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"PAIN RELIEF IN PEDIATRIC PATIENTS UNDERGOING THORACOTOMY FOR CONGENITAL HEART DISEASES WITH CAUDAL ANAESTHESIA"

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ABSTRACT
Objectives: To assess the frequency of pain relief, using FLACC scores, in pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia.
Study design: Descriptive study
Setting: Department of Anesthesiology, National institute of Cardiovascular Diseases, Karachi
Study duration: 26th August 2019 to 25th February 2020.
Materials & Methods: A total of 74 patients undergoing Thoracotomy for Congenital Heart Diseases and of age 6 months-6 years were included. Patients with bleeding disorders and skin lesion at site of needle insertion were excluded. Anesthesia fitness was obtained and a local anesthetic injection (Bupivicaine; dosage 1.5ml/kg) was injected in to the caudal canal. Thoracotomy and surgery was performed by pediatric surgeon with minimum experience of five years. Patients were kept under observation and Face, Legs, Activity, Cry, Consolability (FLACC) score was evaluated and noted after six hours of the surgery by principal investigator. We administered our rescue analgesia in form of Nalbuphine if pain intensity found to be moderate to severe on FLACC scale.
Results: Age range in this study was from 6 months to 6 years with mean age of 3.34 ± 1.51 years. Majority of the females i.e. 43 (58.11%) were between 6 months to 3 years of age. Out of these 74 patients, 45 (60.81%) were male and 29 (39.19%) were females with male to female ratio of 1.6:1. In my study, frequency of pain relief, using FLACC scores was found in 65 (87.84%) pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia.
Conclusion: This study concluded that the frequency of pain relief, using FLACC scores, in pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia is very high.
Keywords: pediatric patients, pain relief, caudal anesthesia.

INTRODUCTION:

Postoperative pain is one of the vital issues after any surgical procedure. It has now been proved that pain can an increase in length of hospitalization. It also leads to delay return in bowel movements ultimately causing development of ileus by activating inflammatory mediators.[1] Traditionally opiates are administered for analgesia. However, it is important to mention that opiate administration bring its own side effects and limitations, especially in pediatric group of patients. On the other hand epidural opiates have achieved significant analgesic results. It candidly decreases stress responses, allows early mobilization, ultimately leading to early extubation.[2,3]

Caudal block is type of central neuraxial block that results from blocking the sacral and lumbar nerve roots by injecting local anesthetic into the caudal epidural space. It is most commonly used in infants and children for giving anesthesia as an adjuvant to general anesthesia. The analgesic effect of the block may extend for hours in the post-operative period. Combined with general anesthesia, regional anesthesia has been proven to be safe, efficacious with short learning curve in pediatric population undergoing infraumblical surgeries. It is not

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known, however, whether the use of caudal anesthesia actually reduces postoperative pain scores and foster extubation in patients undergoing cardiac surgeries.[4] Synchronizing with general anaesthesia helps in reducing intraoperative inhalational or opioid agent consumption.[5] Further, there is reduction in postoperative apnea, length of hospitalization and improvement in post-surgical consequences.[6] Caudal anesthesia may be favorable for early extubation, improved pain, and hemodynamics.[7]

Caudal space is the sacral portion of the epidural space, a needle or catheter may be inserted through the sacral hiatus to provide continuous block. As the space is continuous above it can be used for supra-umbilical surgery like thoracotomy as well. Bupivacaine is most frequently used in caudal space, because of having no availability issues, has a longer duration of action and its less known side effects.[4] Thoracotomy may induce severe intra-operative and post-operative pain and if not managed properly may result in patient distress. Postoperative analgesia for thoracotomy is much desired to avoid the commonly described complications leading on to hypoxemia such as atelectasis, retention of secretions, decrease in the functional residual capacity, and increase in V/Q mismatch.[8] In younger children with immature neuronal structures, adequate regional anesthesia can avoid exposure to potential neurotoxic anesthetics and reduce hypersensitivity resulting from inadequate analgesia.[9]

Nguyen et al.[4] conducted a study to evaluate the role of caudal anesthesia in pain relief in pediatric patients undergoing congenital heart surgery. They utilized the Face, Legs, Activity, Cry, Consolability (FLACC) scale to assess the pain relief. Suty reported post-operative mild pain (FLACC score 0–3) in 85.8% and moderate to severe pain (FLACC scores 4–10) in 14.2% of the patients.

The management of acute post-operative pain has always been lacking in pediatric patients and also the use of parenteral narcotics is associated with high risks of respiratory depression in this vulnerable age group. The use of caudal block will provide prolonged pain relief postoperatively and thus faster the recovery. In this study we will be evaluating the role of caudal block in relieving of postoperatively pain of thoracotomy by using FLACC scores. In our country we are devoid of opioids and pediatric intensive care resources and positive outcome of this might benefit in both of these regards. Nationally we don't have data regarding the use of caudal block in thoracotomy patient so positive outcome of our study will significantly benefit our society.

OBJECTIVE:

To assess the frequency of pain relief, using FLACC scores, in pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia at a tertiary care cardiac hospital in Karachi, Pakistan.

MATERIALS AND METHODS:

Ethical review committee permission was taken before conducting this study in the Department of Anesthesia & Surgical ICU NICVD Karachi, over a period of 6 months (26th August 2019 to 25th February 2020). Informed and written consent was taken from patients/ guardians and explained about the potential risks and benefits of study.

The sample size was calculated using WHO calculator 2.0 version. Taking the frequency of relief in post-operative pain of 85.8%, at 95% confidence interval, and 8% margin of error, sample size for the study was calculated to be n = 74 patients. Margin of error was kept wide (8%) due to the low rate of pediatric congenital surgeries.

The study included pediatric patients (6 months to 6 years) undergoing thoracotomy for congenital heart diseases fulfilled the inclusion and exclusion criteria. By congenital heart disease (CHD, we meant, a structural heart defect due to malformation during embryonic period which manifest after birth. Patients with bleeding disorders, that is, patients with either decreased platelet count (<150,000) or increased International Normalised Ratio (INR) (higher than 2.0) and skin lesion at site of needle insertion were excluded. Age (years) and gender of the patients was recorded. Anesthesia fitness was obtained. On arrival to operation theatre, monitors (SpO2, Pulse Oximeter, NIBP, pre cordial stethoscope and ECG) will be applied. Emergency drugs will be prepared already before the patient arrives in operation theatre. Anaesthesia will be induced with 100% oxygen and sevoflurane using Jackson Rees Circuit. Once the desired depth of anaesthesia is achieved, I/V access was taken. Propofol 3mg/kg, atracurium 0.5mg/kg and Nalbuphine 0.1mg/kg was given followed by intubation with ETT of appropriate size. After this, patient would be placed in lateral position. Sufficient exposure would be done for Caudal Block. After taking all aseptic measures, Caudal Block procedure will be done with help of 23G needle after identifying the anatomical landmarks. On aspiration of the syringe if it is negative for CSF and blood, injection bupivacaine isobaric 0.25% at 1.5ml/kg was given. After this arterial line and central line was placed. Thoracotomy and surgery was performed by pediatric surgeon with minimum experience of five years. Patients were kept under observation and Face, Legs, Activity, Cry, Consolability (FLACC) score was evaluated and noted after six hours of the surgery by principal investigator. We administered our rescue analgesia in form of Nalbuphine if pain intensity found to be moderate to severe on FLACC scale. All the collected data was recorded on predesigned proforma (provided in annexure A). Confounding variables and

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recall bias was controlled by counter verification of pain score chart documented by nursing staff. Patient information was kept secured and accessible to authorized person only.

DATA COLLECTION PROCEDURE:
Data was entered and analysis using SPSS version-21. Shapiro-Wilk test was applied to check the hypothesis of normality for age (years) and FLACC score and was expressed using appropriate descriptive statistics such as mean ± SD, median (IQR), maximum and minimum. Frequency and percentages were calculated for categorical variables such as gender, age group, and pain relief. Effect modifiers like gender and age group were controlled through stratification. Post stratification appropriate chi-square test or fisher exact test was applied. Two sided p-value of ≤ 0.05 was taken as criteria of statistical significance. For the graphical presentation of data, bar graphs and pi-charts were used.

RESULTS:
Age range in this study was from 6 months to 6 years with mean age of 3.34 ± 1.51 years. Majority of the females i.e. 43 (58.11%) were between 6 months to 3 years of age as shown in Table I.
Out of these 74 patients, 45 (60.81%) were male and 29 (39.19%) were females with male to female ratio of 1.6:1 (Figure IV). Mean FLACC score was 2.05 ± 0.51 (Table II).
In my study, frequency of pain relief, using FLACC scores was found in 65 (87.84%) pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia as shown in Table III. Stratification of Pain relief with respect to age groups and gender is shown in Table IV & V respectively.

Table-I: Distribution of patients according to Age (n=74).

AGE	**NO. OF PATIENTS**	**PERCENTAGE**
6 months-3 years	43	58.11
4-6 years	31	41.89
Total	**74**	**100.0**

Mean ± SD = 3.34 ± 1.51 years

FLACC SCORE	NO. OF PATIENTS	PERCENTAGE
0-3	65	87.84
4-10	09	12.16
Mean ± SD	**2.05 ± 0.51**	

Table-II: Distribution of patients according to FLACC score (n=74).

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Table III: Stratification of Pain relief with respect to age groups

AGE GROUPS	PAIN RELIEF		P- VALUE
	YES	NO	
6 MONTHS – 2 YEARS	36	07	0.202
3 – 5 YEARS	29	02	

Table IV: Stratification of Pain relief with respect to gender

GENDER	PAIN RELIEF		P- VALUE
	YES	NO	
MALE	41	04	0.283
FEMALE	24	05	

DISCUSSION

The aim of the anesthesia strategies in congenital heart surgery is to provide an uneventful perioperative course with preventing devastating factors such as pain, anxiety, hypoxia and hypercarbia that increase the sympathetic nervous system activity and consequently myocardial oxygen consumption. Therefore it is important to provide effective perioperative analgesia with high fentanyl doses and suppression of the stress response. The use of regional anesthesia in adult patients undergoing open heart surgery is incrementally increasing due to many of its benefits such as reduction of postoperative complications and significantly decrease in morbidity and mortality.[10] Besides, regional anesthesia in pediatric cardiac surgery gained popularity in recent years and many benefits were reported such as in adults.[11]

Purpose of the regional analgesia is to prevent the surgical stress induced neuroendocrine response. Stress response to surgical trauma is characterized by hypermetabolism and alterations in the endocrine function. Not only pain, but also factors such as temperature alterations, hypovolemia, ischemia, acidosis, infection, type and duration of surgery may lead to stress response too. Increase in sympathetic activity due to pain, give rise to tachycardia and increase at peripheral vascular resistance which results with increase at cardiac load. Although epidural anesthesia is more effective than caudal anesthesia in suppressing stress hormones and catecholamines in adults undergoing cardiac surgery[12-14], caudal anesthesia with bupivacaine, showed significant decrease in serum cortisole and glucose compared to iv fentanyl in infants.[15]

I have conducted this study to determine the frequency of pain relief, using FLACC scores, in pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia. Age range in this study was from 6 months to 6 years with mean age of 3.34 ± 1.51 years. Majority of the females i.e. 43 (58.11%) were between

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6 months to 3 years of age. Out of these 74 patients, 45 (60.81%) were male and 29 (39.19%) were females with male to female ratio of 1.6:1. Mean FLACC score was 2.05 ± 0.51. In my study, frequency of pain relief, using FLACC scores was found in 65 (87.84%) pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia. Nguyen et al.[4] conducted a study to evaluate the role of caudal anesthesia in pain relief in pediatric patients undergoing congenital heart surgery. They utilized the Face, Legs, Activity, Cry, Consolability (FLACC) scale to assess the pain relief. Suty reported post-operative mild pain (FLACC score 0–3) in 85.8% and moderate to severe pain (FLACC scores 4–10) in 14.2% of the patients.

Since 1980, when this technique of epidural opioids was first introduced, has led up to significant results in the world of satisfactory analgesia.[16] Caudal anaesthesia has gained more recognition in paediatric anaesthesia especially in procedures involving below umbilicus level.[17-19] Serlin et al.,[20] in their study concluded and highlighted the safety of caudal epidural morphine amongst children who underwent thoracic and abdominal surgery. At the same time it is pertinent to mention that various studies have specifically been conducted confirming the safety of caudal in open heart surgery.[21] Rosen and Rosen,[22] in their study involving 32 children between age 2–12 years gave caudal morphine established the safety and effectiveness in postoperative management pain in children who underwent open heart surgery.

On the contrary, Bichel et al.,[23] compared general anesthesia synchronized with epidural anesthesia in one group vs deep opioid anesthesia in the other group in children who underwent cardiac surgery, showed that there was insignificant difference in the hemodynamics between the two groups. Similarly, Rojas-Pérez et al.,[24] concluded that caudal block showed minimal variations amongst children who received caudal for perioperative pain management.

Caudal anesthesia was found to be safe as long as Bupivacaine was used <2mg / kg. (20). However, there are very few reports about the effects of caudal epidural anesthesia on pain and stress response. In study of Bichel et al[25] suppression of surgical stress in pediatric cardiac surgery with epidural sufentanil is reported. Sendasgupta et al[26] evaluated the level of blood glucose, cortisol and the hemodynamic response on elective congenital heart surgery in children, they reported that caudal epidural sufentanil and bupivacaine in addition to general anesthesia suppresses the stress response.

CONCLUSION

This study concluded that the frequency of pain relief, using FLACC scores, in pediatric patients undergoing thoracotomy for congenital heart diseases with caudal anesthesia is very high. So, we recommend that caudal anesthesia should be used preferably in pediatric patients undergoing thoracotomy for congenital heart diseases in order to prevent post-operative pain in these patients.

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