

## 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

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### Abstract

**Background:** Inguinal hernia surgery is associated with moderate to severe post-operative pain especially in paediatric age groups as pain threshold is lesser in children so in this study our aim was to compare usg guided transversus abdominis plane block and caudal block for post-operative analgesia for unilateral inguinal hernia repair surgeries. **Materials and Methods:** 60 pediatric patients of American society of anaesthesiologist (ASA) I /II aged 1-8 years of either gender, scheduled for elective open unilateral inguinal hernia repair under general anesthesia were divided into two groups. Patients of group 1 were given caudal block group using 0.25% bupivacaine 1ml/kg and group 2 were given ultrasound guided TAP block using 0.25% bupivacaine 0.5ml/kg. The postop analgesic efficacy, hemodynamic stability, degree of motor weakness and Adverse effects if any was noted. **Results:** There was no significant difference in median CHEOPS score until 6 hours in postoperative period. No Significant difference was observed in hemodynamic parameters in intraoperative and postoperative period. All patients in both the groups were comfortable with a CHEOPS score between 5-6 in the post-operative period with no opiate requirements. No significant haemodynamics changes and adverse effects were observed. **Conclusion:** We found that children in both the study groups i.e caudal block and USG guided TAP block were having stable intraoperative and post-operative hemodynamic conditions. Post-operative analgesia measured using CHEOPS score was maintained between 5-6 and patients in both groups were comfortable throughout the study period. There was no need of any rescue analgesia during post-operative period for the study period of 6 hours.

**Keywords:** caudal block, tap block, cheops score, post-operativ analgesia Paediatric.

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### Introduction

Post-operative pain is associated in many surgeries which is an important variable in the surgical stress response and outcome. Hence opioids are used widely for patient-controlled analgesia. But their side effects limit their efficacy. Caudal epidural analgesia is one of the most commonly used regional technique in the pediatric population. It is being used as an anesthetic adjuvant to general anesthesia in providing post-operative pain relief for lower abdominal procedures[1]. Because of the easy access through the sacrococcygeal ligament and the potentially reduced risk of injury to neural structures at this level compared with access at lumbar and thoracic levels, the caudal approach to epidural space is preferred in children[2]. Transversus abdominis plane (TAP) block is the newly used regional anesthesia technique for providing analgesia after abdominal surgeries. This is performed through lumbar triangle by landmark technique or with ultrasound guidance[3]. TAP block was described by Rafi in 2001 in adult patients initially. Later Hebbard also described an ultrasound technique. TAP block has been used for pediatric use which acts by blocking the anterior branches of spinal nerves from T7-L1 in anterior abdominal wall lying in the neurofascial plane between internal oblique and transversus abdominis muscle[4]. There have been few studies describing the use of TAP block for herniotomy in children.

This study aim was to compare post-operative analgesia in TAP block versus caudal block in unilateral open herniotomy in pediatric age group. The analgesic efficacy, hemodynamic stability, degree of motor weakness and adverse effects if any was noted.

### Methods

This Prospective randomized study was conducted after approval by the Institute Ethical Committee and written informed consent from the parents. 60 pediatric patients of ASA I – II, aged 1-8 years, scheduled for elective open unilateral inguinal hernia repair under general anesthesia were included for the study. Exclusion criteria included parents refusal, any bleeding disorders, local site infection and any drug history of allergy or hypersensitivity. The study was carried out from December 2017 to November 2019. The total 60 patients were equally divided into two groups of 30 patients randomly by using computer generated table ensuring allocation concealment into Group 1 were given caudal block Group 2 were given ultrasound guided TAP block.

Thorough Preanesthetic check up was done in each patient. All patients were kept fasting as per standard protocol. All children were premedicated orally with midazolam 0.05mg/kg 30min prior to surgery. On arrival to operation theatre, Intravenous line was secured standard routine monitoring of heart rate, systemic arterial blood pressure, pulse oximetry (SpO<sub>2</sub>), electrocardiogram (ECG) were started and baseline reading T0 were recorded. Then readings were recorded every 15mins. All patients received general anesthesia. Sevoflurane was used for induction and maintenance of anesthesia. Airway was secured using an LMA. Anesthesia was maintained with sevoflurane, nitrous oxide 60% in O<sub>2</sub>. Group 1 patients were placed

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in left lateral position and block was given using 0.25% bupivacaine 1ml/kg and Group 2 patients were placed in supine position. Using the ultrasound probe rectus muscle was visualized at the level of umbilicus, in the same side of the surgery. Probe was further moved laterally to scan the anterolateral part of the abdomen to obtain transverse view; external oblique muscle, internal oblique muscle, transversus abdominus muscle, peritoneal cavity[31]. Then after skin disinfection, a 22G 50mm needle with an injection line was used. Once the tip of the needle was placed in the space between the internal oblique muscle and transversus abdominus muscle, using the in-plane technique to visualize the entire needle and after negative aspiration, injection bupivacaine 0.5ml/kg 0.25% was injected. This injection was considered successful when an echoluscent lens shape appeared between the two muscles. Successful blockade defined by the absence of gross movement or 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 (gross movements or >20% change in HR and/or MAP) persisting more than 1 min after skin incision were managed by increasing sevoflurane concentration and fentanyl 1ug/kg and the block was considered a failure. Inj. Fentanyl was repeated intraoperatively and the time and dose were noted[29]. Postoperatively, patients were observed for 6 hours in the recovery room. Post-operative analgesia was evaluated using Children’s Hospital Eastern Ontario Pain Scale (CHEOPS)[32]. CHEOPS is a

behavioral scale intended for children aged 1-8 yrs. It encompasses 6 indicators. Children were observed for 1 min to fully assess each indicator. The score ranges from 4 to 13. If score was above 6, we used rescue analgesia (IV paracetamol 15mg/kg)[32]. Post-operative need for rescue analgesia and its time and dose was noted. Motor weakness was assessed by using a three-point scale[31] 0- no movements 1-possible to move legs 2- able to stand .The sites of TAP block and caudal block were checked to detect any complications like hematoma. Any adverse effects like nausea, vomiting, inflammation was noted.

**Results**

The age wise distribution among the two groups, the mean age for group 1 was 5.366 years and group 2 was 5.066 years. P value was 0.54 which was insignificant. The difference between mean weight for two groups was insignificant. P value was 0.629 The sex wise distribution in both the groups which showed no significant difference. There was no significant difference in CHEOPS score till 6 hours post operatively. There was no significant difference between the two groups in Mean arterial pressure and heart rate in the intraoperative and postoperative period. No rescue analgesia was required in both the groups during the study period. The mean saturation levels among two groups was well maintained between 99-100%

**Heart Rate**

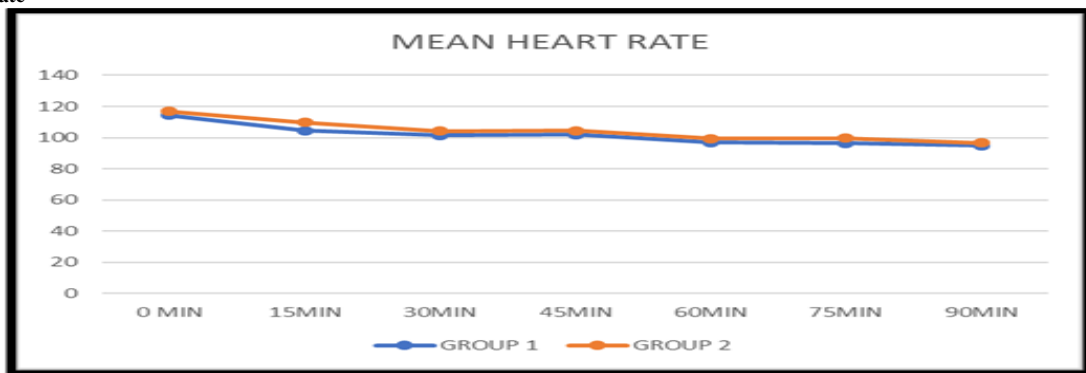


Fig 1:Mean heart rate

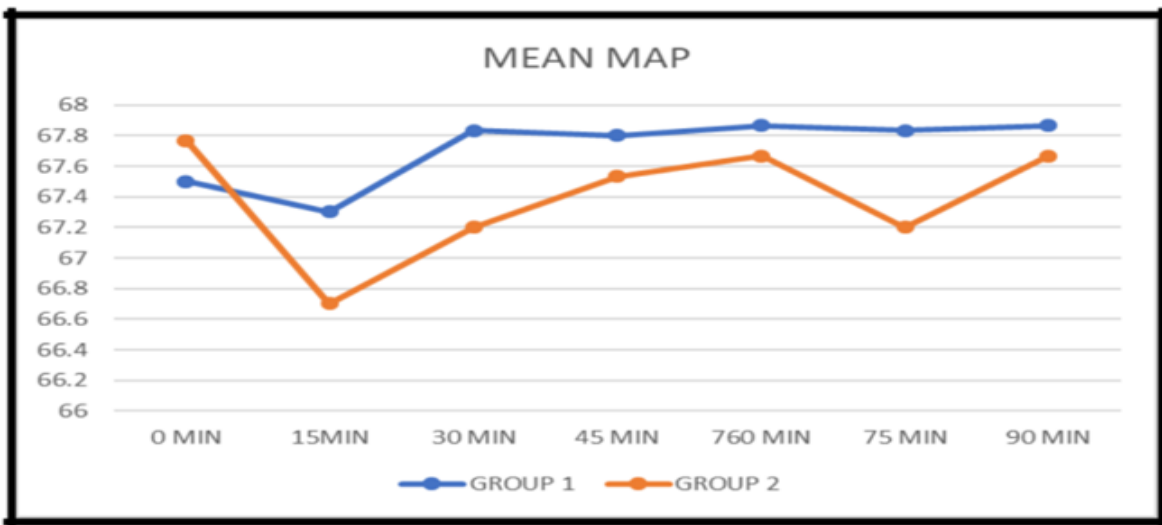
Table 1: Mean heart rate

	GROUP	N	MEAN	SD	SEM	T STAT	df	P VALUE
0 min	1	30	114.4	6.249	1.146			
(application of block)	2	30	116.733	6.667	1.217	-1.453	58	0.151
15 min (skin incision)	1	30	104.4	6.75	1.232			
	2	30	109.8	7.837	1.43	-1.77	58	0.082
	1	30	101.366	6.997	1.277			
30 min	2	30	104.166	7.594	1.386	-1.46	58	0.149
	1	30	101.966	7.068	1.29			
45min	2	30	104.366	7.939	1.449	-1.215	57	0.22
	1	30	96.966	6.94	1.267			
60 min	2	30	99.33	8.1	1.478	-1.194	57	0.23
	1	30	96.4	7.521	1.373			
75 min	2	30	99.733	5.52	1.007	-1.629	58	0.108
	1	30	94.833	5.52	1.007			
90 min	2	30	96.6	5.52	1.007	-1.213	58	0.229

The above table represents the mean of intraoperative HR of the two groups, there was no significant difference regarding intraoperative heart rate between the two groups as p value is >0.05.

**Table 2:No significant difference among two groups regarding MAP**

	GROUP	N	MEAN	SD	SEM	TSTAT	df	P VALUE
0 MIN (application of block)	1	30	67.5	1.8	0.328			
15 MIN (skin incision)	2	30	67.766	1.584	0.289	0.447	57	0.656
30 MIN	1	30	67.3	1.594	0.291			
45 MIN	2	30	66.7	1.676	0.306	1.396	58	0.16
60 MIN	1	30	67.433	1.605	0.293			
75 MIN	2	30	65.419	1.404	0.256	-0.42	57	0.675
90 MIN	1	30	67.8	1.492	0.272			
	2	30	67.533	1.564	0.285	0.664	58	0.5
	1	30	67.866	1.627	0.297			
	2	30	67.666	1.577	0.287	1.137	29	0.24
	1	30	67.833	1.694	0.309			
	2	30	67.2	1.814	0.331	1.373	58	0.17
	1	30	67.866	1.627	0.297			
	2	30	67.666	1.577	0.287	1.137	29	0.24



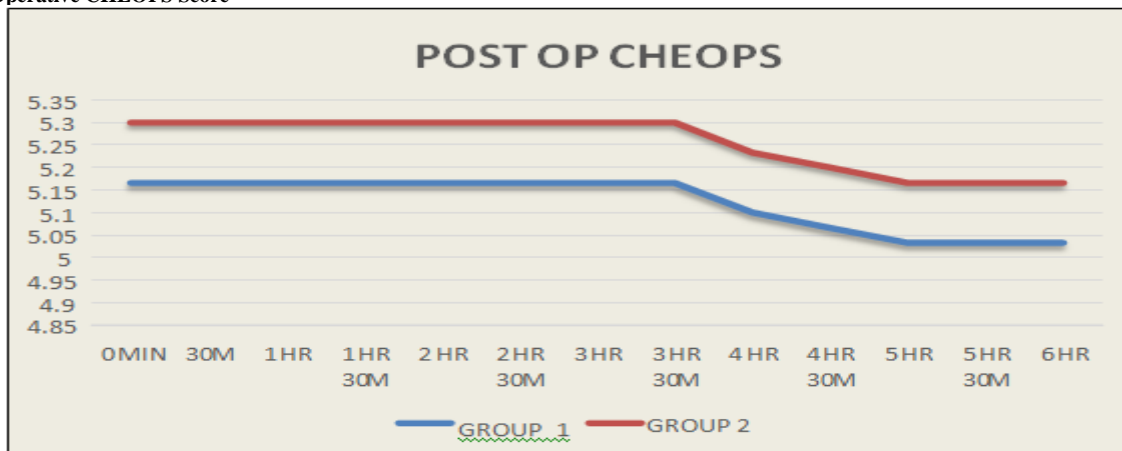
**Fig 2: No significant difference among two groups regarding MAP**

The above table and graph indicate that there no significant difference among two groups regarding MAP as p value is >0.05.

**Post operative pain score**

Patients were observed postoperatively up to 6 hours. CHEOPS score was calculated in order the assess the pain scores in our study groups based on the CHEOPS criteria. If score was >6 then rescue analgesia in the form of IV paracetamol was administered.

**Post Operative CHEOPS Score**



**Fig 3:Post OP CHEOPS**

The above graph indicates the CHEOPS score post operatively in both groups. The difference among the groups was not significant.

### Discussion

Effective post-operative analgesia is important in pediatric patients due to its potential benefits of reduced rescue post-operative analgesia, early mobilization, better parent satisfaction and shorter hospital stay. Various techniques of regional anesthesia have been used to provide post-operative pain relief in pediatric age group. Caudal anesthesia is one of the oldest modalities and still commonly used method in children. It is used for surgical procedures below the umbilical level like inguinal hernia surgeries, orthopedic surgeries, urinary procedures. It is a safe, simple and effective method for providing post-operative pain relief in infra-umbilical procedures and reduces need for intraoperative analgesia. The transversus abdominus plane block (TAP) is a compartment block which is a good alternative technique to central neuraxial blockade that provides analgesia through injections between the internal oblique and transversus abdominus muscles. The target nerves being ilioinguinal and iliohypogastric nerves. This study was conducted in the Department of Anesthesiology, MGM Medical College from December 2017 to November 2019. In our study comprising of 60 pediatric patients aged between 1 to 8 years, 30 patients were allocated to group 1 and group 2 each. After the induction of general anesthesia and securing the airway using an LMA, the patients were given the desired block. Caudal group (group 1) received caudal block using 1ml/kg of 0.25% Inj. Bupivacaine. TAP group (group 2) received USG GUIDED TAP block using 0.5ml/kg of 0.25% Inj. Bupivacaine. The demographic data obtained, the mean age of patients in Groups 1 and 2 was 5.366 years and 5.066 years respectively. Statistically, there was no significant difference between the groups ( $p=0.54$ ). The mean weight of patients in Groups 1 and Group 2 was 16.666 and 16.133 kilograms respectively. This showed no significant difference between the two groups ( $p=0.629$ ). There was no statistical difference between both the groups with regards to sex, duration of surgery and ASA grading. Both the groups were comparable to each other.

### Intra operative

In our present study, heart rate was comparable between the two groups. Preoperatively mean heart rate was  $115 \pm 5$  beats/min. We observed that there was no significant change between the preoperative and intraoperative heart rate in both the groups and, also before and after application of the desired block. Heart rate was maintained between 90-110 beats/min showing no episodes of tachycardia, in either of the groups. Also, the  $p$  value  $>0.05$  showing that there was no significant difference between the 2 study groups. Kanojia et al in their study both the groups intraoperative hemodynamic parameters like HR and MAP were within the normal limits and did not show any significant increase i.e.  $>20\%$  from the baseline recorded values. We also recorded mean arterial pressure every 15 mins. The mean arterial pressures in both the groups was maintained between the range of 66-68mmhg with no episodes of hypertension.  $P$  value was  $>0.05$  showing no significant difference between both groups. Mohammed et al which compared USG guided TAP block vs USG guided caudal block vs conventional analgesia for lower abdominal surgeries in children, showed that MAP, pre-operative and intraoperative HR had no significant differences between the groups.

None of the patients showed any signs of inadequate analgesia (gross movements or  $>20\%$  change in HR and/or MAP) at the time of surgical incision requiring intravenous Fentanyl.

### Post-operative

Monitoring of HR postoperatively was done every 30 mins up to 6 hours, with no significant difference in either of the groups ( $p=0.229$  and  $p=0.461$  at 0mins and 6 hours respectively). No episodes of tachycardia were recorded. Heart rate was maintained between 90-110 beats/min. Mean arterial pressure post operatively was well maintained between 66-68 mm hg in both groups. Monitoring was done every 30 mins up to 6 hours in both the groups. No episodes of hypertension were noted. Mohammed et al which compared USG guided TAP block vs USG guided caudal block for pain relief in

children undergoing lower abdominal surgeries, showed that, there were no complications in terms of postoperative hemodynamic instability in all the groups[38]. Our study showed that post operatively oxygen saturation levels were also normal with no episodes of desaturation.

### Cheops pain score

CHEOPS (children's hospital eastern Ontario pain scale) is based on 6 criteria: crying, facial expression, child verbal expression, torso, touching at wound and legs position[23]. All parameters of CHEOPS were closely monitored post operatively every 30 mins up to 6 hours in both groups. Both the techniques (USG guided TAP block and caudal block) were successful in providing excellent intraoperative and post-operative analgesia in the patients. No requirement of rescue analgesia was noted during the study period of 6 hours. All patients in both the groups were comfortable with a CHEOPS score between 5-6 in the post-operative period with no opiate requirements. The CHEOPS score of 5-6 is maintained throughout the study period of 6 hours in both the groups. In a study done by Fredrikson M Seal et al[2] three patients showed signs of incomplete analgesia and were given Inj. Fentanyl. The short time of 5 min between the application of block and skin incision may explain the incomplete intraoperative analgesia. However, in our study skin incision was allowed after 15 min of application of block. In another study by Kanojia et al, comparing TAP block vs caudal block for postop analgesia in children undergoing lower abdominal surgeries, VAS scores were analyzed which were very low in both groups showing good analgesia in postoperative Period[24]. No post-operative side effects like motor blockade, nausea /vomiting, hematoma formation was noted in any of the two study groups. No post-operative rescue analgesia was required during the study period (6hr postoperative).

### Conclusion

In this study, we found that children in both the study groups i.e caudal block and USG guided TAP block were successful in providing intra operative and post-operative hemodynamic stability and analgesia in pediatric patients posted for inguinal hernia repair. Post-operative analgesia measured using CHEOPS score was maintained between 5-6 and patients in both groups were comfortable throughout the study period. Also, there was no need of any rescue analgesia during post-operative period for the study period of 6 hours. Thus, we concluded that both caudal block and USG guided TAP block are effective in providing both intra operative and post-operative analgesia and maintaining hemodynamic stability.

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