Spring 4-12-2023

Guidelines for Performing Caudal Blocks in Pediatric Sub-Umbilical Surgeries

Rachael Allen
allen16@otterbein.edu

Spring 4-12-2023

Guidelines for Performing Caudal Blocks in Pediatric Sub-Umbilical Surgeries

Rachael Allen

Guidelines for Performing Caudal Blocks in Pediatric Sub-Umbilical Surgeries

Rachael Allen, SRNA, RN, BSN

Department of Nursing, Otterbein University

In Partial Fulfillment of the Requirements for the Degree

Doctor of Nursing Practice

2024

DNP Final Scholarly Project Team:

Brian Garret, DNP,MSN,CRNA, Team Leader Approved by: Brian Garrett, CRNA

Regina Prusinski, DNP, APRN, FNP-BC, CPNP-AC, Team Member

Amy Bishop DNP, AGCNS-BC, Team Member

Author Note

We have no conflicts of interest to disclose.

Correspondence concerning this article should be addressed to Otterbein Project Team Leader, 1 South Grove Street, Westerville, OH 43081. bgarret@otterbein.edu

Abstract

Adequate pain control in pediatric patients undergoing sub-umbilical surgeries is critical because of the increased need for opioids and heart rate (HR) fluctuations that occur in the postoperative period. The traditional approach of providing anesthesia in sub-umbilical surgeries is general anesthesia(GA); however, this approach does provide prolonged pain relief. This project aims to establish evidence-based guidelines for implementing caudal blocks (CA) with GA in pediatric sub-umbilical surgeries. By implementing CA with GA, patients experience less pain, leading to a reduction of opioids and HR fluctuations in the postoperative period. The project follows the John Hopkins Evidence-Based Practice (JHEBP) model, a systemic approach for incorporating research findings into patient care. Data collection will involve retrospective chart analysis to assess patient information related to CA and postoperative pain. The project will monitor postoperative pain by assessing the Face, Legs, Activity, Cry, and Consolability (FLACC) score and the hemodynamics, specifically HR. The project seeks to enhance pain relief in pediatric patients undergoing sub-umbilical surgeries, improving pain scores, and reducing the need for postoperative opioids and HR fluctuations.

keywords: pediatric, caudal blocks, postoperative, pain relief, sub-umbilical

Introduction

In the United States, nearly 80% of surgical cases involving pediatric patients will result in the development of acute postoperative pain. Postoperative pain is a common consequence of sub-umbilical surgeries. Alternative pain control methods, such as regional anesthesia, can minimize the occurrence of postoperative pain. The most common regional anesthesia used in pediatric sub-umbilical surgeries is CA.

Traditionally, anesthesia for sub-umbilical surgeries is GA. GA is utilizing medications administered intravenously (IV) or through inhalation to produce amnesia or analgesia with or without muscle paralysis. Anesthesia allows patients to be unconscious and tolerate surgical procedures that otherwise would be intolerable. GA relies heavily on the use of IV opioids to provide pain relief. IV opioids work by blocking the opioid receptors and thus reducing the pain felt by the patient. CA is using local anesthetic (LA) injected through the sacral hiatus into the epidural space, blocking the sensation of pain at the nerve root. The blocking of pain sensation and transmission allows for pain relief with minimal opioid administration and reduces HR fluctuations in the postoperative period. Utilizing CA reduces intraoperative pain and prolongs postoperative pain relief.

This scholarly project aims to develop guidelines about the benefits of CA and utilizing LA and adjuncts to reduce postoperative pain and HR fluctuations in pediatric patients. When CA is used with GA in sub-umbilical procedures, there is a reduction in postoperative pain, resulting in fewer HR fluctuations in the postoperative period (Sanghvi & Dua, 2023). Educating providers about the benefits of CA and the choices of LA and adjuncts is essential to increasing the use of CA in pediatric sub-umbilical surgeries.

Background

CA is a type of regional anesthesia in which LA is injected through the sacral hiatus into the epidural space when the patient is in a lateral position. The sacral hiatus, located between S2-S4, is where the dura sac terminates. LA is administered, blocking the pain sensation, and reducing nerve transmissions at the nerve root, thus inhibiting motor and sensory function in the lower extremities for several hours (Adilovic et al., 2019).

The efficacy of a CA depends on the type and dose of LA, as well as any additive agents. The selection of LA depends on the type, concentration, and volume of LA. Additive agents, such as dexmedetomidine, may be added to the LA to prolong the duration of analgesia (Tao et al., 2019). The most common type of LA utilized in CA is bupivacaine and ropivacaine. Bupivacaine has a high cardiotoxicity risk when used in large doses; however, with the small doses required for CA, the risk is minimal. Ropivacaine has a similar chemical structure to bupivacaine but with less cardiac toxicity.

When determining the adjunct to use with LA, the provider must determine its purpose. The adjunct can be added to prolong the duration of the block or increase motor blockade and sensory blockage. When utilizing dexmedetomidine in CA, the motor blockade is increased. Alpha-2 agonists, such as clonidine or dexmedetomidine, prolong spinal blockade and limiting autonomic complications such as hypotension and bradycardia (Schwartz,2022).

Opioids, such as fentanyl and morphine, may also be added to CA to manage postoperative pain. However, epidural opioids have a multitude of side effects. These side effects can range from nausea and vomiting to respiratory depression and HR fluctuations in the postoperative area. The side effects of epidural opioids use makes them less than ideal for use in pediatrics (Suresh et al., 2014).

The primary goal of LA, besides to block pain receptors is to blunt the neuroendocrine stress response that is activated during surgery. The activation of the neuroendocrine stress response results in hemodynamic instability in the perioperative period. The neuroendocrine stress response is responsible for changes in HR. The benefit of utilizing CA is that the LA suppresses the neuroendocrine stress response, thus reducing HR fluctuations (Benka et al., 2020). Combining CA and GA decreases the neuroendocrine stress response, resulting in less respiratory, cardiovascular, and neurologic depression, a smoother emergence, and faster wake-up times. CA is beneficial in pediatrics, especially in sub-umbilical surgeries; however, some patients have contradictions for receiving CA. These patients are those with allergies to LA, sacral deformities, perianal surgeries, and bacteremia. The provider must ensure that CA is appropriate for each patient before proceeding.

Significance to the Profession

As an anesthesia provider, it is essential to understand that pain is a subjective experience with long- and short-term impacts. Painful stimuli such as surgery and injury in early life can lead to long-term adverse consequences and pain hypersensitivity if undertreated. The utilization of alternative methods, such as CA, for controlling pain is essential to providing prolonged postoperative pain control. According to William et al. (2017), by controlling postoperative pain, the patient experiences less mental and physical stress, and reducing stress leads to a faster and more effective recovery.

The significance of using CA with GA for sub-umbilical surgeries lies in the ability to provide prolonged pain control, thus reducing the need for postoperative opioids and minimizing supplemental oxygen needs. By delivering LA directly to the nerve roots and preventing pain signal transmission, the anesthesia provider minimizes the patient's need for additional opioids.

The reduction of opioids reduces the postoperative risk of side effects such as sedation, respiratory depression, and cardiovascular effects, all of which lead to less tachycardia in the postoperative period (William et al., 2017). Pain control also reduces the risk of respiratory complications such as inadequate respirations and reduction of supplemental oxygen in the postoperative period.

PICOT Question

Pediatric patients undergoing sub-umbilical surgeries experience pain and HR fluctuations in the postoperative period. This scholarly project aims to determine if utilizing CA in conjunction with GA compared to GA reduces pain, HR fluctuations in the postoperative period. The Population, Intervention, Comparison, Outcomes, and Timeline for this scholarly project are in (P) pediatric patient undergoing sub-umbilical surgeries, does the use of (I) caudal blocks in junction with general anesthesia compared to (C) general anesthesia (O) reduce opioids and HR fluctuations in (T) the perioperative period.

Objectives

This scholarly project aims to develop and implement evidence-based practice literature on CA to improve the care quality for pediatric patients undergoing sub-umbilical surgeries. This scholarly project aims to develop and implement a clear guideline on CA, develop a possible implementation system, and evaluate the outcomes of the proposed change. The proposed objectives for this scholarly project are:

- Develop an EBP guidelines for using CA in conjunction with GA in sub-umbilical pediatric surgeries
- Develop a comprehensive plan to implement EBP guidelines related to CA and LA with adjuncts to reduce postoperative pain and HR fluctuations.

- Develop a comprehensive plan to adjust the guidelines if outcomes do not align with project outcomes.

Literature Synthesis and Analysis

Through researching the scholarly project, the databases utilized were PubMed, Cochrane Library of Systematic Review (CLSR), and the Cumulative Index to Nursing and Allied Health Literature plus Full Text (CINAHL). The articles were filtered by a publish date within the last five to ten years and had to contain the entire article. Results that only provided abstracts, research trials without full text, or those on irrelevant topics were excluded. The search terms utilized were derived from the PICOT question. The search phrases on each database were pediatric, caudal, anesthesia, sub-umbilical, and lower abdomen.

The searches on PubMed yielded twenty-two results; 12 articles were excluded from the literature syntheses and analysis due to irrelevance. The remaining 10 articles were reviewed and utilized in the analysis. The searches on CLSR and CINAH databases yielded 16 and four journal articles, respectively. Of those articles, seven were appropriate for the literature review. See Appendix A for Literature Review.

General Anesthesia vs Caudal blocks + General Anesthesia

Research on postoperative pain from sub-umbilical surgeries revealed the use of a multi-modal anesthetic, such as implementing CA with GA. Benka et al. (2020) present that through a combined CA and GA in sub-umbilical surgeries, the transmission of surgical pain is reduced, and the patient experiences less HR fluctuation. The study results show a significant difference between the HR and pain assessments of the GA and GA+CA groups. The GA+CA maintained postoperative HR within 20% of preoperative vital signs compared to the GA group.

Another research article by Sharma et al. (2015) compared GA vs. CA+GA in pediatric patients undergoing sub-umbilical surgeries. The result of using CA+GA vs. GA is the reduction of supplemental oxygen, decreased postoperative opioids, and less time spent in the immediate postoperative period. The article concludes that CA provides better inter-operative and postoperative analgia with fewer complications (Sharma et al., 2015).

Studies by Adbullayeve et al. (2019) and Handlogten et al. (2020) compare the results of using CA with GA vs. GA in patients undergoing sub-umbilical surgeries. The two studies focused on the outcomes of postoperative opioid usage. Adbullaveve et al. (2019) found that the postoperative use of opioids was reduced by 75%, and Handlogten et al. showed a reduction of postoperative opioids by 60%.

Bupivacaine vs Ropivacaine

In the studies reviewed, the LA used in 80% of the studies is ropivacaine and bupivacaine. The most common LA used was ropivacaine. Joshi et al. (2022) compared the analgesic effect of ropivacaine and bupivacaine. The study compared both LAs at a concentration of 0.25% at a dose of 1ml/kg to determine which LA provided reliable and long-lasting analgesia, resulting in similar results. Ropivacaine was found to displace a slightly lesser motor block than bupivacaine with similar sensory recovery, resulting in both LAs being equally effective for use in a CA.

Khalil et al. (2019) compared the analgesic effects, postoperative blood pressure and HR changes, and motor and sensory effects of ropivacaine and bupivacaine. The study examined both LAs at 0.25% concentrations at a dose of 1ml/kg. The study results showed that with both LAs, postoperative blood pressure and HR were maintained within 10% of preprocedural HR and blood pressure. Additionally, the study addressed concerns of bupivacaine's cardiotoxicity in

pediatric patients. The study concludes that when taking into consideration the cardiotoxicity potential of bupivacaine, ropivacaine is their choice of LA in CA.

Additives to Caudal Blocks

A study by Singh and Pal (2022) evaluated the efficacy and safety of using 1mcg/kg dexmedetomidine with 0.25 % bupivacaine versus 0.25% bupivacaine in CA. The pain assessments for both treatments were assessed postoperatively at 30 minutes, 1, 2, 4, 6, 8, 10, 12, 18, and 24 hours, along with the use of additional opioids administered in the postoperative period. The study results showed that patients who received dexmedetomidine 1mcg/kg and 0.25% bupivacaine had a prolonged analgesic duration and a 25% reduction in postoperative opioids.

The use of additives with CA allows the provider to change the onset or duration of the LA. The literature on CA shows that the most common additives were neostigmine and dexmedetomidine. In a study by Pramoth et al. (2022), neostigmine with bupivacaine was evaluated. The study compared the use of bupivacaine versus bupivacaine and neostigmine to determine which provided more effective analgesia. The results showed that the patients who received bupivacaine required more postoperative pain medications; bupivacaine and neostigmine together provided an analgesia duration of 16 hours, while bupivacaine and dexmedetomidine provided a longer duration of 24 hours.

A meta-analysis by Shah et al. (2022) compared the analgesic effects of many additives to CA. The study compared the effects of nine additives with ropivacaine. However, this scholarly project focuses on two additives: neostigmine and dexmedetomidine. The study evaluated the analgesic effects for 24 hours post-surgery. The results of using neostigmine with ropivacaine prolonged the duration of analgesia by 513 minutes. By combining

dexmedetomidine with ropivacaine, postoperative opioids were reduced by 25% compared to the other additives.

Literature Review Summary

The utilization of CA with GA in sub-umbilical surgeries allows for a prolonged duration of analgesia when compared to using GA. Providing a prolonged duration of analgesia reduces the need for postoperative opioids, minimizes HR fluctuations, in the postoperative periods. CA has allowed patients to maintain postoperative HR within 20% of preoperative vital signs and maintain oxygen saturations above 90% without supplemental oxygen in PACU (Shah et al., 2022). CA also requires fewer postoperative pain medications, and patients control pain with the use of scheduled non-opioids such as Tylenol and ibuprofen and minimal opioids (Adilovic et al., 2019).

The selection of LA and additives determines the CA's effectiveness and provides a prolonged duration of analgesia. While each LA performs the same action of reducing pain, the side effects differ. CA aims to provide prolonged anesthesia and prevent any undesirable effects. The studies evaluated in the literature review provide data on the effect of bupivacaine and ropivacaine, providing an equal block with a similar duration of analgesia along with sensory and motor blockade (Khalul et al., 2019 & Joshi et al., 2022). Additionally, the studies conclude that when using dexmedetomidine as an additive, there is a reduced need for additional postoperative opioids in the postoperative period. Therefore, 0.25% ropivacaine with additive dexmedetomidine provides better postoperative pain management and reduces postoperative opioids because ropivacaine has less cardiotoxicity than bupivacaine. (Khalul et al., 2019 & Joshi et al., 2022).

Evidence Based Practice Model

The model choice for this scholarly project is the Johns Hopkins Evidence-Based Practice Model (JHEBP) for Nursing and Healthcare professionals. This model reevaluates the initial PICO question and utilizes the PET process guide (practice question, evidence, translation) to transition evidence-based practice from literacy works to the clinical setting. The JHEBP offers a structure and systemic approach for clinicians to use current research and non-research data to assess best practices and provide safe, high-quality care (Dang et al., 2022). This model was selected as the framework because it allows for inquiry, practice, and learning within interprofessional teams as their significant components of the model (Dang et al., 2022). The JHEBP proves a three-phase process systemic approach to creating best practices improvement. The three phases are developing a practice question, finding the best evidence, and translating the best evidence into practice.

PET

The JHEBP model begins with an inquiry because the foundation of nursing is derived from questioning, analyzing, and collecting data and information on a clinical concern (Dang et al., 2022). (See Appendix B) An inquiry is used to understand the extent of a problem and identify a solution. In EBP, the inquiry evaluates existing practices, identifies gaps in practice, and collects evidence to address the gaps in practice.

Practice

This practice is the first phase of the PET model. During sub-umbilical pediatric surgeries, anesthesia providers can utilize CA with GA to reduce postoperative pain. However, many providers have decided to use GA and intraoperative opioids. Consequently, patients suffer from significant postoperative pain, leading to increased postoperative opioid use and HR

fluctuations. The JHEBP model correlates to the PICO question: In pediatric patients undergoing sub-umbilical surgeries, does the use of caudal blocks in conjunction with general anesthesia compared to general anesthesia alone reduce opioids and HR fluctuations in the perioperative period? The main goal is to develop an EB guideline for increasing the utilization of CA in pediatric sub-umbilical surgeries. The collaborative process involves key stakeholders such as Anesthesiologists, Certified Registered Nurse Anesthetists (CRNA), and perioperative staff, presenting an opportunity to enhance patient care and minimize practice variations.

Evidence

In the second phase of the JHEBP model, the project team conducted a comprehensive literature review (Dang et al., 2022). The project team searched for various types of evidence, including research studies, EBP practice guidelines, quality improvement data, expert opinions, and patient survey data. The review primarily focuses on pain control related to CA with GA, utilization of adjuncts in LA to promote postoperative analgesia, and hemodynamic changes, such as HR fluctuations that occur when CA is not implemented. The literature review findings and the evidence synthesis are discussed in depth in the "Literature Review" and "Synthesis of Evidence" sections of the project.

Translation

In the third phase of the PET method of the JHEBP Model, the project team evaluates the feasibility of implementing changes. It develops a comprehensive action plan (Dang et al., 2022). The main objective was to establish guidelines for implementing CA in pediatric sub-umbilical pain in a level-one trauma pediatric hospital, the use of LA and adjuncts to reduce pain, and prioritizing the monitoring of their effectiveness and making appropriate adjustments if the

desires outcomes are unmet. The team will evaluate the evidence and guidelines and present them on a poster to allow key stakeholders to review and provide feedback.

The rest of the steps of the JHEBP model entail disseminating the findings internally and externally through various methods such as publications and meetings (Dang et al., 2022). Sharing the findings allows distributions of best practices and identify practice improvements, ultimately improving patient outcomes. In the reflection phase, the level-one hospital can implement changes or make additional adjustments for utilizing CA with GA in pediatric sub-umbilical surgeries. The focus of these changes is specifically on utilizing CA to reduce opioid administration and reduce HR fluctuations in the postoperative period.

Plan for Implementation

Phase 1

The initial implementation phase involves eight CRNAs and four anesthesiologists assessing the existing knowledge and growth among pediatric anesthesia providers and working with the hospitals Institutional Review Board (IRB) to receive approval to conduct the study. In the context of a level one pediatric trauma center where the project is to occur, the anesthesia department consists of more than 25 providers. Currently, the hospital performs roughly 25 sub-umbilical surgeries every month. During a staff meeting, the project leader will administer a knowledge evaluation of the staff's current knowledge. The knowledge evaluation will allow the project leader to assess the current CA knowledge and identify areas for improvement (See Appendix C).

Following the knowledge evaluation, the knowledge deficits will be addressed at the next staff meeting. The meeting will include a PowerPoint or poster introducing the guidelines and

presenting relevant literature on CA in pediatric patients. (Appendix D). The anesthesia team may need to attend a mandatory unit meeting to receive training.

The goal is to ensure the CRNAs, and anesthesiologists can confidently and accurately perform CA and identify and utilize which adjuncts can be added to the LA to provide prolonged analgesia and reduce opioids and HR fluctuations in the postoperative period. After the educational meeting, the CRNAs and anesthesiologists will be evaluated by performing a skills check-off.

Phase 2

After completing the training in Phase 1, Phase 2 will involve the CRNA or anesthesiologist implementing CA with GA in sub-umbilical surgeries. The anesthesia provider will evaluate each patient to ensure they meet the criteria for CA. Each patient is an ASA 1-III, is not allergic to LA, has sacral deformities, or has a current infection at the injection site. The anesthesia provider will then receive consent from the parents for adding the CA. The CA with GA will be completed, noting which adjunct was administered with the LA. In the postoperative period, the patient will be evaluated for pain utilizing the FLACC scale. The FLACC scale will be assessed at 15 minutes, 30 minutes, 1 hour, and 1.5 hours, and any opioids administered will noted. The patient's HR will also be assessed at the same frequency as the pain.

Phase 3

The final phase involves the implementation team reviewing the charts of each of the patients who received a CA with GA during phase 2. The team will evaluate the CA with GA administration and note the LA and adjunct utilized during the intraoperative period, then evaluate the FLACC scores, opioids administered in the PACU, and the HR recorded during the

intervals. The implementation team will perform a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis on the data (See Appendix E).

Furthermore, the implementation team will organize an interdisciplinary meeting, bringing together the nursing manager, project team leader, unit educators, quality improvement (QI) representatives, This meeting aims to discuss the results and consider any adjustments to the project based on the data gathered during phase 2. If any adjustments to the guidelines are necessary, the changes will be put into effect. Following any guideline modifications, the project team will initiate a chart review of the patients who received the change in care and ensure the changes are providing the desired results. In the event the guidelines do not align with anticipated outcomes, the project team will stop the implementation, which will remain in effect until a comprehensive plan to resolve the issue can be constructed.

Project Facilitators

Collaborating with the perioperative staff, including CRNAs and anesthesiologists, is essential to the project. This project will require active participation from the anesthesiologist, CRNAs, PACU nurses, OR staff, unit educators, and the QI department. Proper preparedness for consent in the preoperative unit, implementation of equipment for CA in the OR, and accurate documentation by the anesthesia providers and the PACU staff are also essential. Additionally, this project will require collaboration with the Information technology (IT) and QI departments to ensure accurate documentation of pertinent project outcomes.

Timeline for Implementation

The project's timeline spans approximately eight months, encompassing planning, educating, training, and chart reviews, excluding the potential for any modifications or reevaluations required for meeting outcomes. During the initial months, the project team will be

administered a knowledge evaluation of CA. Subsequently, based on the knowledge evaluation data, the anesthesia team will receive education on CA, LA, and adjuncts. After the educational meeting, the anesthesia team must demonstrate competency through a skills check-off. Once the implementation phase begins, the project will continue for an additional three months or until 100 sub-umbilical surgeries with CA have been performed. Data analysis through chart reviews will occur over a month, and then the project team will provide the unit with a presentation during a staff monthly meeting. The poster will be displayed in a staff area to be reviewed by those who cannot attend the meeting. Chart reviews will be conducted every four months through the project's first year to determine the effectiveness of implementing CA in sub-umbilical surgeries.

Budget

The project team must analyze the equipment cost to establish an accurate budget plan. The equipment the team may need to purchase is a pediatric caudal injection simulation mannequin and an ultrasound machine. A CA simulator is necessary for this project to allow the anesthesia staff to practice performing CA and will be utilized for the skills checkoffs. The cost of a pediatric caudal injection simulator would run the project at approximately $940.95. A quality ultrasound is required for this project to ensure accuracy in placing the CA. A quality ultrasound, such as a composite ultrasound machine, costs approximately $25,000. Fortunately, the project will be performed at a level-one trauma children's hospital. The educational department has a caudal injection simulator, and the anesthesia department already has a quality ultrasound.

Additionally, the team must assess the cost of the educational hours for the anesthesiologist and the CRNAs. The cost of providing two hours of education for two

anesthesiologists is $1,536, calculated at $192 per hour (Anesthesiologists, 2023). The education cost of providing eight CRNAs with two hours of education is $1,410 at the cost of $94 an hour (Nurse anesthetist, 2023). Since the educational hours will be conducted during staff monthly meeting, the educational cost should be covered under the current anesthesia department's built-in educational hours (Appendix F).

Outcomes

After completion of the project, data analysis will occur over one month. The team will analyze the charts of patients who received CA while undergoing sub-umbilical surgeries during the three months. The data points that will be analyzed will be the LA and adjuncts used in the CA, the FLACC assessments that occur at 15 minutes, 30 minutes, 1 hour, and 1.5 hours, the opioids administered with the assessments, and the HR that occurs at the same time as the FLACC scores. The data analysis will then be compared to the goals of the project.

The goal of the project is to see a 25% reduction in postoperative opioids, specifically non-scheduled opioids, during the postoperative period. The second goal indicating a successful project will be maintaining a HR within 20% of the patients' preoperative vital signs. Additionally, the project aims to maintain a FLACC score of less than four, which indicates a need for non-pharmacologic pain interventions, not postoperative opioids.

Limitations

The first limitation is this study depends on the ability to receive consent from the pediatric patient's guardian, which may limit the number of participating patients. The second limitation is the noncompliance of anesthesia providers. The guidelines will be presented to staff, but the individual anesthesia providers must decide to utilize CA with GA. These limitations will

be addressed during the chart analyses, and the project members will analyze how these limitations affect the outcomes of the scholarly project.

Conclusion

The project highlights the need for improving postoperative pain in pediatric sub-umbilical surgeries. CA offers the ability for anesthesia providers to provide prolonged pain coverage, leading to fewer postoperative opioid administrations and reduced HR fluctuations. The project aims to bridge the gap between current literature and clinical practice by following the JHEBP model. The project emphasized the significance of EB guidelines for implementing CA in sub-umbilical surgeries to reduce postoperative pain and HR fluctuations. The use of guideline recommendations developed by the project team will allow anesthesia providers to increase the utilization of CA with GA in pediatric sub-umbilical surgeries. Utilizing CA with GA allows for a reduction of opioids and HR fluctuations in the postoperative period, thus improving patient outcomes after surgery.

Reference

Abdullayev R., Sabuncu U., Uludağ Ö., Kusderci H., Oterkus M., Buyrukcan A., Duran M., Bulbul M., Apaydin HO., Aksoy N., & Abes M.(2020). Caudal Anesthesia for Pediatric Subumbilical Surgery, Less Load on the Postoperative Recovery Unit. *Cureus*. 11(3), e4348. https: //doi.org/10.7759/cureus.4348.

Adilovic A., Rizanovic N., Adilovic H., Ejubovic M., Jakic A., Maksic H., & Simic D. (2019). Caudal Block with analgosedation- a superior anesthesia technique for lower abdominal surgery in pediatric population. *Medicinski Glasnik,* 16(2), 164-171. https: //doi.org/10.17392/1017-19

Benka A., Pandurov, M., Galambos., I,Rakić,G., Vrsajkov, V., & Drašković, B. (2020). Effects of caudal block in pediatric surgical patients: a randomized clinical trial. *Brazilian Journal of Anesthesiology*. 70(2), 97-103.ISSN 0104-0014. https://doi.org/10.1016/j.bjane.2020.02.007.

Bong, C., Tan, J., Lim, S., Low, Y., Sim, S., Rajadurai, V., Khoo P., , Allen, J., Meaney,M., & Koh,W. (2019). Randomized controlled trial of dexmedetomidine sedation vs general anesthesia for inguinal hernia surgery on perioperative outcomes in infants. *British Journal of Anaesthesia*. 122(5): 662-670. https://doi.org/10.1016/j.bja.2018.12.027

Calciolari S, González-Ortiz LG, Mongelli F, Cantini L, Capdevila X, La Regina D, Saporito A.(2023). Identification and economic burden of main adverse events of nerve injuries caused by regional anesthesia: a systematic review. Braz J Anesthesiol. 73(3):305-315. doi: 10.1016/j.bjane.2021.02.043. Epub 2021 Apr 3. PMID: 33823209; PMCID: PMC10240238.

Calculating Medical Malpractice Settlement Damages. (2022). The Knowles Group. Retrieved September 11, 2022, from https://www.theknowlesgroup.org/blog/calculating-medical-malpractice-settlementdamages/#:%7E:text=The%20average%20medical%20malpractice%20settlement,out%2 Dof%2Dpocket%20expenses.

Chong MA, Szoke DJ, Berbenetz NM, & Lin C. (2019). Dexamethasone as an Adjuvant for Caudal Blockade in Pediatric Surgical Patients: A Systematic Review and Meta-analysis. *Anesth Analg*. 127(2):520-528. doi: 10.1213/ANE.0000000000003346. PMID: 29596095

Dusmex A., Sargin A., Sahutoglu C., Sertoz N., & Balcioglu T. (2023) Evaluation of the analgesic effect of caudal anesthesia in pediatric lower extremity orthopedic surgery. *Eastern Journal of Medicine*, 28(3), 413-419. https: //doi.org/10.5505/ejm.2023.32391

Imani F, Farahmand Rad R, Salehi R, Alimian M, Mirbolook Jalali Z, Mansouri A, Nader ND. Evaluation of Adding Dexmedetomidine to Ropivacaine in Pediatric Caudal Epidural Block: A Randomized, Double-blinded Clinical Trial. Anesth Pain Med. 2021 Feb 28;11(1):e112880. doi: 10.5812/aapm.112880. PMID: 34221950; PMCID: PMC8241816.

Khalil S., Campos C., Farag A., Vije H., Ritchey M., & Chuang A (1999). *Caudal Block in Children***:** Ropivacaine Compared with Bupivacaine. *Anesthesiology*, 91, 1279. https://doi.org/10.1097/00000542-199911000-00018

Namugenyi C., Nimmagadda S., & Reiners T. (2019). Design of a SWOT analysis model and its evaluation in diverse digital business ecosystem contex. *Procedia Computer Science.*159, 1145-1154.http://DOI: 10.1016/j.procs.2019.09.283

Pramoth C., & Satheesh P. (2022). Caudal bupivacaine-neostigmine for perioperative analgesia in pediatric patients undergoing infra-umbilical surgeries. *International Journal of Academic Medicine and Pharmacy,* 5(1), 572-575. https: //DOI: 10.47009

Shah U J, Karuppiah N, Karapetyan H, et al. (2022) Analgesic Efficacy of Adjuvant Medications in the Pediatric Caudal Block for Infraumbilical Surgery: A Network Meta-Analysis of Randomized Controlled Trials. *Cureus,* 14(8), 28582. https: //DOI.org 10.7759/cureus.28582

Sharma T., Shah N., Patel J., Chhaya A., 7 Upadhyaya R. (2015). Comparison of general anesthesia v/s caudal epidural in pediatric infra umbilical surgeries. *International Journal of Biomedical Research,* 6(1),35-39. https: //doi.org/10.7439/ijbr

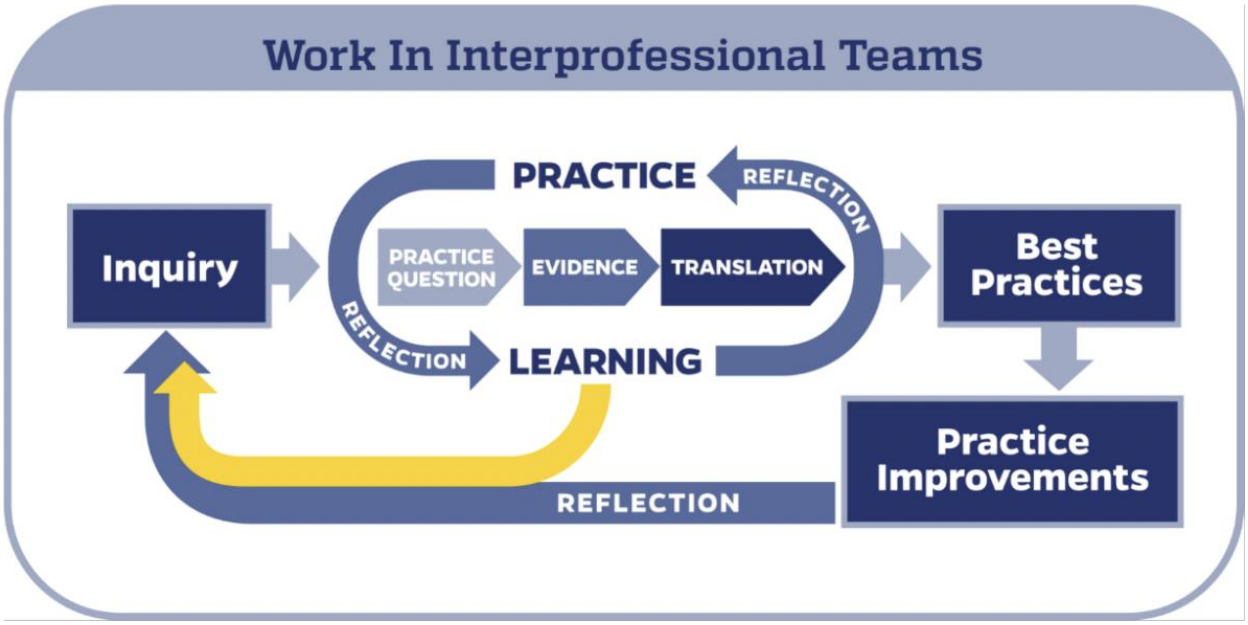
Singh V.& Pal S. (2022). Effect of dexmedetomidine and bupivacaine at caudal region in pediatrics group: a hospital study. *Journal of Cardiovascular Disease Research,* 13(5), 3001-3009. https: //doi.org/0975-3583

Tao, B., Liu, K., Wang, D. *et al.* Perioperative effects of caudal block on pediatric patients in laparoscopic upper urinary tract surgery: a randomized controlled trial. *BMC Pediatr* 19, 427 (2019). https://doi.org/10.1186/s12887-019-1812-0

Zubair M., Hasan A., Shahid J. (2021). Comparison of caudal bupivacaine and bupivacaine-tramadol combination for postoperative analgesia in children undergoing lower abdominal surgeries. *Anaesthesia, Pain & intensive care.* 25(5); 620-624. DOI: 10.35975/apic.v25i5.1630

Schwartz, R. H., Hernandez, S., Noor, N., Topfer, J., Farrell, K., Singh, N., Sharma, A., Varrassi, G., & Kaye, A. D. (2022). A Comprehensive Review of the Use of Alpha 2 Agonists in Spinal Anesthetics. *Pain physician*, *25*(2), E193–E201.

Appendix B


Work In Interprofessional Teams
Inquiry
PRACTICE
REFLECTION
PRACTICE QUESTION
EVIDENCE
TRANSLATION
REFLECTION
LEARNING
Best Practices
Practice Improvements
REFLECTION

Appendix C

Example of knowledge evaluation presented at the staff meeting

What are the landmarks of a Caudal Block?
What is the first sign of toxicity when using bupivacaine in the Caudal block?
What are the contraindications of caudal block?
Where does the spinal cord end in a pediatric patient?
What is the max volume of LA that can be used for a caudal block?

Appendix D

GUIDELINE

Statement of Purpose

This guideline aims to prove evidence-based practice recommendations regarding the selection of local anesthetics (LA) and the additive of dexmedetomidine in caudal blocks (CA). Additive agents, such as dexmedetomidine, are added to LA to increase motor and sensory block duration, provide analgesia, and decrease postoperative opioid requirements and heart rate fluctuations. Selection of LA and the additive agent dexamethasone includes assessing the indications and contraindications, risks and benefits, types of surgery, required block duration, and institution of correction measures to address any complications.

Consideration for Caudal block includes.

- Obtaining appropriate pre-op assessment of the patient
- Addressing patients consents and surgeon preferences.
- Availability and cost of LA, additive
- Utilization technique aspects ensuring administration, such as ultrasound.
- Availability of anesthesia providers to address complications.
- Availability of medications to address any potential complications (including lipid emulsion)
- Providing appropriate post-analgesia care following CA

Definitions:

- Analgesia: absence of the sensation of pain
- Caudal Block: central neuraxial block, most used in pediatrics to provide analgesia for surgeries below the umbilicus.
- Motor Block: nerve blockade that paralyzes the motor function of a muscle.
- Sensory block: selectively inhibit pain transmission while leaving motor function intact.

Guideline:

The guideline applies to the use of regional anesthesia in which LA and additives are administered to the patient. This guideline assists the anesthesia providers in the selection of surgery type, selection of LA and the additive dexmedetomidine of CA. The guideline intents to direct quality patient care without guaranteeing a specific patient outcome. The guideline is not a substitute for clinical judgement and does not establish legally enforceable requirements or responsibilities. The 2023 American Society of Anesthesiologists guidelines should be consulted directly.

a) Patients Specifics

(1) Type of Surgery

(a) Circumcision
(b) Herniorrhaphy
(c) Appendectomy
(d) Hydrocladia's repair
(e) Hydrocelectomy
(f) Orchiopexy
(g) Lower extremity Orthopedic surgeries

(2) Demographics

(a) Less than 6 years old
(b) Less than 50kg

b) Local Anesthetic Selection

(1) Ropivacaine is the recommended type of local anesthetic

(a) Rational for recommending Ropivacaine

(i) Ropivacaine has a faster sensory and motor onset
(ii) Ropivacaine showed stronger effect with the additive dexmedetomidine compared to bupivacaine.

(2) Other Local Anesthetics that can be used

(i) Bupivacaine

1. Bupivacaine has demonstrated an enhanced motor blockade, but as demonstrates more cardiac toxic effects.

c) Dosing

(1) 1ml/kg ropivacaine 0.25% and dexmedetomidine 2mcg/kg
(2) 1ml/kg bupivacaine 0.25% and dexmedetomidine 1mcg.kg

d) Recommended Criteria

(1) Common inclusion criteria

(a) ASA I-III, less than 6 years old, less than 30 kg,

(2) Common exclusion criteria

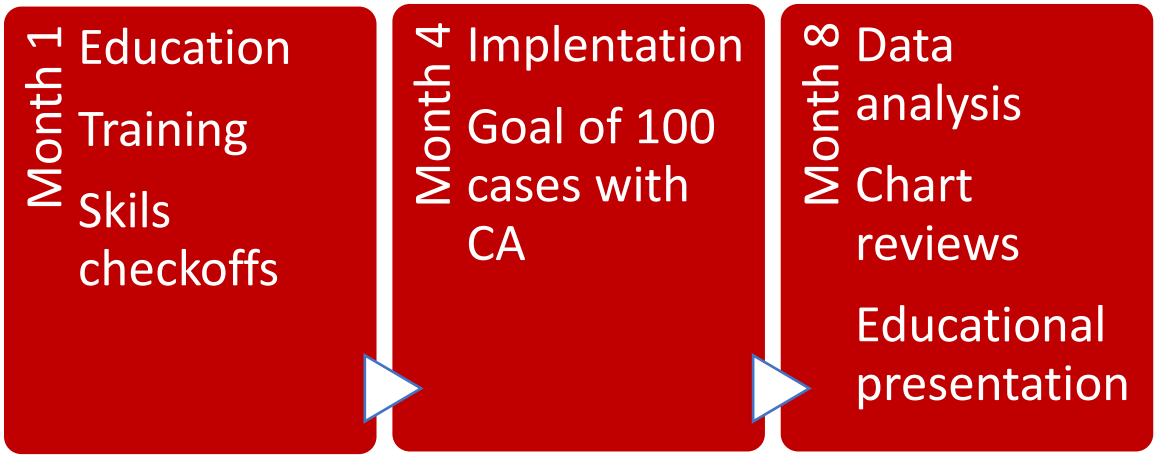
(a) Allergies to LA, sacral deformities, perianal surgeries, bacteremia

Appendix E

SWOT Analysis

Strengths	Opportunities
• Patient approvement • Decreased post-op pain	• Mores staff involvement
Weaknesses	**Threats**
• Surgeons' preferences • Differing professional opinions of CA and LA	• Current staff culture • Staff push back

Appendix F: Timeline



Appendix D

Item	Description	Cost
simulation	Pediatric Caudal Injection Simulator	$940.95
Ultrasound	Sonosite Kiosk POCUS Ultrasound Machine	$25,000
Anesthesiologist education	Average wage = $401,000= $192/hr X4 anesthesiologist	$1,536
CRNA education	Average wage=$197,000= $94/hr x8 CRNAs	$1,410
		$28,886.95

APA Citation: Bong, C., Tan, J., Lim, S., Low, Y., Sim, S., Rajadurai, V., Khoo P., , Allen, J., Meaney,M., & Koh,W. (2019). Randomized controlled trial of dexmedetomidine sedation vs general anesthesia for inguinal hernia surgery on perioperative outcomes in infants. *British Journal of Anaesthesia*. 122(5): 662-670. https://doi.org/10.1016/j.bja.2018.12.027

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Compares the perioperative conditions and adverse events between dexmedetomidine sedation with caudal block and general anesthesia	Single-centre RCT	**Number of 104** **Characteristics:** **Exclusion Criteria:** :>26wks gestation, risk for neurodevelopment, severe cognitive disease, contraindications for caudal, difficult surgery **Attrition:0** **Setting: hospital**	**Independent variables:** **IV1= GA with Caudal** **IV2=dexmedetomidine sedation with caudal** **Dependent variables:**	**Scale(s) used:** **Reliability information (*alphas*, if any):** Incidence of perioperative adverse events compared between the groups	**Statistical tests, if any:** **Qualitative analysis, if any:** Duration of surgery, anesthesia, PACU, apnea, bradycardia, HoTN, HTN, delayed return to feeding	**Statistical findings, if any:** **Qualitative findings, if any:** Dexmedetomidine sedation and caudal block is a feasible anesthetic technique for inguinal hernia surgery in infants younger than 3 months	Experimental studies-recommended	**Strengths:** **Limitations:** Did not blind the anesthesia or surgical providers **Risk or harm if implemented:** **Feasibility of use in the project practice area:** **Very feasible**

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study randomly assigned 104 infants younger than three months to either the DEX group (51 infants) or the GA group (48 infants). In the DEX group, 90.2% of the infants operated completely solely under dexmedetomidine sedation. In comparison, 3.9% were converted to general anesthesia with intubation, and 5.9% required brief administration of nitrous oxide or low-dose sevoflurane. Overall, 96.1% of infants in the DEX group did not require intubations.

The perioperative conditions were found to be similar in both groups. However, the DEX group had significantly lower heart rates and higher mean arterial pressure intraoperatively. Regarding adverse events, two infants (3.9%) in the DEX group required postoperative intensive care admission compared to six infants (12.5%) in the GA group.

Based on these findings, the study concludes that dexmedetomidine sedation with the caudal block is a feasible alternative to general anesthesia in infants undergoing hernia surgery. This technique avoids tracheal intubation, which may be particularly beneficial in neonates and reduces the risk of perioperative cardiorespiratory adverse events.

Thematic Analysis

Key Themes or FSP related significance:

1. Dexmedetomidine sedation, when paired with caudal blocks, required fewer tracheal intubations.
2. Dexmedetomidine is more hemodynamically stable.
3. Dexmedetomidine analgesia reduces the risk of perioperative cardiorespiratory adverse events.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Chong MA, Szoke DJ, Berbenetz NM, & Lin C. (2019). Dexamethasone as an Adjuvant for Caudal Blockade in Pediatric Surgical Patients: A Systematic Review and Meta-analysis. *Anesth Analg*. 127(2):520-528. doi: 10.1213/ANE.0000000000003346. PMID: 29596095

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	Caudal and IV dexamethasone are similarly effective for prolonging the duration of analgesia from Caudal blockade, resulting in doubled to	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***

						tripled duration		
Determining how effective adjuvant dexamethasone is for prolonging the duration of analgesia of caudal blockade and is there a difference between caudal versus intravenous routes of administration	Systemic review and random-effects meta-analysis of randomized controlled trails	1315 Pediatrics <18, receiving Caudal block for surgical or postoperative analgesia. Trials that involved healthy volunteers were excluded. 98% attrition	Control: General Anesthesia IV1= Dexamethasone in Caudal block IV2= Dexamethasone IV IV3 Dexamethasone given IV and in Caudal block	**R**isk bias assessed by Cochrane methodology. Strength of evidence: GRADE system	Duration of analgesia	Caudal and IV dexamethasone are similarly effective for prolonging the duration of analgesia from Caudal blockade, resulting in doubled to tripled duration	Highest: Clinical Appraisal	Cochrane Risk of Bias tool scored all studies at a level three or higher (low risk of bias)
Will complete this in Assignment E								
Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style): The article discusses a systemic review and meta-analysis of randomized controlled trials on dexamethasone as an adjunct for caudal block in pediatric surgery. Caudal block is a technique for postoperative analgesia in the lower abdomen, but it has a limitation of short duration of action. Dexamethasone has been used to prolong the analgesic effect, but the optimal routes of administration and concerns about steroid-related side effects remain unclear. The researchers reviewed 14 randomized controlled trials involving 1315 pediatric patients undergoing lower abdominal operations. Dexamethasone was administered either through the caudal route or intravenous route. The meta-analysis showed that both caudal and intravenous administration of dexamethasone significantly prolonged the duration of analgesia compared to the control group. Secondary benefits include a reduced need for narcotic rescue analgesia, decreased postoperative rescue analgesia requirements, and lower postoperative nausea and vomiting rates. Adverse events associated with dexamethasone were rare.								

Based on the findings, both caudal and intravenous dexamethasone is effective in prolonging the duration of analgesia from the caudal block with similar results; however, since caudal dexamethasone is considered off-label, the study recommends intravenous administration, although only high intravenous doses have been studied, 0.5 milligrams per kilogram up to 10 milligrams.

Thematic Analysis

Key Themes or FSP related significance:

1. **1.** Dexamethasone can be used in conjunctions with caudal blocks.
2. Dexamethasone prolongs the duration of analgesia of CA to allow for longer post operative analgesia.
3. The use of dexamethasone reduces the need for rescue analgesia and lowers the rates of postoperative nausea and vomiting.
4. Dexamethasone used intrathecally is an off-label use

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Riaz A, Shah A, Jafri S. Comparison of pediatric caudal block with ultrasound guidance or landmark technique. Anaesth. Pain & intensive care 2019;23(1):18-22

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Clinical trial to find out the usefulness of the recently introduced ultrasound guidance in success of performing caudal block	Randomized controlled clinical trial	240 children ages 2-10 ASA I&II Elective below umbilicus abdominal, lower limb or perianal surgery	IV1: ultrasound guided Caudal Block IV2: landmark technique Success of caudal block Number of punctures to	Success of block injection defined as no blood or CSF aspirated, injection into caudal canal without any resistance and no subcutaneous swelling	HR, number of needle punctures, ad block performing times	The success rate was higher with ultrasound group ((5%) compared to landmark technique group (70.83%)	recommended	Limitations: blinding was not possible as the procedure is totally different

		Exclusion emergency surgeries, spinal deformity, coagulation abnormality , allergy to local anesthetics, systemic or local infection	achieve caudal block.					

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

This clinical trial compared the effectiveness of ultrasound-guided caudal block with a traditional landmark technique in children undergoing below umbilicus surgery. The study involved 240 children between the ages of two and 10 divided into two equal groups. The primary group was to assess the success of the block, while the secondary goal was to observe the occurrence of tachycardia and increased heart rate during skin incisions. Additionally, the procedure's time and the number of needle punctures were recorded.

The results showed no significant differences between the two groups regarding age, gender, or weight. However, the ultrasound group had a higher success rate on the first attempt, 95 percent, than the landmark technique. The frequency of tachycardia during skin incision was also significantly lower in the ultrasound group, 10%, compared to the landmark technique. However, the time taken to perform the procedure was slightly longer in the ultrasound group compared to the landmark technique.

In conclusion, using ultrasound guidance improves caudal block placement success rates compared to the landmark technique in children. However, it should be noted that the ultrasound guided approach requires more time to perform the procedure.

Thematic Analysis

Key Themes or FSP related significance:

1. **1.** Caudal blocks can be performed with landmark technique or ultrasound, with ultrasound being the preferred method.

2. Caudal blocks with ultrasound take more time than the landmark technique.
3. Caudal blocks with ultrasound technique had a 95% success rate with the first stick.
4. Caudal blocks with ultrasound technique have 10% less tachycardia with the skin incision.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Doctor TP, Dalwadi DB, Abraham L, Shah N, Chadha IA, Shah BJ. Comparison of ropivacaine and bupivacaine with fentanyl for caudal epidural in pediatric surgery. Anesth Essays Res. 2013 May-Aug;7(2):212-5. doi: 10.4103/0259-1162.118965. PMID: 25885835; PMCID: PMC4173527.

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Ropivacaine causes differential neuraxial blockade, which is associated with less motor block and lower cardiovascular damage. To extend the duration of action of local anaesthetics, several adjuvants are administered. Our goal was to see how fentanyl affected the duration of postoperative analgesia when used in conjunction with ropivacaine in a pediatric population of children aged 3 to 8 years following infraumbilical operations.	Perspective, comparative, and randomized investigation (RCT)	100 patients ages 3-8 yo undergoing infraumbilical operation who are ASA 1-2 Excluded: missed milestones or developmental delayed, suspected coagulopathy or bleeding diathesis, body weight more than 30 kg, and local infection at puncture site Attrition: 100%	IV1: caudal block of 0.2% ropivacaine 0.5ml/kg IV2: caudal block of 0.2% ropivacaine 0.5ml/kg with fentanyl 0.5mcg/kg	FLACC	FLACC scores to measure postoperative pain for 24 hours, length of motor blockade and negative effects. Hemodynamics, postoperative analgesia duration and number of rescue analgesics is reduced	The mean duration of analgesia in ropivacaine group was 440.60±101.29 minutes (7.25hrs) and in ropivacaine fentanyl group was 891±312.84 (14.76hrs). Statistically, the difference was highly significant.	High-recommend	Strengths: the two groups were equivalent in terms of age, weight, sex, operation length Limitations: increased vomiting

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study compares the effectiveness of two local anesthetics, Ropivacaine and Bupivacaine, combined with fentanyl and caudal blocks for intra and postoperative pain relief period ropivacaine, the S-ammeter of an amide local anesthetic, is chosen for its selective neural blockade, reduced motor blockade, and lower cardiovascular and neurological toxicity, making it suitable for daily case pediatric surgeries. The summary involves 112 patients' (age ranges 3.02 ± 3.29 years parentheses classified as ASA I-IV. They are divided into two groups group BF (bupivacaine + fentanyl) and group RF (ropivacaine + fentanyl). This study monitors vital signs, inhalational gas requirements during surgery and postoperative pain levels during pain scores. Duration of analgesia is longer in both groups are RF and BF, but group RF demonstrates a slightly delayed need for rescue analgesics. Group RF also displays greater hemodynamic stability and lower interoperative inhalational gas requirements compared to the other groups. The study concludes that combining ropivacaine and fentanyl offers a more effective option for pediatric surgeries below the umbilicus, either as an adjunct to general anesthesia or as a standalone technique with reduced complications and a higher success rate.

Thematic Analysis

Key Themes or FSP related significance:

1. The study focuses on comparing the effectiveness of ropivacaine and bupivacaine, combined with fentanyl, in the context of cardinal blocks for pediatric surgeries.
2. Advantages of ropivacaine specific quantities such as targeted neutral blockade, minimal motor impact, and reduced risk of cardiovascular and neurological complications make it suitable for daily case pediatric surgeries.
3. the study involves 112 patients of varying ages and ASA classifications divided into group BF equivocate plus fentanyl and RF ropivacaine plus fentanyl.
4. Both groups show prolonged analgesia duration. Group RF exhibits delayed need for rescue analgesics, improved hemodynamic stability and reduced interoperative inhalational gas requirements.
5. The study concludes that combining replicating and fentanyl is a promising approach for pediatric surgeries below umbilicus the combination can be used as an adjunct to general anesthesia or standalone technique.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Imani F, Farahmand Rad R, Salehi R, Alimian M, Mirbolook Jalali Z, Mansouri A, Nader ND. Evaluation of Adding Dexmedetomidine to Ropivacaine in Pediatric Caudal Epidural Block: A Randomized, Double-blinded Clinical Trial. Anesth Pain Med. 2021 Feb 28;11(1):e112880. doi: 10.5812/aapm.112880. PMID: 34221950; PMCID: PMC8241816.

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
The effects and side effects of adding. Dexmedetomidine To ropivacaine in the caudal epidural block were investigated in children after lower abdominal surgery	Randomized Double-blind Clinical trial	**46 children ages 3-6 undergoing lower abd surgery under GA**	**IV1:R: Caudal block with ropivacaine (1ml/kg) IV2: DR: Caudal block with ropivacaine (1ml/kg) with dexmedetomidine Variable: CHEOPS, DOA, amount of analgesia consumed, Hemodynamic change, adverse effects at 1, 2, and 6 hrs.**	**CHEOPS,**	**CHEOPS, DOA, amount of analgesia consumed, Hemodynamic change, adverse effects at 1, 2, and 6 hrs.**	**DR: group pain score at the 6th hr. is significantly lower, and the duration of analgesia was longer/ The amt of analgesia consumed was lower in the DR group**		**Strengths: Limitations: Risk or harm if implemented: Feasibility of use in the project practice area:**

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study examined the impact of adding dexmedetomidine to ropivacaine for caudal epidural, blocks in children recovery from lower abdominal surgery. The objective was to evaluate pain relief and potential side effects. Forty-six children aged three to six were split into two groups: one received only ropivacaine (control), while the other received a combination of dexmedetomidine and ropivacaine. Pain scores, analgesia duration, analgesia consumption, hemodynamic changes, and adverse effects were assessed over time. The findings revealed that the addition of dexmedetomidine enhanced pain relief after six hours, extended the duration of pain relief, and reduced analgesic consumption without notable adverse effects. Diastolic blood pressure was lower in dexmedetomidine group. In conclusion, combining dexmedetomidine with ropivacaine in caudal epidural blocks appears advantageous for managing postoperative pai in pediatric patients.

Thematic Analysis

Key Themes or FSP related significance:

1.The primary aim of the research was to investigate the effects of combining dexamethasone with ropivacaine and coddle epidural blocks for pain management in children after a lower abdominal surgery.

2. This study involved 46 children aged 3 to 6 divided into two groups the control received ropivacaine while the other received a combination of dexamethasone and ropivacaine

3. The results indicated that the addition of dexamethasone to ropivacaine led to improved pain relieved after six hours after surgery the combination prolonged the duration of analgesia and reduced the consumption of analgesics

4 The study found that the addition of dexamethasone did not result in significant adverse effects while there was a reduction in diastolic blood pressure in the dexamethasone group other hemodynamic parameters did not show significant differences.

5. Based on the findings the study concludes that adding death annexing into our pivot cane provides benefits for postoperative pain management in children undergoing lower abdominal surgeries.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Tao, B., Liu, K., Wang, D. *et al.* Perioperative effects of caudal block on pediatric patients in laparoscopic upper urinary tract surgery: a randomized controlled trial. *BMC Pediatr* **19**, 427 (2019). https://doi.org/10.1186/s12887-019-1812-0

Conceptual Framework or Model	***Design or Method***	***Sample & setting***	***Major Variables Studied & their Definitions if any***	***Outcome Measurement(s)***	***Data Analysis***	Caudal block with 1.3ml/kg of 0.15% ropivacaine reducing	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
To evaluate the perioperative effects of caudal block on pediatric patients in laparoscopic upper urinary tract surgery	Randomized control trial	96 pediatric patients ages 6 mon to 7 years ASA I-II undergoing. Excluded: allergic rxn to LA,	NO caudal block Caudal block with 1ml/kg of 0.15% ropivacaine Caudal block with 1.3ml/kg of 0.15% ropivacaine	FLACC score	FLACC score higher than 4= rescue dose of 0.5mcg/kg fentanyl given, re-investigate	Caudal block with 1.3ml/kg of 0.15% ropivacaine reducing	recommend	Limitations: did not record maximum level of cranial spread

		malformation of spine, infection around puncture site, coagulation dysfunction Attrition: 88%	Postoperative fentanyl usage		d at 15 in and redosed if FLACC greater than 4			No placebo injection was used. Feasibility of using high levels of local on small patients us unlikely

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study evaluated the perioperative effects of a caudal block on pediatric patients undergoing laparoscopic upper urinary tract surgery. The researchers randomized 96 pediatric patient patients aged six months to seven years into three groups: a non-block group, no caudal block performed, ROP1.0 group patients received 1.0 milliliters per kilogram of 0.15% ropivacaine and in R0P1.3 group patients received 1.3 milliliters per kilogram of 0.15% ropivacaine.

The primary outcome measured was perioperative fentanyl use, and secondary outcomes included pain score, hemodynamic fluctuations, the number of patients needing rescue fentanyl, and side effects. The results showed that color block with 1.3 milliliters per kilogram of 0.15% ropivacaine significantly reduced perioperative fentanyl usage compared to the non-block group in the ROP1.0 group. Additionally, patients in the ROP1.3 group experienced more stable hemodynamics, lower pain scores in the post-anesthesia care unit (PACU) and eight hours after the operative, less demand for rescue fentanyl, and shorter PACU stays.

In conclusion, caudal blocks with 1.3 milliliters per kilogram of 0.15% ropivacaine were found to decrease perioperative fentanyl use and provide effective postoperative pain relief in pediatric patients undergoing laparoscopic upper urinary tract surgery when compared to no caudal block and caudal block with 1.0 milliliters per kilogram of 0.15% ropivacaine.

Thematic Analysis

Key Themes or FSP related significance:

1. Ropivacaine can be used in caudal blocks in many different dosages.

2. Ropivacaine 1.3ml/kg has a long analgesic effect than ropivacaine 1.0 ml/kg.

3. Larger doses of ropivacaine lead to reduced fentanyl use.
4. Ropivacaine 1.3ml/kg leads to lower pain scores, hemodynamic fluctuations, amount of rescue narcotics, and fewer side effects when compared to Ropivacaine 1.0ml/kg.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Ismail AA, Mohamed Hamza H, Ali Gado A. Efficacy of Dexmedetomidine Versus Morphine as an Adjunct to Bupivacaine in Caudal Anesthesia for Pediatric Thoracic Surgeries: A Randomized Controlled Trial. Anesth Pain Med. 2021 May 3;11(2): e112296. doi: 10.5812/aapm.112296. PMID: 34336616; PMCID: PMC8314090.

Conceptual Framework or Model	***Design or Method***	***Sample & setting***	***Major Variables Studied & their Definitions if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***
Aimed to compare the efficacy of dexmedetomidine Vs morphine as adjutants to bupivacaine in caudal anesthesia to determine which can prolonged the anesthetic effects	Randomized, blinded study	50 patients divided into 2 groups ages 1–6-year-old, scheduled for thoracotomy surgery and are an ASA I -III Exclusion: infection at puncture site, surgery >3hrs, failed extubation, failed caudal block, coagulopathy, mental retardation, congenital	M: received morphine and bupivacaine D: dexmedetomidine and bupivacaine	FLACC	FLACC scale, adverse effects: vomiting, itching, bradycardia, HoTN, respiratory distress, morphine administration	Dexmedetomidine can produce and prolong analgesia, as compared to morphine when used as an adjunct to bupivacaine in caudal anesthesia	recommend	Limitations: Did not use different concentrations of meds. Did not include a placebo group. Did not compare caudal vs IV opioids. Only focused on postoperative variables not interoperative variables

		anomalies of the sacrum Attrition 100%						

Will complete this in Assignment E

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study aimed to enhance postoperative pain management in pediatric patients undergoing thoracic surgeries using caudal anesthesia. The main challenge of caudal anesthesia is its short analgesic duration, which can be extended by adding adjuncts. The study compared the effectiveness of dexmedetomidine and morphine as adjuncts to be the bupivacaine in caudal anesthesia. 50 patients were divided into two groups 1 receiving morphine and bupivacaine and the other receiving dexmedetomidine and bupivacaine. The primary outcome was a duration of postoperative analgesia. Secondary outcomes included morphine usage, FLACC pain scale scores, and adverse effects. The results indicated that the dexamethasone determine group experienced longer postoperative analgesia compared to the morphine group. Additionally, the dexamethasone group exhibited lower heart rates blood pressure pain scores and morphine consumption. Adverse effects were similar between the two groups. In conclusion, using dexmedetomidine as an adjunct be pivoting and a caudal anesthesia for pediatric thoracic surgeries lead to improved and extended postoperative pain relief compared to morphine.

Thematic Analysis

Key Themes or FSP related significance:

1. **1.** The study focuses on caudal anesthesia as an effective method for managing postoperative pain in pediatric patients.
2. the main challenge of caudal anesthesia is its limited postoperative analgesia duration the study addresses this by investigating the impact of adding adjectives to bupivacaine.
3. The study is a randomized trial that compares dexamethasone versus morphine as adjuncts to bupivacaine.
4. The primary outcome is the duration of post operative anesthesia including morphine administration in the first 24 hours flat pane scale scores and adverse effects.
5. The study concludes dexamethasone as an adjunct to bupivacaine results in better and prolonged postoperative analgesia compared to morphine.

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Zubair M., Hasan A., Shahid J. (2021). Comparison of caudal bupivacaine and bupivacaine-tramadol combination for postoperative analgesia in children undergoing lower abdominal surgeries. *Anaesthesia, Pain & intensive care.* 25(5); 620-624. DOI: 10.35975/apic.v25i5.1630

Conceptual Framework or Model	*Design or Method*	*Sample & Setting*	*Major Variables Studied & their Definitions, if any*	*Outcome Measurement(s)*	*Data Analysis*	*Findings*	*Level of Evidence*	*Quality of Evidence: Critical Worth to Practice*
Compare the use of bupivacaine alone with bupivacaine plus tramadol for a single shout caudal block to determine whether tramadol can be an effective adjunct to bupivacaine for providing better postoperative analgesia	Randomized control trial	**150 children ages ASA I or II ages 6mon to 12 y undergoing lower abdominal surgery. Exclusion Criteria: congenital heart disease, coagulation disorder, sepsis, uncorrected hypovolemia, parental refusal, malformation of the sacrum or infection at the site of injection Attrition: 100% :**	**A: 0.5ml/kg of bupicivaine 0.25% B: 0.5ml/kg bupicaine plus tramadol 2mg 2mg/kg Fixed volume of solution injected caudally 1ml/kg**	**TPPPS (Toddler preschool postoperative pain score)**	**TPPPS score Duration of analgesia from induction to first administration for supplemental analgesia Pain score of 3/10 received rescue analgesia**	**The average age of patients was 5.14 mon-2.76 years. Mean durations of analgesia was significantly high in group B (bupivacaine with tramadol) was compared to group A (bupivacaine) 7.37+/-1.96 vs 11.12 +/- 1.86 hours: p=0.0005**	**recommend**	**Strengths: multimodal approach to pain management Limitations: was not a blind control trail**
Will complete this in Assignment E								

Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):

The study aimed to compare the effectiveness of bupivacaine alone versus bupivacaine combined with tramadol for postoperative pain relief in children undergoing lower abdominal surgery. The researchers conducted a randomized controlled trial involving 150 children at a hospital in Islamabad. The patients were divided into two groups: Group A received bupivacaine only, while Group B received a combination of bupivacaine and tramadol through a caudal epidural block immediately after anesthesia induction.

The duration of anesthesia was assessed using the TPPPS pain scale. The average age of the patients was 5.14 years period the results showed that the mean duration of analgesia was significantly longer in Group B (bupivacaine with tramadol) compared to Group A (bupivacaine only). The duration of analgesia and Group B was 11.12 hours, while in Group A, it was 7.37 hours.

Based on these findings, the researchers concluded that adding tramadol at 2 milligrams per kilogram to bupivacaine for caudal administration provided extended analgesia and was safe for children undergoing lower abdominal surgery. This suggests that tramadol can be an effective adjunct to bupivacaine for improved postoperative pain management in pediatric patients.

Thematic Analysis

Key Themes or FSP related significance:

1. Tramadol can be added to bupivacaine in caudal blocks.
2. Bupivacaine's mean duration of analgesia is 7.37 hours.
3. Bupivacaine and tramadol's mean duration of analgesia is 11.12 hours.
4. Tramadol is a safe adjunct for caudal blocks in pediatrics undergoing lower abdominal surgery

Appendix A: Evidence Review Worksheet Assignment C

APA Citation: Shah U J, Karuppiah N, & Karapetyan H, (2022) Analgesic Efficacy of Adjuvant Medications in the Pediatric Caudal Block for Infraumbilical

Conceptual Framework or Model	***Design or Method***	***Sample & Setting***	***Major Variables Studied & their Definitions, if any***	***Outcome Measurement(s)***	***Data Analysis***	***Findings***	***Level of Evidence***	***Quality of Evidence: Critical Worth to Practice***

Evaluate the comparative analgesic efficacy and relative ranking of caudal adjuvants added to local anesthetics vs local anesthetics alone	Network metanalysis of RCT	RTC of pediatric patients undergoing infra-umbilical surgery under caudal epidural blocks (under general anesthetic or sedation) Exclusion RCTs employing lidocaine or epinephrine to accelerate block onset, adult patients, and short acting local anesthetics,	Control: no adjuvant Variables Clonidine, dexmedetomidine, ketamine, magnesium, morphine, fentanyl, tramadol, dexamethasone, neostigmine Long-acting LA such as bupivacaine, levobupivacaine or ropivacaine	Used the mean and standard deviation	Used the R-statistical package. Bayesian methods	Produces a ranking of the adjuncts for each outcome of interest using the surface under the cumulative ranking curve (SUCRA), yielding a probability (%) of an intervention being among the best options and a mean rank. Combines result from all the analgesic outcomes to ascertain eh vest adjuvant across all analgesic outcome using a rank-heat plot	recommend	Did not include studies utilizing lidocaine or epinephrine .
Will complete this in Assignment E								
Annotated Bibliography statement (may be several sentences summarizing the article based upon the information above using professional APA writing style):								

The study evaluated the effectiveness of adjuncts added to local anesthetics and caudal blocks for improving pain relief in pediatric infra-umbilical surgery. The researchers conducted a network meta-analysis using data from randomized control trials (RCTs) obtained from various databases. They assess the duration of analgesia, number of analgesic doses, and total dose of acetaminophen administered within 24 hours as the primary outcomes.

The analysis showed that neostigmine was the adjunct that provided the most extended duration of anesthesia compared to other adjuncts, with a mean difference of 513 minutes. On the other hand, Dexamethasone reduces the frequency of analgesic doses and the total amount of acetaminophen. Neostigmine, tramadol, and dexamethasone were the most effective adjuncts in prolonging the duration of analgesia, although the certainty of evidence varied.

In summary, this network meta-analysis demonstrated that neostigmine was the most effective in prolonging analgesia, while dexamethasone showed benefits in reducing the frequency of analgesic doses in acetaminophen consumed. However, the certainty of the evidence is excellent for different adjuncts.

Thematic Analysis

Key Themes or FSP related significance:

1. Neostigmine, dexmedetomidine, and tramadol can be used as adjuncts in caudal blocks.

2. Neostigmine has the most extended duration of analgesia, an average of 513 minutes

3. 3. Dexmedetomidine reduces the frequency of pain analgesic doses and the amount of acetaminophen used.