Pediatric Guide to Tonsillectomy and Adenoidectomy

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Abstract

The use of opioids during a tonsillectomy and adenoidectomy (T&A), in the pediatric population, has shown adequate pain management. However, other modalities of analgesia have also shown value in pain control without the unfavorable side effects of narcotics. Hypoventilation with subsequent hypercarbia, apnea, hypoxia and a significant number of deaths have occurred due to the use of narcotics. The population most likely to require T&A are children with OSA who are at highest risk for morbidity and mortality. ADU SRNA’s will participate in the care of pediatric patients undergoing T&As during assigned pediatric specialty rotations occurring at AHS facilities. Therefore, an educational PowerPoint addressing evidence based preoperative, intraoperative, and postoperative pain management techniques for children undergoing a T&A was devised. The aim of this scholarly project was to increase the knowledge base of the ADU SRNA 2019 cohort regarding multimodal pain management techniques for pediatric T&A’s. Involvement in the pretesting and posttest assessment was voluntary. For statistical analysis, paired samples t-tests were conducted to analyze the data. Statistical analysis was performed by Roy Lukman, PhD. The mean pre-test score was 60.77 while the mean post-test score was 93.08 with a confidence interval of 95%. The obtained t-test was -5.676 (p < .001), which is statistically significant. It can be concluded that the average scores increased significantly.
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Introduction

Tonsillectomy and Adenoidectomy (T&A) is one of the most common surgical procedures performed in the pediatric population. In the United States, an estimated 737,000 patients have undergone tonsillectomies each year (Goldman et al., 2013). Forty years ago, the majority of tonsillectomies performed were indicated for infection. Today, OSA is the most common indication, accounting for over half a million cases a year (Kieran et al., 2013). T&A's present unique challenges particularly for anesthesia providers. These problems include a shared airway between the anesthesia provider and surgeon, combined with the presence of bloody secretions within the airway itself. As a result, there exists a significantly higher risk of airway complications such as laryngospasm, limited intraoperative access to the patient’s airway and other perioperative ventilatory compromises. Traditional pain management techniques that rely heavily on the administration of short and long acting narcotics have resulted in respiratory depression and significant morbidity and mortality.

While postoperative bleeding is the most common complication associated with malpractice claims, anoxia, the absence of oxygen reaching tissue, related to opioids and anesthesia has the greatest overall risk from a monetary standpoint (Sadhasivam, Subramayam, Varughese, & Wilging, 2013). An anoxic event was noted to have the highest monetary award at $9,017,379, and injuries including anoxia had higher mean monetary awards than death (Mahmoud, Patino, & Sadhasivam, 2013).

The lack of knowledge regarding the intrinsic pathology of T&A along with the use of narcotics for pain control has been found to potentiate obstructive sleep apnea, lead to increase morbidity and mortality. Medication errors and the lack of consistent practices in the
administration of pain medication are also factors in post-tonsillectomy deaths. Implementing evidence based standardized pain management practices would, therefore, promote the quality of care and safely leading to better patient outcomes. (Goldman et al., 2013). Anesthesia providers and surgeons should strive to develop and evaluate ways of identifying children at high risk to determine safe postoperative outcomes. Currently, however, there is no set standard for perioperative pain management for the pediatric T&A patient in either ambulatory or inpatient settings, which has led to respiratory compromise.

Of concern locally, is the absence within the Adventist Health System (AHS) of standardized guidelines for this vulnerable population regarding preoperative screening to identify OSA, intraoperative anesthetic management, postoperative pain management or monitoring for adverse respiratory outcomes. ADU SRNA’s will participate in the care of pediatric patients undergoing T&As during assigned pediatric specialty rotations occurring at AHS facilities.

Therefore, two questions, presented in PICO format, assisted in a systematic review of the literature. The first question addressed the clinical problem: In pediatric patients undergoing a tonsillectomy and adenoidectomy (P), how do narcotic medications (I) compare to other modalities of analgesia (C) affect pain management and respiratory depression (O) within the perioperative period (T)? Educational innovation is addressed in the second question: In Adventist University student nurse anesthetists (P), does a 30-minute (T) PowerPoint presentation regarding multimodal pain management approaches for pediatric T&A patients (I) result in an increase in the knowledge base (O)?
Literature Review

Research for the pediatric perioperative management of T&A is limited. Despite the increasing number of tonsillectomies performed, there has been a wide variation in the management of patients, both nationally in the United States, and across the globe. The evidence has tended to point towards increased benefit of using other modalities of analgesia in conjunction with decreased narcotics for prevention of adverse pulmonary complications. Opioid-related respiratory depression has accounted for several deaths and events leading to significant morbidity including anoxic brain injury after adenotonsillectomy in children (Mahmoud, Patino, & Sadhasivam, 2013). As OSA is an exacerbating factor for this population, an apparent need for additional research to define best practices for the management of children with OSA, including safer pain management strategies is evident. According to Cheung et al., (2015), preoperative screening for OSA was suggested to enable anesthesia providers implementing perioperative measures to minimize risks of oxygen desaturation, apnea, or increased work of breathing postoperatively. It is of the highest importance to remain vigilant while providing continuity of care in every stage of the perioperative period.

Pre-Anesthetic Evaluation

Preoperative evaluation in anticipation of adenotonsillectomy should pay particular consideration to the probability and severity of OSA and sleep-disordered breathing (SDB). The ASA practice guidelines for the management of patients with OSA recommend that all adult and pediatric patients with OSA over one year of age should be screened for OSA before undergoing surgery (Cheung et al., 2015). The incidences of perioperative respiratory complications have been proven to be ten times higher for children with OSA compared to those without OSA.
(Lauder and Emmott 2014). Thus, the ability to predict which patients are at risk is of utmost importance to direct appropriate perioperative care and postoperative disposition. Caring for a child with OSA has presented pharmacological challenges. Increased perioperative respiratory complications have been attributed to increased opioid sensitivity in patients with hypoxemia. According to Brown (2004), hypoxia has been observed to result in an increased number of pain related mu opioid receptors in children with OSA. This upregulation explained the amplified depressant response to morphine, given for analgesia in this population (Hoffbauer et al., 2015). Hence, children undergoing adenotonsillectomy with a concurrent diagnosis of OSA and severe preoperative intermittent hypoxemia have an increased sensitivity to opioids and decreased postoperative opioid requirements. Assessing the severity of sleep apnea is important as it can predict the risk of postoperative adverse outcomes.

The initial approach to a child with suspected SDB should include a thorough interview that screens for behavioral problems, poor school performance, decreased the quality of life, failure to thrive, and enuresis (Schwengel, 2009). As those factors are often not assessed along with the more common questions regarding snoring, apnea, frequent arousals, morning headaches, and daytime sleepiness.

Although polysomnography (PSG) has proven to be the gold standard for diagnosing OSA and SDB in children, the ability of PSG to predict postoperative respiratory complications has yet to be established in children with OSA (Kieran et al., 2013). Therefore, it would be unnecessary to perform in every case. The American Academy of Otolaryngology’s Clinical Practice Guideline recommended PSG in children suffering from symptoms of OSA before T&A if they exhibit medical comorbidities, which include obesity, trisomy 21, craniofacial abnormalities, neuromuscular disorders, sickle cells, and inherited metabolic conditions (Archer
et al., 2010). According to Mahmoud et al., (2013), children with OSA and craniofacial syndromes can quickly obstruct and experience oxyhemoglobin desaturation. Without a tool such as PSG guiding the anesthetic plan, it would be the responsibility of the anesthesia provider to determine the patient’s risk of respiratory compromise with expert clinical judgment.

The detailed interview of the patient would appropriately be followed by a precise physical assessment which should include: nasal anatomy, ability to breathe through the nose, presence of elongated facies, oral opening size, mandibular size, intermaxillary distance, thyromental distance, tonsillar size, tongue volume, body habitus, and Mallampati score (Schwengel, 2009).

The preoperative period can be stressful for children and their parents. The goals of pre-anesthetic medication for children include allaying patient anxiety and facilitating the induction of anesthesia (Akin et al., 2012). Caution must be exercised regarding sedative premedication in children with severe OSA, due to significant airway obstruction and severe oxygen desaturation that can occur. Administration of sedation or anesthesia results in increased airway collapse because of increased closing pressure, loss of pharyngeal muscular tone, and failure of coordination of phasic activation of upper airway muscles with diaphragmatic activity (Mahmoud et al., 2013). The increased opioid sensitivity, coupled with the synergistic effects of sedatives and anesthetics, placed OSA patients at a higher risk of sedation and anesthesia induced respiratory complications and delayed emergence post anesthesia (Schwengel, 2009).

Hence, opioid and sedative sparing anesthesia with careful titration of relatively shorter acting anesthetic agents seemed to be warranted during anesthesia for adenotonsillectomy in children with OSA.

After having developed an appropriate plan of action, the anesthesia provider should confirm proper airway management tools including a variety of sizes of face masks, oral airways,
nasopharyngeal airways, tracheal tubes, laryngoscope blades and handles, and laryngeal mask airways are available (Mahmoud et al., 2013). Advanced airway interventions may be necessary to maintain airway patency, oxygenation, and adequate ventilation in any stage of the perioperative period (Archer et al., 2010). Consequently, avoidance of airway complications requires institutional and individual preparedness, careful assessment, proper planning and judgment, excellent communication and teamwork, knowledge and use of a range of techniques and devices, and a willingness to stop performing procedures when they are failing.

**Intraoperative Anesthetic Management**

Adenotonsillectomy is a painful procedure requiring adequate analgesia. For pain control, a narcotic administration has proven useful and became the preferred method of analgesia in the perioperative period. Complications from opioids, such as oversedation and respiratory depression are unwanted but commonly seen. (Tekelioglu et al. 2013). Children with significant OSA presented an increased anesthetic risk in the perioperative period, more so than patients with normal upper airways (Heitmiller et al., 2009). Avoiding opioids, or at least reducing the dose, should be standard practice in adenotonsillectomy patients exhibiting respiratory comorbidities. Therefore, better perioperative risk reduction strategies and monitoring of high-risk pediatric patients are important in avoiding serious complication during a pediatric tonsillectomy.

The differing metabolism of narcotics by pediatric patients, especially those with OSA, make it difficult to determine what, when, and how much medication to give for pain. In 2012, a black-box warning against codeine-containing medications in children undergoing tonsillectomy was issued by the Food and Drug Administration (FDA) due to reported deaths in this setting caused by sleep-disordered breathing (Greenberg et al., 2014). Codeine has been found directly
responsible for multiple pediatric deaths (Wolfe et al. 2016). Other opioid options have included morphine, which appears adequate for intraoperative pain control when used in the recommended dose. Morphine has become the standard against which all other forms of analgesia are measured (Lauder & Emmott 2014). Due to the upregulation of pain receptors discussed previously, there is reduced morphine requirement for children presenting hypoxemia associated with OSA (Brown et al., 2004). Hydromorphone has fewer side effects than morphine theoretically, yet has not replaced morphine as the opioid of choice due to the disparity in potency; it is 8-10x more potent than morphine and has led to clinicians underestimating its respiratory depressant effects (Wolfe et al. 2016).

There has been a great effort to convert anesthesia providers to using other modalities of analgesia in conjunction with narcotics to decrease use of opioids, therefore, reducing respiratory compromise in the pediatric population. In practice, anesthesia providers avoided non-steroidal anti-inflammatory drugs (NSAIDs) in children undergoing T&A due to increased risk of postoperative bleeding (Greenberg, Mattos, Robison, & Yellon, 2014). However, it has been proven that the risk of bleeding observed in adult patients taking NSAIDS is significantly lower in children following a tonsillectomy (Hoffbauer et al., 2015). Pharmacological options open the possibility of different drug combinations to help control the pain in patients undergoing an adenotonsillectomy while avoiding oversedation. Non-opioids such as the NSAIDs ketorolac and ibuprofen, acetaminophen, dexamethasone, and dexmedetomidine became subjects of study to decrease usage of opioids. The premise with multimodal analgesia was to reduce opioid consumption, to lessen adverse events, nevertheless provide adequate pain control. The potential to improve efficiency with multi-modal analgesia is advocated for management of pediatric perioperative pain by concurrently targeting different analgesic mechanisms and reducing the
dose requirements of single agents, therefore, minimizing dose-dependent adverse effects (St. John-Green, St John-Green, & Wong, 2013). It is important for the anesthesia provider to determine what combination of analgesic medications will best work to avoid respiratory complications. One proposed recommendation from the above list of medications is dexmedetomidine. An alpha-2 agonist, this drug has analgesic properties that cause sedation without respiratory compromise and does not affect coagulation (Diefenderfer et al., 2010). When administered intraoperatively, dexmedetomidine has proven to decrease the opioid requirement used in the postoperative period. There is no current evidence to recommend any particular anesthetic technique for children with OSA (Sadhasivam et al., 2013). However, all the available non-narcotic options served as tools for the provider to enhance pain management.

**Postoperative Care**

The role of narcotics in postoperative analgesia following a tonsillectomy remains unclear. Residual effects of anesthetics and opioids administered can manifest in the postoperative period as apnea, hypopnea, desaturation, and hypercarbia (Sadhasivam et al., 2013). OSA is a clear risk factor for postoperative respiratory complications; as the severity of nocturnal hypoxemia rises, the incidence of pulmonary complications increases (Goldman, 2013). While the postoperative pain in children with OSA needs to be controlled to promote a smooth recovery process, these patients run the risk of their chronic hypoxemia rendering them more susceptible to the respiratory depressant effects of opioids. Currently, no evidence demonstrates any immediate improvement in ventilation after surgery, suggesting that any respiratory issues that existed before the surgery will still require an undetermined amount of time to correct themselves. Frequently, postoperative airway edema, along with increased sensitivity to the respiratory-depressant effects of opioids, may result in obstructive symptoms
and hypoxemia (Diefenderfer et al., 2010). As the care provider role switches from the anesthesia team to the post anesthesia care unit (PACU) team, understanding of the sedative effects of analgesics and airway management is required to provide safe continuity of care. Traditionally the focus on reducing postoperative morbidity and mortality has been whether the patient should be admitted to the hospital for monitoring overnight. The onset of respiratory compromise following a tonsillectomy has been found to occur less than 15 hours after having the procedure. However, the standard for tonsillectomy and adenoidectomy has shifted to making it mainly an ambulatory procedure with patients being sent home within 24 hours of surgery (Brown et al., 2004). At which point, the care of the patient shifts again, landing on the parent or guardian to determine how much narcotic the patient needs vs. how much he or she has had already. There is increased concern for postoperative respiratory complications that may necessitate intubation and other major interventions, which are only immediately available in the hospital setting (Kieran et al., 2013). Baugh (2014) recommends clinicians and care takers set realistic goals as eliminating pain altogether would very likely lead to respiratory depression, and believes the control of pain, not its elimination, should be the objective. The greater number of tonsillectomies performed in the United States may account for the current recognition of this problem; therefore, further research is needed to determine best practices for perioperative care, hospital admission criteria, and pain management.

**Contribution and Dissemination/Justification**

There exists a lack of knowledge regarding multimodal pain management techniques for pediatric T&A’s and the potential risk of respiratory depression and complications. This project was aimed to increase the knowledge base of ADU SRNA’s with the development and
implementation of an educational PowerPoint presented in the spring of 2018 to the 2019 ADU SRNA cohort. Results of this scholarly project will be disseminated during the ADU NAP Scholarship/Poster Presentation Day, tentatively scheduled for April 9, 2018, from 1:00-3:00 PM.

**Project Aims**

The primary aim of this scholarly project was to increase the knowledge base of the 2019 ADU SRNA cohort regarding multimodal pain management techniques as well as the risk for respiratory depression in pediatric patients undergoing T&A’s. This will have been demonstrated by statistically significant improvements in test scores as compared to baseline pretest scores.

**Project Methods**

This scholarly project had a quantitative pre/post-test design. A convenience sample of 26 SRNAs from the 2019 cohort had been selected. Inclusion criteria included any students making part of the class of 2019 of the NAP at ADU. An educational PowerPoint was developed to contain the latest evidence-based recommendations regarding perioperative anesthetic management and the potential for respiratory depression and subsequent morbidity and mortality of the pediatric T&A patient. All tests administered, as well as collected data, were de-identified. No identifying information was requested or included on the tests. The subjects took a post-test following the lecture that. Pretest and post-test were numerically matched for statistical comparison. The data was entered into Microsoft Excel using a basic spreadsheet and sent to Roy Lukman PhD for statistical analysis using SPSS. Information was stored and protected with a password in the scholarly project team member’s personal laptop. Immediately after dissemination, all pre and post tests will be shredded and all data deleted off from the
computer. Only four people will have access to the collected data; these individuals include the scholarly project team members, the committee chair, and the statistician.

**Timeline**

The predicted timeline for this scholarly project begins with the literature review about this topic concluded on June 30, 2017, when the project proposal is due. Scholarly project paper development ensued from May to July 17, 2017. The completed online ADU CITI modules certificate were submitted on May 31, 2017. Preparation for the SRC/IRB application forms was completed June 30, 2017. Pre/post-test and power point presentation were completed by December 31, 2017. Finally, the implementation/presentation phase was carried out on January 18, 2018 by presenting the topic to the 2019 NAP cohort and administration of the pre/post-test. Results of this scholarly project will be disseminated during the ADU NAP Scholarship/Poster Presentation Day, scheduled for April 9, 2018, from 12:00-2:30 PM.

**Data Collection**

Data was collected using a pretest and a post-test immediately following the PowerPoint presentation. Upon explanation of the scholarly project, all individuals participating signed an informed consent to verify that they are willing participants in the study. The subjects’ baseline knowledge of the topic was then tested before implementing the PowerPoint presentation. The data collected from pre and post-test was then entered into a Microsoft Excel sheet and submitted to Roy Lukman Ph.D. for statistical analysis.

**Evaluation**

The posttest, a replica of the pretest, was administered immediately following the PowerPoint presentation during the MSNA 502 Clinical Conference II course on January 18, 2018. It was the project aim that upon presenting the lecture on the pediatric guide to T&A, the
knowledge base of the NAP cohort of 2019 would demonstrate an increased knowledge base on the topic. For statistical analysis, paired samples t-tests were conducted to analyze the data. Statistical analysis was performed by Roy Lukman, PhD. The mean pre-test score was 60.77 (SD=29.51) with a mean post-test score of 93.08 (SD=9.28). The obtained t-test results indicated a significant increase in student knowledge base between pre and post tests (t (25) = -5.68, p<.001).

**Limitations**

Limitations for the scholarly project include the relatively small sampling size of 26 SRNAs. This was a homogenous sample due to the inclusion criteria calling for only those students who are enrolled in the Nurse Anesthesia Program class of 2019. Lastly, post test was administered immediately after the lecture which tested knowledge base but not information retention.

**Conclusions**

Through conduction of the literature review, it was concluded that although opioid use to treat pain, related to tonsillectomy and adenoidectomy, is not inherently an unsafe practice, it does put the pediatric patients receiving them at an increased risk of adverse respiratory events. The literature revealed multiple pharmacological approaches that have proven effective in attenuating these risks by reducing opioid requirement and use in these cases. The risk of a patient suffering an adverse respiratory effect can never be eliminated, only reduced, which was pointed out in the literature to emphasize the importance of developing adequate knowledge of the airway anatomy for this population and developing an expertise in their airway management.

Using the power point presentation to lecture on a pediatric guide to tonsillectomy and
adenoidectomy, it was concluded the knowledge of the subjects taking the test increased substantially from baseline. This demonstrates a potential positive impact that a power point lecture can have in the development of the nurse anesthesia students made evident by the increased test score average. There is no metric that will show how much retention of the knowledge attained will remain over time or if any of the knowledge learned will be implemented in practice. The researchers can only hope that the information presented will motivate each individual to methodically plan their patients’ anesthesia at the highest level of their scope of practice.
References


postoperative analgesia and sedation in pediatric patients undergoing tonsillectomy and adenoidectomy. *Pediatric Anesthesiology, 111*, 490-495. http://dx.doi.org/10.1213/ANE.0b013e3181e33429


Appendix A

Pre/Post-Test Key

1. Physiologically, what is to blame for the increased opioid sensitivity in OSA patients?
   a. Mu receptor upregulation
   b. Mu receptor downregulation
   c. Alpha receptor up regulation
   d. Alpha receptor downregulation

2. How much more potent is Hydromorphone than morphine?
   a. 2-4x
   b. 8-10x
   c. 10-20x
   d. 80-100x

3. Which of the following is an example of a non-opioid analgesic?
   a. Ketorolac
   b. Dexamethasone
   c. Dexmedetomidine
   d. Acetaminophen
   e. All the above
   f. None of the above

4. Which sedative can provide some analgesia, making it a good candidate for multimodal analgesia?
   a. Propofol
   b. Precedex
   c. Thiopental
   d. Sevoflurane

5. What is the premise with multimodal pain management?
   a. Provide pain relief, Increase opioid consumption, lessen adverse events
   b. Provide pain relief, decrease opioid consumption, lessen adverse events.
   c. Provide pain relief, decrease opioid consumption, increase revenue for provider
   d. None of the above.

6. Residual effects of anesthetics and opioids administered can manifest in the postoperative period as:
   a. apnea
   b. hypoapnea
   c. desaturation
   d. hypercarbia
   e. All of the above
7. Clinicians and caretakers should set realistic goals, as eliminating pain completely would very likely lead to respiratory depression, and control of pain, not its elimination, should be the objective.
   a. True
   b. False

8. Postoperative airway edema, along with increased sensitivity to the respiratory-depressant effects of opioids, may result in:
   a. obstructive symptoms
   b. hypoxemia
   c. bradycardia
   d. a & b
   e. None of the above

9. Anesthesia providers avoided non-steroidal anti-inflammatory drugs (NSAIDs) in children undergoing T&A due to increased risk of post-operative bleeding.
   a. False
   b. True

10. Multi-modal analgesia is advocated for management of pediatric perioperative pain by concurrently targeting different analgesic mechanisms and reducing the dose requirements of single agents, therefore, minimizing dose-dependent adverse effects.
    a. True
    b. False
Appendix B

ADU NAP CAPSTONE PROJECT – INFORMED CONSENT

Our names are Elma A. Clark and Jose Hurtado, and we are MSNA students in the Nurse Anesthesia Program (NAP) at Adventist University of Health Sciences (ADU). We are doing a Capstone Project called Pediatric Guide to Tonsillectomy and Adenoidectomy. This project is being supervised by Sarah Snell, MSNA, CRNA. We would like to invite you to participate in this project. The main purpose of this form is to provide information about the project so you can make a decision about whether you want to participate.

WHAT IS THE PROJECT ABOUT?
The purpose of this project is to increase the knowledge base of the 2019 ADU SRNA cohort regarding multimodal pain management techniques as well as the risk for respiratory depression in pediatric patients undergoing T&A’s.

WHAT DOES PARTICIPATION IN THIS PROJECT INVOLVE?
If you decide to participate in this project, you will be asked to complete an anonymous pre-assessment, attend a classroom presentation, and then complete an anonymous post-assessment. The assessment will address student’s knowledge regarding multimodal pain management techniques for pediatric T&A’s and the potential risk of respiratory depression and complications. Your participation by attendance at the presentation and completion of the survey is anticipated to take approximately 1 hour.

WHY ARE YOU BEING ASKED TO PARTICIPATE?
You have been invited to participate as part of a convenience sample of students currently enrolled in the ADU NAP. Participation in this project is voluntary. If you choose not to participate or to withdraw from the project, you may do so at any time.

WHAT ARE THE RISKS INVOLVED IN THIS PROJECT?
Although no project is completely risk-free, we don’t anticipate that you will be harmed or distressed by participating in this project.

ARE THERE ANY BENEFITS TO PARTICIPATION?
We don’t expect any direct benefits to you from participation in this project. The possible indirect benefit of participation in the project is the opportunity to gain additional knowledge about multimodal pain management techniques for pediatric T&A’s and the potential risk of respiratory depression, and complications.

HOW WILL THE INVESTIGATORS PROTECT PARTICIPANTS’ CONFIDENTIALITY?
The results of the project will be public shed, but your name or identity will not be revealed. To maintain confidentiality of assessments, the investigators will conduct this project in such a way to ensure that information is submitted without participants’ identification. No names will appear on the paper and each paper will be numbered for evaluation only. Thus, the investigators will not have access to any participants’ identities.

WILL IT COST ANYTHING OR WILL I GET PAID TO PARTICIPATE IN THE PROJECT?
Your participation will cost approximately one hour of your time, but will require no monetary cost on your part. You will not be paid to participate.

VOLUNTARY CONSENT
By signing this form, you are saying that you have read this form, you understand the risks and benefits of this project, and you know what you are being asked to do. The investigators will be happy to answer any questions you have about the project. If you have any questions, please feel free to contact Elma A. Clark (el.aseron.patterson@my.adu.edu) and Jose Hurtado (jose.hurtado@my.adu.edu). If you have concerns about the project process or the investigators, please contact the Nurse Anesthesia Program at (407) 303-9331.

Date_____________

Participant Signature/ Participant Name (PRINTED LEGIBLY)

Participant Name (PRINTED LEGIBLY)
Appendix C
Analysis Charts

### Paired Samples Statistics

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### Paired Samples Test

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Appendix D

Power Point Presentation

2/26/18

Pediatric Guide to Tonsillectomy and Adenoidectomy

ELMA CLARK, BSN, SRNA & JOSE HURTADO, BSN, SRNA

PROJECT MENTOR: NIKI BOLIN, MSNA, CRNA, US ANESTHESIA PARTNERS

COMMITTEE CHAIR: SARAH SNELL, DNP, CRNA

Objectives

- Familiarization with the tonsillectomy and adenoidectomy (T&A) procedure according to current literature
- Learn to identify the risks involved in taking care of pediatric T&A patient
- Identify which subpopulation is at higher risk.
- Learn about the special considerations when managing a pediatric airway
- Understand the effects that OSA has on narcotic tolerance.
- Review current best-practice for pediatric use and multimodal pain management techniques (for pediatric T&A)

Introduction to T & A

- T&A is the most common surgical procedure performed in the pediatric population, around 737,000 performed a year (Baugh et al., 2013)
- Painful procedure requiring adequate pain control. Narcotic administration is the preferred method of analgesia in the perioperative period. Unwanted complications from opioids, such as oversedation and respiratory depression are unwanted but commonly seen. (Tekelioglu et al. 2013)
- Main reason for: OSA leading to sleep disordered breathing accounting for over 500,000 of cases (Kieran et al., 2013)
- Children with significant OSA are at increased anesthetic risk in the perioperative period than patients with normal upper airway (Heitmiller et al., 2009). OSA IS A MAJOR FACTOR WHEN DETERMINING ANESTHETIC PLAN

Pediatric Airway

- Not just little adults!

- In general, Infants have a large tongue and cranium in relation to small mandible and maxilla
- Increased risk or airway obstruction.
- Chest wall more compliant than adults
- Collapsible with inspiratory efforts against partial occlusion. (P. 1203)
- Children younger than 10 years narrowest part is just below the vocal cords at the cricoid cartilage
- Clinical significance: a tube can clear the vocal cords may create mucosal pressure at the level of the cricoid ring. For this reason, traditionally, uncuffed endotracheal tubes have been used in children less than 8 to 10 years of age.

Tonsils and Adenoids (Pharyngeal tonsil)

- Tonsils are the deepest lymphoid organs
- Named according to their location. In this case, the nasopharyngeal location is labeled Palatine tonsils.
- Palate, 7-8 cm x 5-6 cm x 3-4 cm
- Other locations may vary in size and shape depending on factors such as age, gender, and ethnicity.
- Palatine tonsils are more common in children and adults, while the adenoids are more developed in children.
Tonsils and Adenoids

Waldeyer's Ring

T&A’s Unique Challenges For Anesthesia Providers!

- Shared airway between the anesthesia provider and surgeon.
- Presence of bloody secretions within the airway itself.
- Significantly higher risk of airway complications such as laryngospasm.
- Increased anesthetic requirement and sensitivity to the patient’s airway.
- Traditional pain management techniques that may exacerbate the situation.

- Respiratory depression and significant morbidity and mortality.

Legal Implications

- Postoperative bleeding is the most common complication associated with tonsillectomy. However, deaths related to epistaxis are rare in the pediatric population (Sundaram, Subramaniam, Varughese, & McVay, 2013).
- An anoxic event was noted to have the highest mortality rate at 24.0% of all deaths caused by bleeding in adult patients undergoing endoscopic laser tonsillectomy.

- Medication errors and the lack of consistent practices in the administration of pain medication are also factors in post-tonsillectomy deaths.

- Implementing evidence-based standardized pain management practices would, therefore, promote the quality of care and safety leading to better patient outcomes (Goldman et al., 2013).
LACK OF SET GUIDELINES FOR ANESTHESIA PROVIDERS

- Anesthesia providers and surgeons should strive to develop and evaluate ways of identifying children at high risk to determine safe postoperative outcomes.

- Currently, however, there is no set standard for perioperative pain management for the pediatric T&A patient in either ambulatory or inpatient settings, which has led to respiratory compromise.

- Of concern locally, is the absence within the Adventist Health System (AHS) of standardized guidelines for this vulnerable population regarding preoperative screening to identify OSA, intraoperative anesthetic management, postoperative pain management or monitoring for adverse respiratory outcomes.

Preoperative Evaluation

- The ASA practice guidelines for the management of patients with OSA recommend patients over 1 year of age should be screened for OSA prior to undergoing surgery (Cheung et al., 2013).

- Polysomnography (PSG) is the gold standard for assessing and gauging severity of OSA.

- The American Academy of Otolaryngology's Clinical Practice Guideline recommends PSG in children suffering from symptoms of OSA prior to T&A if medical comorbidities exhibited [obesity, trisomy 21, craniofacial abnormalities, neuromuscular disorders, sickle cells and inherited metabolic conditions] (Kieran et al., 2013).

- In common practice, PSG is not readily available or incorporated in care. It is unnecessary to perform in every case and does not establish the effects of sleep disordered breathing (SDB) on the child’s well-being.

Preoperative Evaluation

- The Apnea Hypopnea Index (AHI) is the number of apneas or hypopneas recorded during the study per hour of sleep. It is generally expressed as the number of events per hour. Based on the AHI, the severity of OSA is classified as follows:
  - None / Minimal: AHI < 5 per hour
  - Mild: AHI ≥ 5, but < 15 per hour
  - Moderate: AHI ≥ 15, but < 30 per hour
  - Severe: AHI ≥ 30 per hour

- Sometimes the Respiratory Disturbance Index (RDI) is used. This can be confusing because the RDI includes not only apneas and hypopneas, but may also include other, more subtle, breathing irregularities. This means a person’s RDI can be higher even than his AHI.

Oxygen Desaturation

- Reductions in blood oxygen levels (desaturation) are recorded during polysomnography or limited channel monitoring. At sea level, a normal blood oxygen level (saturation) is usually 96-97%. Although there are no generally accepted classifications for severity of oxygen desaturation, reductions to not less than 90% usually are considered mild. Dips into the 80-89% range can be considered moderate, and those below 80% are severe.

Preoperative Evaluation

- Special consideration when assessing the probability and severity of OSA is required. The incidence of perioperative respiratory complications are 10 times higher for children with OSA compared to those without OSA (Lauder and Emmott, 2014).

- According to Schwengel (2009) the initial approach to a child with suspected sleep-disordered breathing should include assessment of:
  - Behavioral problems
  - Poor school performance
  - Decreased quality of life
  - Failure to thrive
  - Enuresis
  - Standard airway assessment
  - Nasal anatomy
  - Ability to breath through nose
  - Tonsillar size

- "I'm Sleepy" questionnaire (Wolfe et al. 2016)
Anesthetic Plan

- Decrease use of opioids!
- Perioperative complications are due in part to an increased response to opioids from OSA patients.
- Continuous hypoxia induces a decreased number of pain-related mu-opioid receptors in children with severe OSA that explains the heightened sensitivity to postoperative morphine given for analgesia (Brown 2004)

https://www.opiaterx.com/gonist/list-opioid-agonist-drugs/

- Morphine has become the standard against which all other forms of analgesia are measured. (Brown & Emmott 2014)
- Due to the increased response to opioids from OSA patients, the morphine dose requirement for children with OSA is reduced (Brown et al., 2004). The same applies to all analgesic drugs, including paracetamol, but it is more potent and should be used in a dose based on the respiratory depression effect (Rycroft et al., 2014). In the past, codeine was the analgesic of choice for post op pain control. It pointed out that the use of codeine in children undergoing tonsillectomy is increased risk of post operative bleeding (Greenberg et al., 2014).

- In 2012, a black box warning against codeine-containing medications in children undergoing T&A was issued by the FDA (Greenberg et al., 2014).

- There was a great effort to convert anesthesia providers to using multimodal approaches to decrease use of opioids.
- Use of non-opioids such as acetaminophen, ketorolac, dexamethasone, ibuprofen, and dexmedetomidine has become the focus of study.
- The premise is targeting different analgesic mechanisms and reducing the dose requirements of single agents, therefore, minimizing dose-dependent adverse effects.
- In practice, anesthesia providers avoid non-steroidal anti-inflammatory drugs (NSAIDs) in children undergoing T&A due to increased risk of post-operative bleeding (Greenberg, Tait, Robison, & Yellon, 2014).

- Preparedness is Key
- Airway management tools available... and know how to use them!
- • Variety of sizes of facemasks, oral airways, nasopharyngeal airways, tracheal tubes, laryngoscope blades and handles, and laryngeal mask airways.
- • Careful when in the airways!!
  - Oral airway is preferred. Nasal can cause trauma to the hypertrophied adenoid tissue; risk of bleeding.
  - Introducing and manipulating an oral airway and laryngoscope blade can inadvertently cause trauma to the enlarged tonsils; risk of bleeding.
- • ETT: Wire Reinforced vs. Oral RAE vs regular tube. (Surgeon preference)

- Remember: Advanced airway interventions may be necessary to maintain airway patency, oxygenation, and ventilation.
- Avoidance of airway complications require:
  - • Institutional and individual preparedness.
  - • Careful assessment.
  - • Good planning and judgment.
  - • Good communication and teamwork.
  - • Knowledge and use of a range of techniques and devices.
  - • Willingness to stop performing techniques when they are failing.
- Premedication in pediatrics: Midazolam 0.5-0.7 mg/kg PO. Some clinicians advocate avoiding in children with OSA. (Mahmoud et al., 2013)
- Schwengel (2009) states that sedation resembles natural sleep, with increased airway collapse as a result of increased closing pressure, loss of pharyngeal muscular tone, and failure to coordinate phasic activation of upper airway muscles with diaphragmatic activity (Note video example from the British Lung Institute).
- Antisialagogue recommended. Typically Robinul 0.01 mg/kg IV once after IV access has been obtained.
Inhalational induction. Typically up to 16 y/o with fear of needles (Naglhout p. 1200).

Position: "Rose position" supine, shoulder roll, head extended. Table turned 90–180 degrees.

Mouth gag (Mclvor) is inserted and secured to the mayo stand.

Can be very stimulating. Can occlude ETT.

Ensure adequate anesthesia for this part, verify ETT position and patency before and after mouth gag positioning/repositioning.

NMB are ok to use. (Moving, coughing and swallowing are contraindicated)

Anesthesiologist's Manual of Surgical Procedures

Tonsillectomy and Adenoidectomy

Usually, a throat pack is used.

Adenoids are removed first with a curette, and the nasopharynx packed.

Tonsillectomy: grasping the upper pole of tonsil and drawing it medially, allows a mucosal incision to be made over the anterior faucial pillar.

Tonsil is dissected from its bed and removed. A snare may be used to snip the dissected tonsil off at the lower pole.

Hemostasis is secured with gauze packs and the use of electrocautery.

Removal of throat and nasal packs verified before extubating.

Gastric suctioning of swallowed secretions and blood reduces risk of PONV.

Be attentive to laryngospasm/bronchospasm. Consider deep extubation.

Postoperative airway edema along with bleeding may result in obstructive symptoms and hypoxemia (Diefenderfer et al., 2010).

Residual effects of anesthetics and opioids administered can manifest in the postoperative period as apnea and hypopnea, leading to hypoxemia and hypercarbia.

Any respiratory issues that existed before the surgery will still require an undetermined amount of time to correct themselves.

Postoperative airway edema, along with increased sensitivity to the respiratory-depressant effects of opioids, may result in obstructive symptoms and hypoxemia (Sadhasivam et al., 2013).

As the care provider role switches from the anesthesia team to the post-anesthesia care unit (PACU) team, understanding of the sedative effects of analgesics and airway management is required to provide safe continuity of care.
Postoperative Care

Traditionally, the focus on reducing postoperative morbidity and mortality has been whether the patient should be admitted to the hospital for monitoring overnight. The onset of respiratory compromise following a tonsillectomy has been found to occur less than 15 hours after having the procedure. However, the standard for tonsillectomy and adenoidectomy has shifted to making it mainly an ambulatory procedure with patients being sent home within 24 hours (Brown et al., 2004).

Postoperative Care

The care of the patient shifts again, landing on the parent or guardian to determine how much narcotic the patient needs vs. how much he or she has had already. There is increased concern for postoperative respiratory complications that may necessitate intubation and other major interventions, which are only immediately available in the hospital setting (Kieran et al., 2013).

Postoperative Care

Baugh (2014) recommends clinicians and care takers set realistic goals as eliminating pain altogether would very likely lead to respiratory depression, and believes the control of pain, not its elimination, should be the objective. The greater number of tonsillectomies performed in the United States may account for the current recognition of this problem; therefore, further research is needed to determine best practices for perioperative care, hospital admission criteria, and pain management.

Review of Literature


Objectives: To report data on death or permanent disability after tonsillectomy.

Method: 32-question survey was disseminated via the American Academy of Otolaryngology–Head and Neck Surgery electronic newsletter, regarding adverse events after tonsillectomy, capturing demographic data, risk factors, and detailed descriptions. N=552

Results: Events occurred in 38 children (71%), 15 adults (25%). The events were classified as related to medication (22%), pulmonary/cardiorespiratory factors (20%), hemorrhage (16%), perioperative events (7%), progression of underlying disease (5%), or unexplained (31%). Of unexplained events, all but one occurred outside the hospital.


Objectives: Double-blind, randomized controlled study to determine the effects of intraoperative dexmedetomidine on postoperative recovery including pain, sedation, and hemodynamics in pediatric patients undergoing tonsillectomy and adenoidectomy.

Method: One hundred nine patients were randomized to receive a single intraoperative dose of dexmedetomidine 0.75 µg/kg, dexmedetomidine 1 µg/kg, morphine 50 µg/kg, or morphine 100 µg/kg over 10 minutes after endotracheal intubation.

Results: The median time to first postoperative rescue analgesic was similar in patients receiving dexmedetomidine 1 µg/kg and morphine 100 µg/kg, but significantly longer compared with patients receiving dexmedetomidine 0.75 µg/kg, morphine 50 µg/kg, or unmedicated (P < 0.01). The use of dexmedetomidine 1 µg/kg and morphine 100 µg/kg had the advantages of an increased time to first analgesic and a reduced need for additional rescue analgesia doses, without increasing discharge times.


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Putting it all together for the SRNA

- Understand the goals brought on by OSA during the T&A procedure.
- Know your patient’s OSA specific goals of evaluating the patient and dictating preoperative evaluation.
- Be aware of the physiologic changes (agitation of MI receptor) brought on by OSA, while formulating anesthetic plan.
- Be prepared to share the airway with the surgeon.
- Always remember techniques come first know your equipment, where to find it and how to use it.

Putting it all together for the SRNA

- Anticipate some degree of anxiety, obstructive postoperative secretions, nausea, tachycardia and respiratory distress as necessary for retrieval to PACU to initiate early postoperative care.
- Parental role on postoperative orders may obstruct conventional pain control and may have to order opioid rescue that does not exceed the changes the code provides.
- Remember that strict, strict, strict orders are necessary, but every anesthesia provider should know how to recognize and treat the early postoperative phase.

> Objectives: To determine the efficacy and safety of preoperative pain control in children undergoing tonsillectomy; Analysis of role of tramadol and ketamine in postoperative pain control.
> Method: Prospective, randomized, double-blind, placebo-controlled, parallel-group study performed in children aged 4–15 years. Children underwent tonsillectomy and received topical preoperative analgesia. One group received 1% tramadol, another group received 0.25% ketamine and the control group received saline. The primary outcome was postoperative pain assessed using BART (Baker Face Scale) scores at 15, 30, 45, 60 and 90 minutes. Higher BART scores indicate higher postoperative pain.
> Results: In the tramadol group, BART scores were significantly lower than in the control group at all time points after surgery. In the ketamine group, BART scores were significantly lower than in the control group at all time points except 15 minutes after surgery. The tramadol group had significantly lower BART scores than the ketamine group at all time points except 15 minutes after surgery.
> Conclusion: Topical tramadol is a safe and effective analgesic for children undergoing tonsillectomy.
Appendix E

Poster

Pediatric Guide to Tonsillectomy and Adenoidectomy

Elma Clark, BSN, SRNA and Jose Hurtado BSN, SRNA
Project mentor: Niki Bolin, MSNA, CRNA; US Anesthesia Partners
Committee Chair: Sarah Snell, DNP, CRNA; ADU NAP Department
Nurse Anesthesia Program, Adventist University of Health Sciences

ABSTRACT

• The purpose of this scholarly project was to increase the knowledge base of the ADU SRNA 2019 cohort regarding multimodal pain management techniques for pediatric T&A's.
• The population most likely to require T&A are children with OSA who are at highest risk for morbidity and mortality.
• An educational Power Point addressing evidence based preoperative, intraoperative, and postoperative pain management techniques for children undergoing a T&A was devised.
• Involvement in the pretesting and posttest assessment was voluntary.
• For statistical analysis, paired samples t-tests were conducted to analyze the data with a P value < .001 which is statistically significant. It can be concluded that the average scores increased significantly.

PROBLEM

• Currently, however, there is no set standard for perioperative pain management for the pediatric T&A patient in either ambulatory or inpatient settings, which has led to respiratory compromise.

PICOT Questions

• In pediatric patients undergoing a tonsillectomy and adenoidectomy (P), how do narcotic medications (I) compare to other modalities of analgesia (C) affect pain management and respiratory depression (O) within the perioperative period (T)?

• Educational innovation is addressed in the second question: In Adventist University student nurse anesthetists (P), does a 30-minute (T) PowerPoint presentation regarding multimodal pain management approaches for pediatric T&A patients (I) result in an increase in the knowledge base (O)?

RESULTS

• The incidence of postoperative respiratory complications has been proven to be higher in children with OSA compared to those without OSA (Javali and Emmert 2014).

• The potential to improve efficiency with multimodal pain management by concurrently targeting different analgesic mechanisms and reducing the dose requirements of single agents, therefore, minimizing dose-dependent adverse effects (St. John-Green, St John-Green, & Wong, 2013).

• The paired samples t-test was conducted to compare the pre-test and post-test average scores. The obtained t is 5.676 (p < .001) which is statistically significant. It can be concluded that the average scores increased significantly (from pre-test 60.77% to post-test 93.08%).

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CONCLUSIONS

• The implementation of an educational Power Point on a pediatric guide to tonsillectomy and adenoidectomy showed that the knowledge base of the nurse anesthesia students belonging to the ADU cohort class of 2019 increased substantially from baseline.

• This demonstrates a potential positive impact that a power point lecture can have in the development of the nurse anesthesia students.

REFERENCES AVAILABLE UPON REQUEST