patient supporting the use of the CON technique that utilizes a puncture hole of equivalent size to that of the catheter. Future appropriately powered clinical trials are warranted comparing the adductor canal block to the more commonly applied femoral approach in pediatric patients.

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