European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 04, 2022

Original Research Article

A comparative randomized study of USG guided transversus abdominis plane block versus USG guided caudal block for post-operative analgesia in paediatric unilateral open inguinal hernia repair

[1]Dr. Mahesh Vinukonda, [2]Dr. Kanthala Santhosh Kumar, [3]Dr. Kiran Kumar Suggala

[1]PG Final Year, Mamata Medical College, Khammam, Telangana, India
[2]Senior Resident, Mamata Medical College, Khammam, Telangana, India
[3]Professor and HOD, Mamata Medical College, Khammam, Telangana, India

Corresponding Author:
Dr. Mahesh Vinukonda

Abstract

Introduction: Inguinal hernia repair, the commonly performed surgery in pediatric patient, is associated with significant postoperative pain. Transversus abdominis plane (TAP) block is the newly used regional technique for providing analgesia after abdominal surgeries. Use of ultrasound in regional anaesthesia has improved the safety and reliability of the TAP block and caudal block. There is limited literature comparing the effect of USG guided Transversus abdominis plane block and USG guided caudal block for post-operative analgesia. The aim of our study is to compare post-operative analgesia in USG guided Transversus abdominis plane block versus USG guided caudal block in unilateral open herniotomy in paediatric age group.
Methods: After approval of Institute ethical committee and parental consent, total of 60 patients of ASA I & ASA II physical status, aged between 2-8 years scheduled for elective open inguinal hernia repair surgery were randomly divided into 2 groups: Group T and Group C. After induction of general anaesthesia, Group C received USG guided Caudal block with 1ml/kg of 0.2% ropivacaine & Group T received USG guided TAP block with 0.5ml/kg of 0.2% ropivacaine. Inj. Paracetamol IV 15mg/kg was given in case of failed block.
The primary outcome variable duration of postoperative analgesia using CHEOPS score and the secondary outcomes like HR, BP, SPO2, were measured at 0,1,2,4,6,8,12,16,24 hours respectively and adverse effects, if any were noted.
Results: There was no significant difference in median CHEOPS score till 6 hours of postoperative period among both the groups and thereafter significantly lower CHEOPS score was found in Group T till 24 hours postoperative period, when compared to Group C. Mean duration of analgesia was 563.45±61.31 minutes in Group T, whereas in Group C, it was 362.59±32.54 minutes.
Conclusion: Thus, we conclude that USG-guided Transversus abdominis plane block provided longer duration of analgesia and reduced rescue analgesic dose without any significant adverse effects when compared with USG guided caudal block after inguinal herniotomy.

Keywords: Ultrasound guided transversus abdominis plane block (TAP), USG guided caudal block, unilateral open inguinal herniotomy, ropivacaine, pediatric, postoperative analgesia

ISSN 2515-8260 Volume 09, Issue 04, 2022

1. Introduction
Background

Inguinal hernia repair, the commonly performed surgery in paediatric patient's, is associated with significant postoperative pain. Caudal analgesia is commonly used regional technique in the paediatric population [2]. Transverse abdominis plane (TAP) block is the newly used regional technique for providing analgesia after abdominal surgeries [1]. Use of ultrasound in regional anaesthesia, has improved the safety and reliability of the TAP block and caudal block [2]. There is limited literature comparing the effect of USG guided TAP block and USG guided caudal block on post-operative analgesia.

2. Aim

The aim of our study is to compare post-operative analgesia in USG guided Transversus abdominis plane block versus USG guided caudal block in unilateral open herniotomy in pediatric age group.

3. Materials and Methods

- After obtaining approval from the institutional ethics committee and parent written informed consent. This prospective randomised comparative study was conducted on 60 patients of ASA I and ASA II physical status, aged between 2 and 8 years, who are scheduled for elective open inguinal hernia repair surgery over a period of one year from June 2021 to June 2022 in Mamata General & Super speciality Hospital, Khammam.
- 60 Patients were randomly divided into 2 groups Group C & Group T of 30 each, using a computer-generated random number table. In Group C, after induction of general anaesthesia, patients received USG guided Caudal block with 1ml/kg of 0.2% ropivacaine and in Group T patients received USG guided TAP block with 0.5ml/kg of 0.2% ropivacaine.
- Inj. Paracetamol 15mg/kg was given in case of failed block.
- Post-operative analgesia was evaluated using Children's Hospital Eastern Ontario Pain Scale (CHEOPS). If the CHEOPS score was greater than 6, patients are given rescue analgesia Inj. Paracetamol 15mg/kg IV. Post-operative need for rescue analgesia and its time and dosage were recorded. Adverse effects if any were noted.

4. Inclusion criteria

- Patients aged 2-8 years.
- ASA I-II.
- Either sex.
- Patients posted for elective open unilateral inguinal hernia repair.

5. Exclusion criteria

- Parental refusal.
- Bleeding disorders.
- Local site infection.
- Drug history of allergy or hypersensitivity.

ISSN 2515-8260 Volume 09, Issue 04, 2022

6. Methodology

- All patients were visited 1 day before the surgery. Informed consent from the patient's parent/guardian was taken. Preanesthetic evaluation was done and patient attenders were explained about anesthesia technique. On arrival to operation- theatre, standard routine monitoring of heart rate, blood pressure (BP), saturation (SpO2), electrocardiogram (ECG) was started and baseline readings were recorded. Patient were premedicated with inj. glycopyrrolate 0.005mg/kg, Inj. midazolam 0.05mg/kg, fentanyl 2mcg/kg, pre-oxygenated with 100% O2 for 3 min. Induction was carried out with inj. propofol 2-3mg/kg and intubated with an appropriated size endo tracheal tube after a loading dose of inj atracurium(0.6mg/kg), maintenance of anesthesia was done with O_2: N_2O 40:60, Sevoflurane 1-2%, inj Atracurium 0.1mg/kg given SOS.
- Linear array transducer probe of 6-13MHz connected to a portable ultrasound unit (Sonosite Edge II ultrasound system, Bothell, WA, USA) was used by senior anaesthetist for performing caudal block in group C & Transversus abdominis plane block in group T.
- Patients of group C were given ultrasound guided caudal block.
- Patients of group T were given ultrasound guided Transversus abdominis plane block.
- Successful blockade defined by a significant (20%) change in heart rate and/or mean arterial pressure (MAP) on application of skin incision, which was allowed 15mins after performing the technique. Signs of inadequate analgesia (>20% change in HR and/or MAP) persisting more than 1 min after skin incision were managed by increasing sevoflurane concentration and Inj. Paracetamol 15mg/kg and the block was considered a failure.
- After the skin closure, after achieving adequate spontaneous ventilation and neuromuscular recovery patients were reversed with inj. Neostigmine 40µ/kg and inj. glycopyrrolate 0.01mg/kg iv and extubated and shifted to PACU. Postoperatively, patients were observed for 24 hours in the PACU. Post-operative analgesia was evaluated using Children's Hospital Eastern Ontario Pain Scale (CHEOPS).

Children's Hospital Eastern Ontario Pain Scale (CHEOPS)		
Parameter	**Finding**	**Points**
CRY	No cry	1
	Moaning	2
	Crying	2
	Screaming	3
Screaming	Smiling	0
	Composed	1
	Grimace	2
child verbal	Positive	0
	None	1
	Complains other than pain	1
	Pain complains	2
	Both pain and non-pain complain	2
Torso	Neutral	1
	Shifting	2
	Tense	2
	Shivering	2
	Upright	2
	Restrained	2
Touch	Not touching	1
	Reach	2
	Touch	2

	Grab	2
	Retrained	2
Legs	Neutral	1
	Squirming kicking	2
	Drawn up tensed	2
	Standing	2
	Retrained	2

Interpretation

- Minimum score: 4
- Maximum score: 13
- CHEOPS pain score = SUM (points for all 6 parameters)

To maintain blinding post-operative evaluation of patient was done by an anaesthesia staff, who were not involved in administering block.

7. Statistical analysis

Data was entered at the end of study using Microsoft excel and was analyzed using SPSS statistical software (version 20.0 IBM Corporation, NY, USA). Numerical variables (e.g. age, weight, HR and BP) were presented as mean ± SD and categorical variables (e.g., sex and adverse effects) were presented in numbers and percentage (%). The quantitative variables were compared using unpaired t-test between the two groups. The qualitative variables were compared using the Chi-square test.
A 'p' value of less than 0.01 was considered significant.
A 'p' value of greater than 0.01 was considered not significant.

8. Results

A total of 60 children were participated in the study. There was no significant difference in terms age, gender, weight, height, BMI and duration of surgery between the two groups**.**

Demographic variables

Table 1: Demographic details of the study participants

Parameters	Group T (mean ± SD)	Group C (mean ± SD)	P value
Age (in years)	4.400±2.19	4.766± 2.12	0.5
Gender (M: F)	17:13	16:14	0.67
Weight (Kgs)	13.8±3.1	13.5±3.4	0.55
Height (cm)	103.65±32.65	105.87±28.76	0.37
BMI (Kg/m2)	13.82±0.6	12.27±1.3	0.3
ASA (I/II)	24/6	23/7	0.28
Mean duration of surgery	60.76±35.76	50.65±28.12	0.34

Table 1, shows age distribution, sex distribution and demographic profile such as weight, height and BMI and duration of surgery. Patients who took part in this study were in the age group of 2 to 8 yrs. The mean age of group T and C are 4.400±2.19 & 4.766±2.12 respectively. On statiscal comparison p value found to be > 0.05 hence the two groups were comparable.

ISSN 2515-8260 Volume 09, Issue 04, 2022

Heart Rate

Table 2

Postoperative Time	Group T (Mean ± SD)	Group C (Mean ± SD)	P Value
0 MIN	99.86 ± 5.52	94.83±5.56	0.229
1HR	99.86±5.52	94.83±5.6	0.229
2 HR	99.86±5.52	94.83±5.6	0.229
4HR	93.33±4.73	94.26±4.86	0.461
6HR	92.33±4.72	94.26±4.86	0.128
8HR	92.33±4.72	94.26±4.86	0.128
12HR	92.33±4.72	94.26±4.86	0.128
16HR	96.4±7.52	99.733±5.52	0.108
24HR	94.83±5.52	96.6±5.52	0.229

Table 2 shows mean heart rate measured at various intervals postoperatively in both the groups. Though there changes in the heart rate, it was not significant statistically.

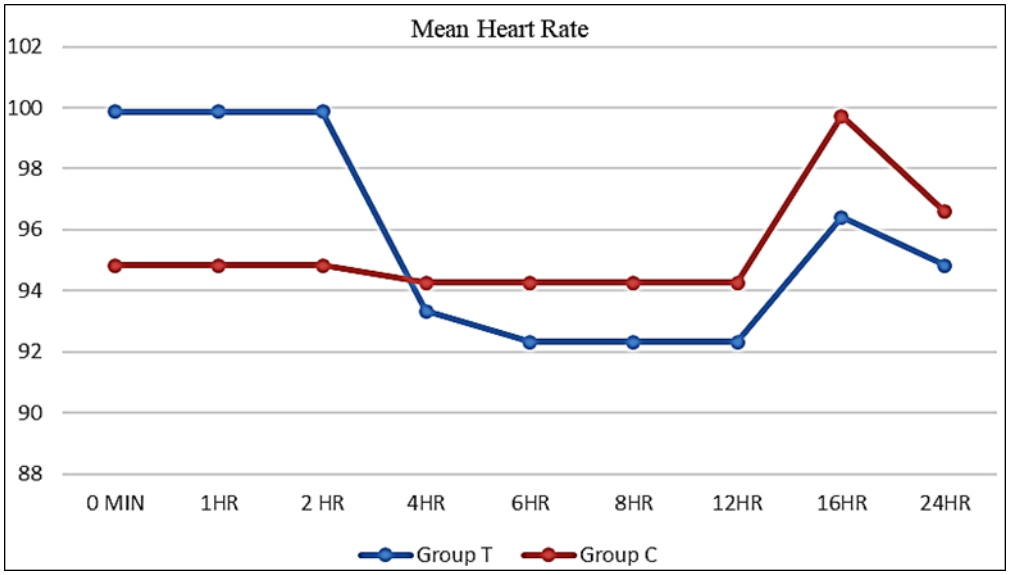

Fig 1: Graphical representation of Heart Rate

Mean arterial pressure

Table 3

Postoperative Time	Group T (mean ± SD)	Group C (mean ± SD)	P value
0 MIN	67.86±1.62	67.66±1.57	0.24
1HR	67.86±1.62	67.66±1.57	0.24
2 HR	67.86±1.62	67.66±1.57	0.24
4HR	67.86±1.62	67.66±1.57	0.24
6HR	67.3±1.59	66.7±1.67	0.16
8HR	67.3±1.59	66.7±1.67	0.16
12HR	66.7±1.67	66.7±1.67	0.16
16HR	67.83±1.694	67.2±1.81	0.17
24HR	67.86±1.627	67.66±1.57	0.24

Table 3 shows mean arterial pressure measured at various interval postoperatively in both the groups. The hemodynamics in the both the groups were stable and found to be statistically insignificant.

ISSN 2515-8260 Volume 09, Issue 04, 2022

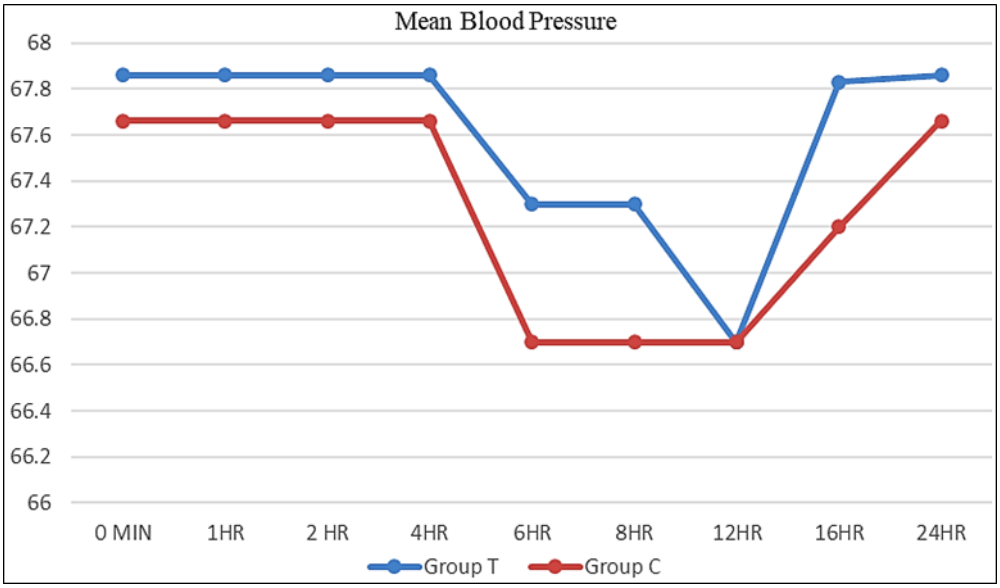

Fig 2: Graphical representation of Mean Arterial Pressure

Pain score

Table 4

Postoperative Time	Group T (mean ± SD)	Group C (mean ± SD)	P Value
0 MIN	5.166±0.372	5.3±0.458	0.229
1HR	5.166±0.372	5.3±0.458	0.229
2 HR	5.166±0.372	5.3±0.458	0.229
4HR	5.166±0.372	5.3±0.458	0.229
6HR	5.033±0.179	5.166±0.372	0.089
8HR	7.1±0.179	5.166±0.372	0.001*
12HR	7.566±0.773	6.000±0.001	0.001*
16HR	8.166±0.592	7.000±0.001	0.001*
24HR	8.500±0.820	7.000±0.001	0.001*

Table 4 shows mean CHEOP score measured at various intervals postoperatively in both the groups.

- When compared with Group C, Group T had less CHEOPS score.
- During the first 6 hours there was no significant (p=0.089) difference in the CHEOPS score between Group T and Group C.
- At 8th, 12, 16, 24 hour there was a significant difference in the CHEOPS score between Group T and Group C with p=0.001.

ISSN 2515-8260 Volume 09, Issue 04, 2022

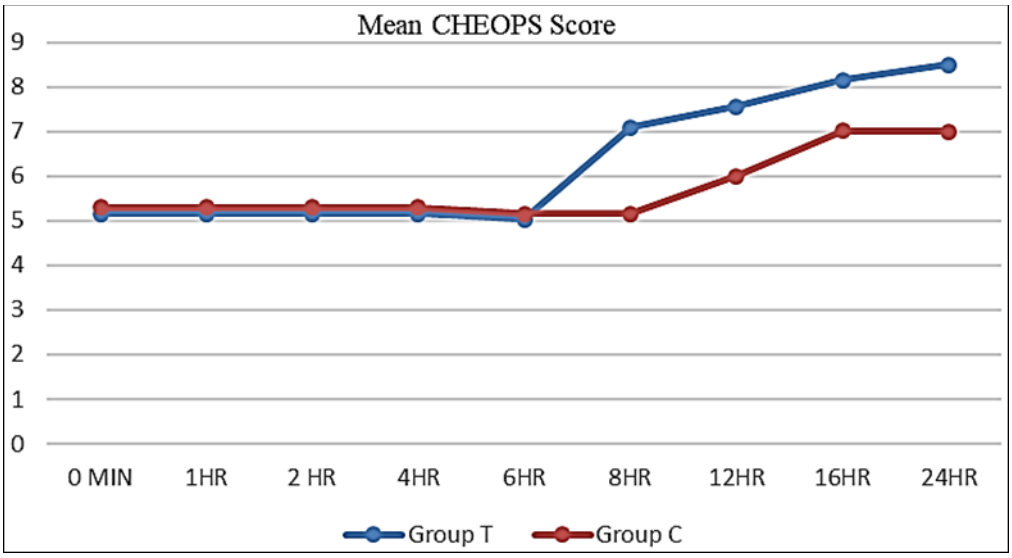

Fig 3: The above graph indicates the CHEOPS score post operatively in both groups

Duration of analgesia

Table 5

	Group T (Mean ± SD)	Group C (Mean ± SD)	P
Mean duration of analgesia	563.45±61.31	362.59±32.54	0.0001*
Total no. of rescue analgesia doses	2.73±0.58	3.64±0.48	0.0001*
Total dose of rescue analgesic given in 24h	21.71±6.25	36.31±4.87	0.0000*

Table 5 shows Mean duration of analgesia, total no & total dose rescue analgesia in both groups.

- In Group T mean duration of analgesia is 563.45±61.31 minutes, where as it was 362.59±32.54 minutes in group C, which was found to be statistically significant(p=0.001). This showed that Group T provided longer duration of analgesia when compared with Group C (P value: 0.0001).
- The mean number of rescue analgesia doses in group T is 2.73±0.58 where as it was 3.64±.48 minutes in group C, which was found to be statistically significant (p=0.001).

Nausea and Vomiting

- In postoperative period, total 8 patients in Group T and 14 patients in Group C suffered from nausea and vomiting, but this difference is not statistical significant.

Other side effects, such as hypotension, bradycardia, respiratory depression, and urinary retention, were not reported in both the groups.

9. Discussion

Transversus abdominis plane (TAP) block has emerged as a reliable technique of postoperative multimodal analgesia over the past decade. Since its introduction by Rafil in 2001, due to increased usage of ultrasound and enhanced understanding of anatomy, the Transversus abdominis plane block has evolved into various sub-blocks which target various dermatomes of the abdomen. In this prospective randomized study, we compared USG-guided Transversus

ISSN 2515-8260 Volume 09, Issue 04, 2022

abdominis plane block with USG-guided caudal block for postoperative analgesia after inguinal herniotomy [10]. Our results showed that USG-guided Transversus abdominis plane block provided longer duration of analgesia upto 24 hours postoperatively when compared with the USG-guided caudal block, as demonstrated by a statistically significant decrease in number of rescue analgesic doses and reduced total rescue analgesic consumption in 24 h.

In day care paediatric surgical procedures such as inguinal herniotomy adequate postoperative pain relief is essential is required for early day discharge. Opioids and NSAID are currently used heavily in postoperative pain management, but they have several unwanted side effects in paediatric. In addition, various regional anaesthesia techniques are being used as a part of multimodal analgesia regimen.

The use of regional anaesthesia in children is increasing. It is becoming an integral part of intra- and postoperative analgesia. Regional techniques in children are mostly performed under general anaesthesia. Caudal epidural anaesthesia accounts for over half of regional techniques performed in children. Unlike in the adult population, paediatric regional anaesthesia is an integral part of analgesia rather than being used for anaesthesia [9].

Recently, use of Transversus abdominis plane block shown to provide analgesia for 24h seems promising alternative analgesic option. Although there are numerous local anaesthetic agents available, we chose ropivacaine, the S-enantiomer of the amide local anaesthetic, because it is less cardiotoxic and neurotoxic in children and provides more sensory block than motor block, making it more suitable for postoperative analgesia.

In this study we observed longer duration of analgesia and reduced need for rescue analgesic drug, in USG guided Transversus abdominis plane block when compared to USG guided caudal block. Our study confirms the findings of other studies. Patients in both the groups had significantly lower pain scores (CHEOPS <6) until initial 6 hours of postoperative period, but thereafter, patients in USG guided TAP block group had significantly lower pain when compared to patients in USG guided caudal block group, with p=0.001.

Amit Kumar *et al*. [3], compared the duration of postoperative analgesia for USG guided block (0.5mL/kg of 0.2% ropivacaine) versus caudal block (1mL/kg of 0.2% ropivacaine) in children undergoing inguinal hernia surgery and concluded that Transversus abdominis plane block is superior to caudal block because it does provide a longer duration of postoperative analgesia.

Rautela MS *et al*. [4], compared the postoperative analgesia effect of USG guided Transversus abdominis plane block (0.5 ml/kg 0.25% bupivacaine) and caudal block (0.75/kg 0.2% bupivacaine) in unilateral day-case open inguinal hernia repair in children and concluded that USG guided Transversus abdominis plane block is as effective as a caudal block in providing immediate postoperative analgesia in inguinal hernia repair.

Aradhana Devi *et al*. [5], compared the postoperative analgesia effect of USG guided Transversus abdominis plane block (0.25% bupivacaine 0.5ml/kg) versus caudal block (0.25% bupivacaine 1ml/kg) for post-operative analgesia in paediatric unilateral open inguinal hernia repair and concluded that caudal block and USG guided Transversus abdominis plane block were having stable intraoperative and post-operative hemodynamic conditions for a period of 6 hours. these observations were similar with our results, for initial 6 hours of our study.

We observed statistically significant reduction in total number of rescue analgesia doses requirement in 24 hours of postoperative period in USG-guided Transversus abdominis plane block group when compared to caudal group. similar findings were noted in studies done by Amit Kumar *et al*. [3], Rautela MS *et al*. [4] and Aradhana Devi *et al*. [5].

Postoperative nausea and vomiting were less in TAP block group when compared to caudal group, but the difference was not significant statistically. similar findings were noted in studies done by Amit Kumar *et al*. [3], Rautela MS *et al*. [4] and Aradhana Devi *et al*. [5] reports.

In our study there was no significant change in the hemodynamics during the study, similar

findings were noted in studies done by Amit Kumar *et al*. [3], Rautela MS *et al*. [4] and Aradhana Devi *et al*. [5].

10. Conclusion

We conclude that ultrasound guided Transversus abdominis plane block is effective in providing longer duration of postoperative pain relief in paediatric patients undergoing unilateral open inguinal hernia repair, when compared to USG guided caudal block, with well-maintained hemodynamics postoperatively.

11. Source of Funding: Nil.

12. Conflict of Interest: There are no conflicts of interest.

References

1. Sanghvi C, Dua A. Caudal Anesthesia. [Updated 2022 Apr 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing, 2022 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK551693/
2. Gropper MA, Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, *et al*. Miller's anesthesia, 2-volume set E-book. Elsevier Health Sciences, 2019 Oct.
3. Kumar A, Dogra N, Gupta A, Aggarwal S. Ultrasound-guided transversus abdominis plane block versus caudal block for postoperative analgesia in children undergoing inguinal hernia surgery: A comparative study. Journal of Anaesthesiology, Clinical Pharmacology. 2020 Apr;36(2):172.
4. Rautela MS, Sahni A, Dalal N. Is ultrasound-guided transversus abdominis plane block superior to a caudal epidural or wound infiltration for intraoperative and postoperative analgesia in children undergoing unilateral infraumbilical surgery? A double-blind randomized trial. Journal of Indian Association of Pediatric Surgeons. 2022 Jul;27(3):323.
5. Aradhana Devi, Richa Chinchkar, Nikhat Parkar, Olvyna Dsouza. A comparative randomized study of USG guided transversus abdominis plane block versus caudal block for post-operative analgesia in paediatric unilateral open inguinal hernia repair. Int. J Heal. Clin. Res. [Internet], 2022 Feb. 2 [cited 2022Sep.12];4(24):392-6.
6. Siddiqui A. Caudal blockade in children. Tech Reg Anesth Pain Manag. 2007;11:203-207.
7. Silvani P, Camporesi A, Agostino MR, Salvo I. Caudal anesthesia in pediatrics: an update. Minerva anestesiologica. 2006 Jun;72(6):453-9.
8. McDonnell JG, O'Donnell B, Curley G, Heffernan A, Power C, Laffey JG. The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial. Anesthesia & Analgesia. 2007 Jan;104(1):193-7.
9. Holt F, Wa TK, Ng E. Ultrasound Guided Caudal Anaesthesia.
10. Mallan D, Sharan S, Saxena S, Singh TK. Anesthetic techniques: focus on transversus abdominis plane (TAP) blocks. Local and Regional Anesthesia. 2019;12:81.
11. Sethi N, Pant D, Dutta A, Koul A, Sood J. Abstract PR267: Comparison of Caudal Epidural Block and Ultrasound Guided Transversus Abdominis Plane Block for Pain Relief in Children Undergoing Lower Abdominal Surgery. Anesthesia & Analgesia. 2016 Sep;123(3S):346.
12. Kollipara N, Kodali VR, Parameswari A. A randomized double-blinded controlled trial comparing ultrasound-guided versus conventional injection for caudal block in children undergoing infra-umbilical surgeries. Journal of Anaesthesiology, Clinical Pharmacology. 2021 Apr;37(2):249.

ISSN 2515-8260 Volume 09, Issue 04, 2022

13. Mageed AM, Hussaein WR, Hafiez RH, Hammouda TA. Comparative Study between Caudal Block and Local Wound Infiltration in Inguinal Hernia Repair in Pediatric Patients. QJM: An International Journal of Medicine. 2021 Oct;114(1):hcab086-108.
14. Kumar A, Dogra N, Gupta A, Aggarwal S. Ultrasound-guided transversus abdominis plane block versus caudal block for postoperative analgesia in children undergoing inguinal hernia surgery: A comparative study. Journal of Anaesthesiology, Clinical Pharmacology. 2020 Apr;36(2):172.
15. Sethi N, Pant D, Dutta A, Koul A, Sood J. Abstract PR267: Comparison of Caudal Epidural Block and Ultrasound Guided Transversus Abdominis Plane Block for Pain Relief in Children Undergoing Lower Abdominal Surgery. Anesthesia & Analgesia. 2016 Sep;123(3S):346.