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Original Research Article

COMPARISON OF ULTRASOUND GUIDED TRANSVERSUSABDOMINIS PLANE BLOCK AND CAUDAL EPIDURAL BLOCK FOR PAIN RELIEF UNDERGOING ONE SIDE INGUINAL HERNIOTOMY IN PAEDIATRIC GROUP

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Abstract

Perioperative pain in paediatric population is undertreated in a substantial percentage, due to myths that children do not feel pain. It is also dueto the developmental and cognitive differences in children that pose difficultyin assessment of their pain.In reality, children tend to have more physical and emotional reactionsto pain than adults. They require adequate pain relief to prevent acute and long term adverse effects.In order to provide optimal perioperative pain relief for children, local anaesthetics should be a part of the initial pain management plan which is accomplished by choosing a regional anaesthetic technique such as neuraxial blockade, peripheral nerve blockade

Keywords: Chidren, Appendix, Hernia

Introduction

Perioperative pain in paediatric population is undertreated in a substantial percentage, due to myths that children do not feel pain. It is also dueto the developmental and cognitive differences in children that pose difficultyin assessment of their pain.[1]

In reality, children tend to have more physical and emotional reactionsto pain than adults. They require adequate pain relief to prevent acute and long term adverse effects.

In order to provide optimal perioperative pain relief for children, local anaesthetics should be a part of the initial pain management plan which is accomplished by choosing a regional anaesthetic technique such as neuraxial blockade, peripheral nerve blockade or local infiltration of the wound along with General anaesthesia or sedation.[2]

Among the regional techniques, Caudal block is the oldest and most commonly used regional technique of anaesthesia.[3]

It has been the most preferred technique for lower abdominal & lower limb surgeries for infants & children but is associated with side effects such as motor blockade in lower limbs and retention of urine.

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

The main disadvantage of a single-shot Caudal block, is that it can give only a short duration of post-op pain relief, requiring supplementationof other analgesics.[4]

There is a recent trend towards regional nerve blocks, under ultrasound guidance, as they provide better safety and are associated with lower incidence of adverse effects compared to neuraxial blocks.

Transverse Abdominis Plane block (TAP) block, is an abdominal field block, which provides myocutaneous analgesia, by depositing local anaesthetic drug in the plane between the two muscles, namely Internal Oblique andTransversus Abdominis.[5] This fascial plane is a potential space where theanterior rami of the thoracolumbar nerves (T6-L1) traverse and can be effectively blocked before they supply the anterior abdominal wall muscles andthe skin. The plane can be reached after two pop offs felt while piercing the fascial extensions of external and internal oblique, with the help of a needle perpendicular to the skin while entering through the lumbar triangle of petit. It has been shown that TAP block is easy and safe to perform under ultrasound guidance.

It has been studied to be effective in reducing the post-operative pain scores and morphine consumption in adult patients undergoing appendicectomies, infra-umbilical surgeries, and caesarean sections.[6] There are few recent studies describing the efficacy of TAP block in paediatric population. But there is not much information on how far it is superior to the most preferred caudal block in paediatric surgeries. Since Inguinal hernia repair is one of the most frequently performed paediatric surgical procedure[7], this study was conducted in children undergoinginguinal herniotomy.

MATERIALS AND METHODS

A Randomised Control Trial was conducted in 60 children, undergoing unilateral inguinal herniotomy in Department of Anaesthesiology ,ESIC Medical College, Kalaburagi, after obtaining informed consent from the parents/guardian of the patients. They were randomly allocated into two groups, Group T and Group C, with 30 patients in each, using computer allocated random numbers.

Group T (n=30) Receiving USG-guided TAP Block with 0.5ml/kg of 0.25% bupivacaine.

Group C (n= 30) Receiving Caudal Epidural Block with 1ml/kg of 0.25% bupivacaine

INCLUSION CRITERIA:

- Children of age group 1-7 yrs, weighing 5-20kg, of ASA status I – II
- To undergo Unilateral Inguinal Herniotomy, were included in thestudy.

EXCLUSION CRITERIA:

- Infants less than 2yrs of age and more than 7yrs of age
- Infants less than 5 kg and children more than 20kg
- Children undergoing Bilateral Inguinal Herniotomy
- Children with known allergy to the drugs used in the study
- Local infection at the site of the block
- Children belonging to ASA status III, IV
- Children with contraindications for caudal anaesthesia such as major sacral malformations, those with meningitis, with raised intracranial hypertension.
- Parent refusal for consent This study was conducted to compare the efficacy of the Ultrasound- guided TAP block with the Caudal epidural block for intra-operative and post-operative pain relief.

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

RESULTS

Sixty patients were involved in the study and were randomly allocatedinto two groups, Group T (n=30) and Group C (n=30)

TABLE 1: DEMOGRAPHIC VARIABLES

S.No	Characteristic	USG guided TAP block	Caudal Epidural block	P value
1.	**Age**	4.40± 1.831	4.37± 1.650	0.941
2.	**Sex- Male**	27(90)	28(93.3)	0.640
3.	**Weight**	13.73± 3.667	13.40±4.090	0.741
4.	**Height**	110.83± 21.050	104.72± 20.365	0.257

Demographic Variable such as Age, Sex, Weight and Height werecomparable in both the groups

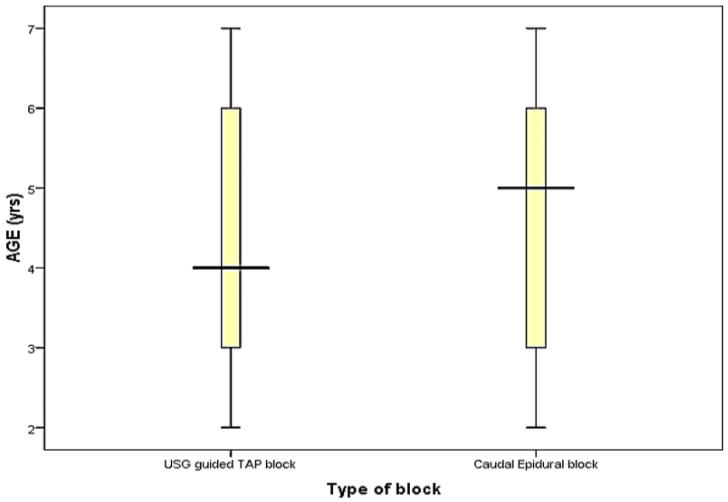

CHART 1: AGE DISTRIBUTION (MEAN ± SD)

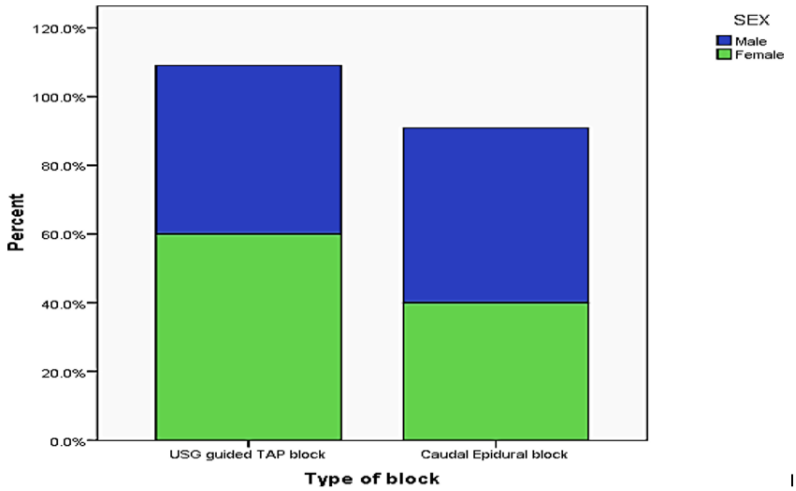

CHART 2: SEX DISTRIBUTION

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

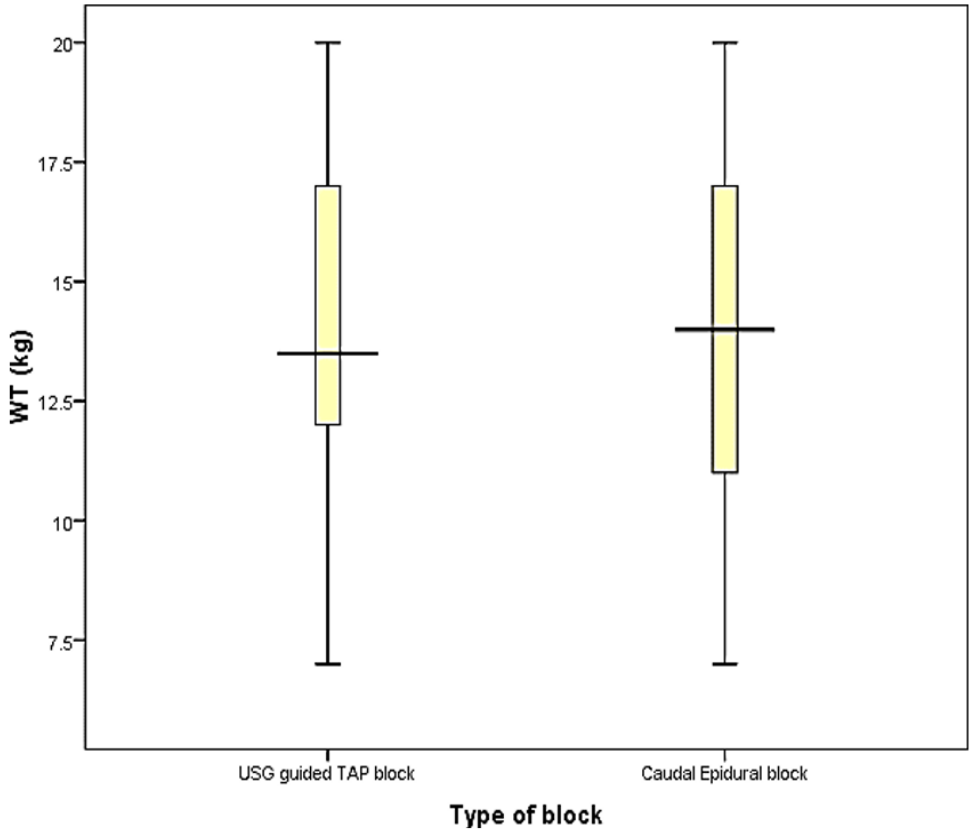

CHART 3: WEIGHT DISTRIBUTION

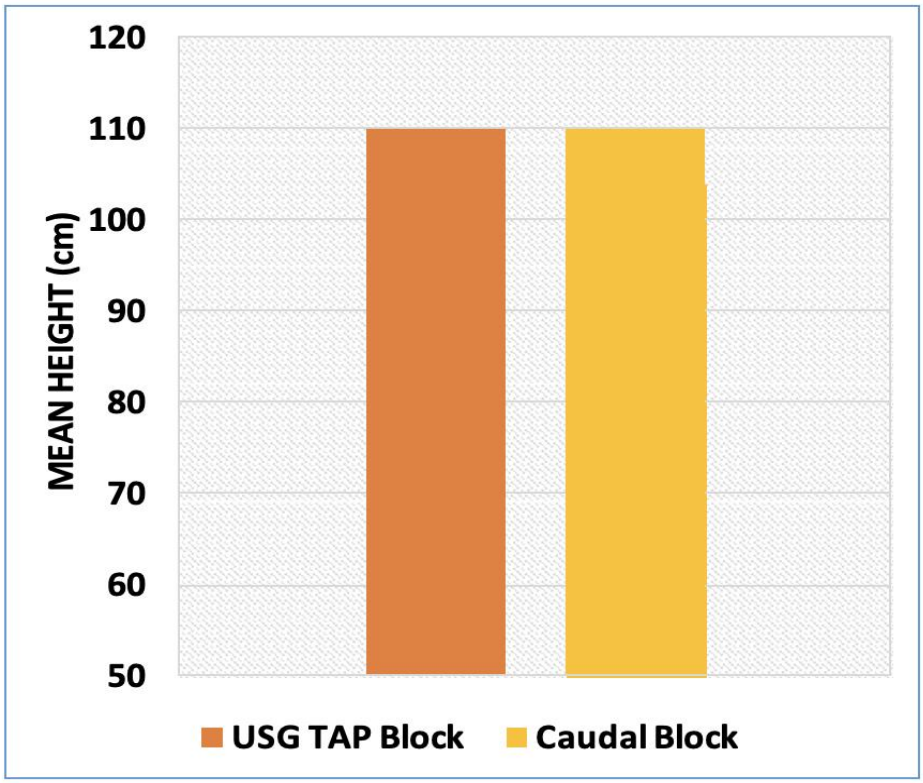

CHART 4: HEIGHT DISTRIBUTION

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

TABLE 2: INTRA-OPERATIVE VARIATIONS IN HEART RATE

TIME	CHARACTERISTIC	USG-GUIDED TAP BLOCK(MEAN±SD)	CAUDAL EPIDURAL BLOCK (MEAN ± SD)
T0	BASELINE (After Block Administration)	103.25 ±15.096	104.75 ±16.712
T1	0 mins (SKIN INCISION)	104.57 ±13.908	106.57 ±16.630
T2	5mins	111.29 ±18.208	102.36 ±15.956
T3	10mins	115.64 ±19.425	102.82 ±15.635
T4	15mins	110.82 ±18.886	104.04 ±13.898
T5	20mins	109.29 ±17.049	101.64 ±12.870
F VALUE		11.086	1.550
P VALUE		**<0.001**	0.208

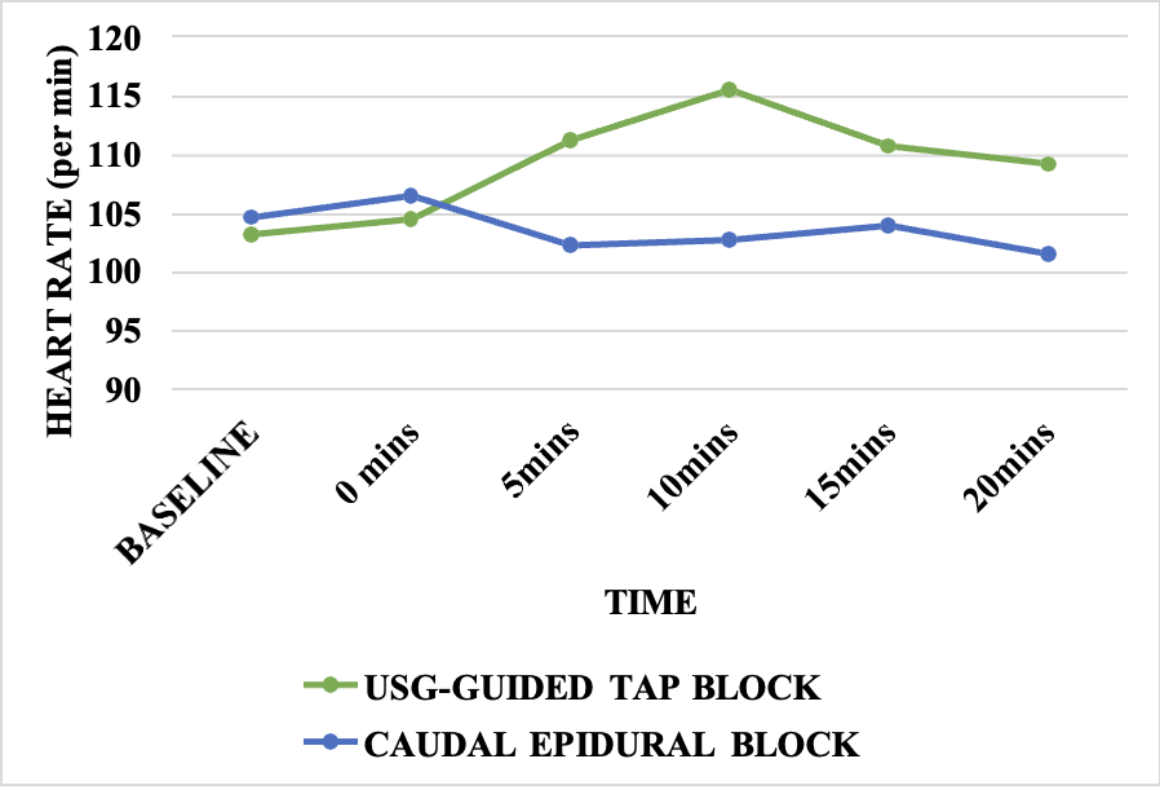

CHART 5: HEART RATE VARIABILITY DURING INTRA OPERATIVE PERIOD

Heart rate varies significantly from baseline during the intraoperative period in Group T with USG-guided TAP block. Heart rate remains stable throughout the intra-operative period with Caudal block in Group C.

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

TABLE 3: INTRA-OPERATIVE VARIATIONS IN MEAN ARTERIAL PRESSURE

TIME	CHARACTERISTIC	USG GUIDEDTAP BLOCK (MEAN± SD)	CAUDAL EPIDURAL BLOCK (MEAN ± SD)
T0	BASELINE (After Block Administration)	68.60 ±4.484	68.45± 4.120
T1	0 mins (SKIN INCISION)	69.63 ±4.189	68.52 ±4.556
T2	5mins	70.40 ±5.386	69.66± 6.586
T3	10mins	72.27 ±5.729	69.31± 5.714
T4	15mins	72.00 ±5.977	69.34± 5.802
T5	20mins	71.27 ±4.920	69.03± 5.797
F VALUE		6.892	1.199
P VALUE		**<0.001**	0.315

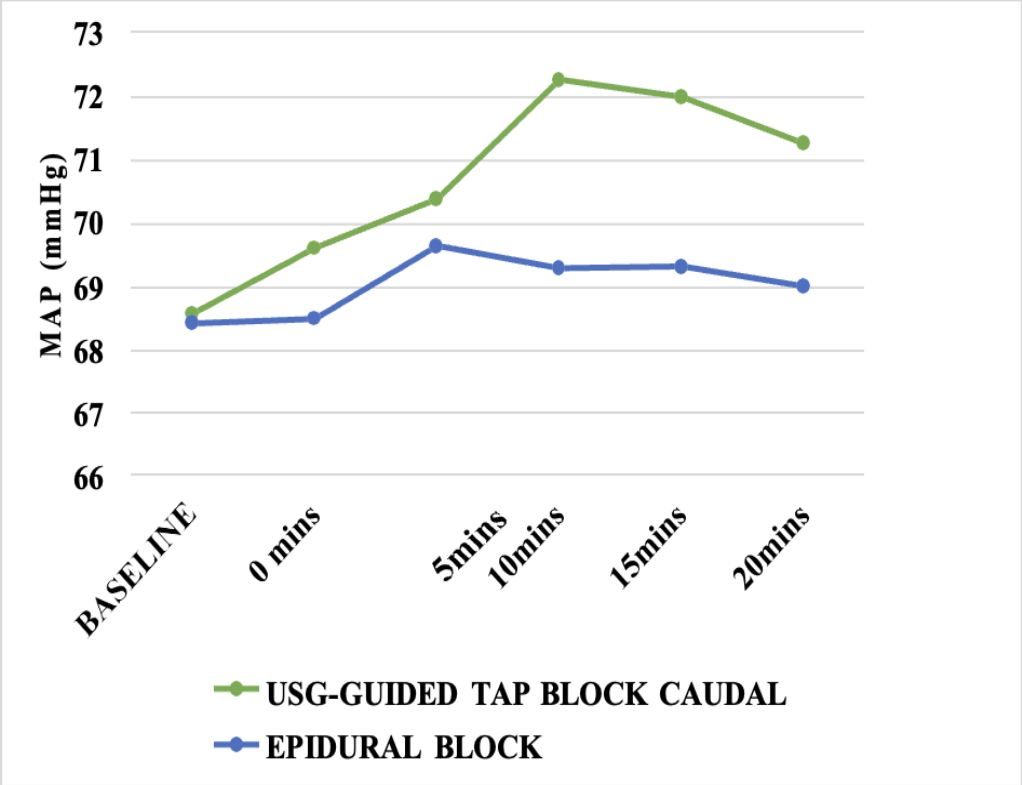

CHART 6: MEAN ARTERIAL PRESSURE VARIABILITY DURING INTRA-OPERATIVE PERIOD

Change in mean arterial pressure from baseline is significant during the intraoperative period in Group T with USG-guided TAP block, whereas changein mean arterial pressure is not significant with Caudal block in Group C

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

TABLE 4: INTRAOPERATIVE ANALGESIC REQUIREMENTS

S.No	Characteristic	USG guided TAP block N (%)	Caudal Epidural block N (%)	P value
1.	**Intra operative requirement of Fentanyl**	16 (53.3)	1(3)	<0.0001

Around 53.3% of patients belonging to Group T required intra-operative fentanyl supplementation, whereas only 3% in Group C, required intra- operative fentanyl supplementation. The difference was found to be statisticallysignificant.

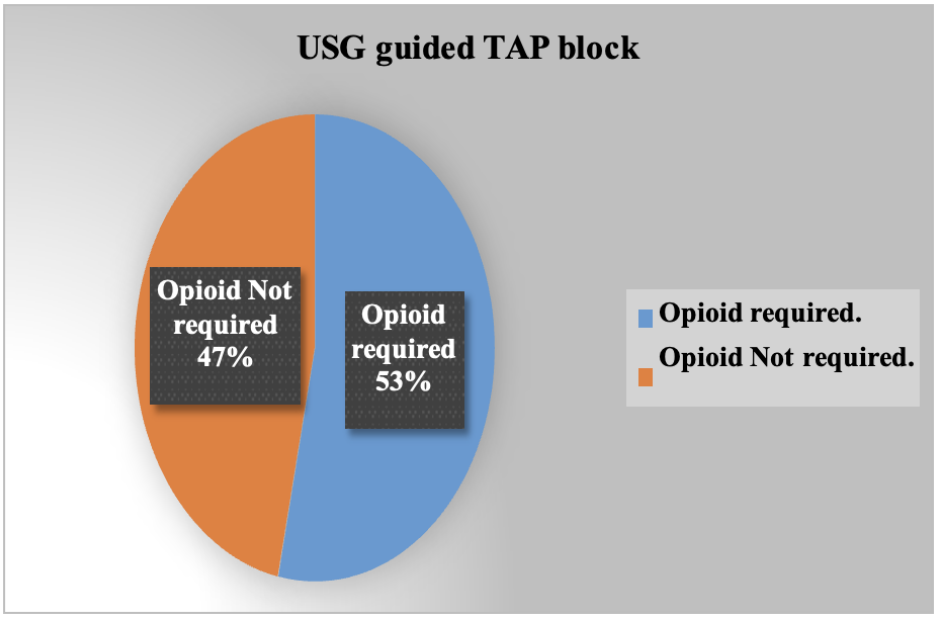

CHART 7: INTRA-OPERATIVE REQUIREMENT OF SUPPLEMENTATION OF FENTANYL IN GROUP T: USG-GUIDEDTAP BLOCK

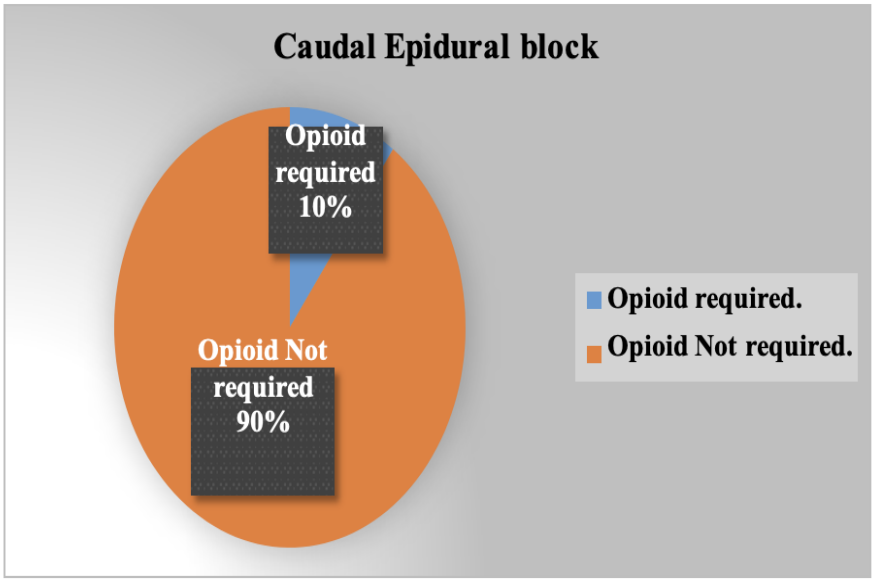

CHART 8: INTRA-OPERATIVE REQUIREMENT OF SUPPLEMENTATION OF FENTANYL IN GROUP C: CAUDALBLOCK

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

TABLE 5: DURATION OF POSTOPERATIVE ANALGESIA

S.No	Characteristic	USG guided TAP block	Caudal Epidural block	P value
1	Duration of Post op analgesia (hrs)	8.60± 1.840	4.57± 1.406	<0.0001

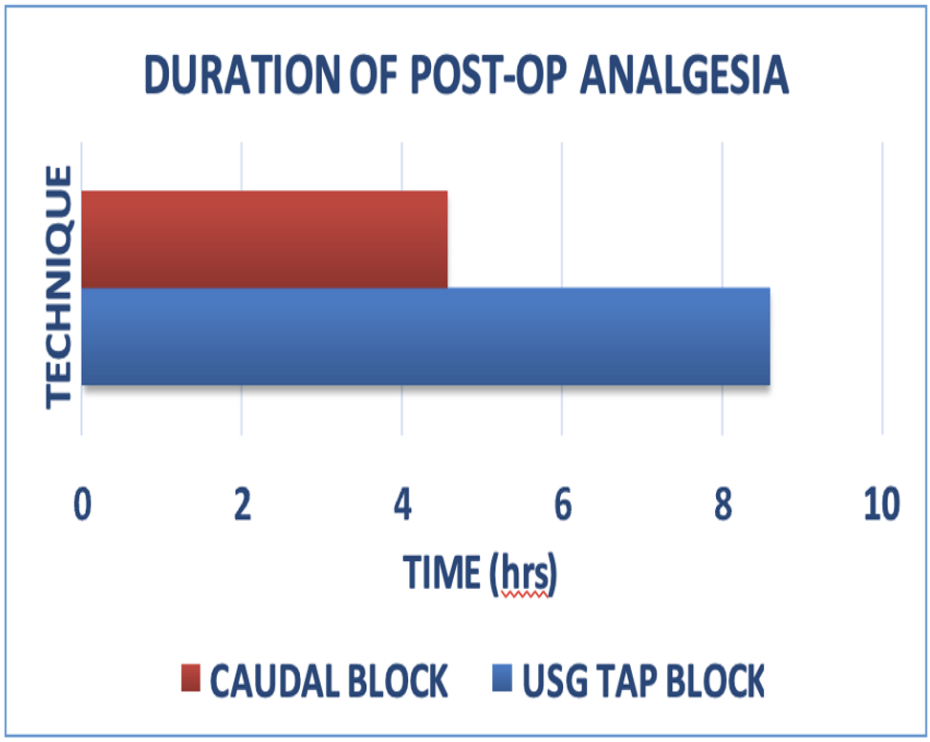

CHART 9: DURATION OF POST-OPERATIVE ANALGESIA

Post-operative analgesia was defined as the duration of analgesia from the immediate post-op period to the time at which the first rescue analgesic wasrequired.
Duration of Post-operative analgesia was longer in Group T than Group

C. TAP block provided postop analgesia for 8.60hrs on average whereas caudalblock provided a post-op analgesia of duration 4.57hrs on average. The difference was found to be statistically significant.

DISCUSSION

Optimal treatment of perioperative pain is usually multimodal. Even in procedures which are done under regional anaesthesia, a general anaesthesia or sedation is usually given for the child to cooperate for the regional technique. This is because it is both unethical and dangerous to perform a regional technique in an agitated, moving child.

In our study, we used the technique of general anaesthesia via ambu LMA, which was inserted after obtunding the reflexes using propofol 2mg/kg and fentanyl 1mcg/kg and succinylcholine 1.5mg/kg to facilitate insertion.Anaesthesia was maintained with 0.75-1 MAC sevoflurane with nitrous-oxide and oxygen (50:50) gas mixture.

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

INTRA-OPERATIVE ANALGESIA:

Analgesia during the procedure is provided by a regional technique either Caudal or TAP block, according to the group, which cannot be assessed directly.

Adequacy of the regional block in supplementing the general anaesthesia can be assessed only indirectly using the changes in haemodynamicparameters and requirement of supplementation by analgesics like opioid. Since pain is associated with stress response resulting in increase in heart rate and blood pressure, significant increase in these haemodynamic parameters would imply an inadequate analgesia by the regional technique. Thecardiovascular responses were used as a surrogate for adequacy of analgesia.

In our study, we assigned thatdespite the administration of 1 MAC of sevoflurane,if there was a 20% increase in heart rate and mean arterial pressure from the baseline, it was due to inadequate analgesia requiring supplementation. In such cases, we supplemented them with 1mcg/kg of fentanyl intravenously.

The heart rate and mean arterial pressure variables remained constant throughout the procedure in Group C (with caudal block) whereas the heart rateand MAP were significantly high from the baseline, during the 10-15mins period after the beginning of surgical procedure in Group T (with TAP block)

This is because Caudal block is a neuraxial blockade which offers complete blockade of sensory, motor and autonomic innervation up to the level of blockade. Hence there is complete analgesia in Caudal block, whereas TAP block anaesthetises only the nerves supplying the parietal peritoneum, skin and muscles of anterior abdominal wall. Hence cord traction and visceral peritonealhandling can result in stress response, causing rise in heart rate and mean arterial pressure in Group T (TAP block).

Results in our study show that 53% of the patients in Group T with TAP block require supplementation with fentanyl, in contrast to Group C, where only 10% required supplemental analgesia during the intra-operative period.

Among the initial research studies with TAP block, a study by Fredrickson[8] on TAP block for inguinal herniotomy in 8 paediatric patients, demonstrated that 5 patients of the 8 did not require any intra-operative supplementation of fentanyl. The rest of the 3 patients required intraoperative supplementation of fentanyl (<0.5 mcg/kg fentanyl), which he attributed to the pain felt during spermatic cord manipulation.

In our study 16/30in TAP block group required fentanyl supplementation, unlike the study by Fredricksonwhere only 3/8 required fentanyl supplementation. This discrepancy between the studies may be due to the small sample size used in his study.

Ray et al[9]studied Caudal block with bupivacaine and ropivacaine administered pre-operatively in paediatric patients undergoing urogenital procedures. He demonstrated no change in haemodynamic parameters during the intra-operative period and no supplementation was required in both the groups. Whereas 3% in Group C in our study, required supplementation of fentanyl.

Since the onset time was not observed in either of the block techniquesin our study, the delayed onset of Caudal block might be the responsible for therequirement of fentanyl supplementation in one patient in Group C, at the time of skin incision.

DURATION OF POST-OPERATIVE ANALGESIA:

The duration of post-operative analgesia with TAP block was found to be significantly longer thanCaudal block.

Studies with Caudal block have demonstrated a post-op analgesia of 4- 6hrs. In our study, the mean duration of post-op analgesia with caudal block was 4.6hrs (274min). Ivani et

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

al[10]conducted a double blind study with forty patients belongingto the age group 1-9 years. They were posted for elective minor surgery under caudal anaesthesia. The children were randomly divided into two groups, twenty in each. One group received 0.25% bupivacaine 2mg/kg and the other received 0.2% ropivacaine 2mg/kg. Hehad demonstrated a post-operative analgesia duration of 253min following single shot caudal with 0.25% bupivacaine which is consistent with the results of our study.

In our study, the time to first rescue analgesia in TAP block group was 516min. The duration of post-operative pain relief was longer in TAP group when compared to caudal group. This may be explained by the following reasons.

Owing to the high vascularity of the caudal space, the absorption oflocal anaesthetic into systemic circulation is more in Caudal block, resulting in faster clearance of the local anaesthetic. Transversus Abdominis Plane is a relatively avascular fascial plane.

The local anaesthetic drug volume deposited in the caudal space has to spread over a larger area to achieve the level of blockade whereas the drug volume injected in TAP spreads in a narrow fascial plane between two muscles.

The post-operative pain felt in a superficial surgery like inguinal hernia repair, is mainly due to pain sensations from the skin, muscles and parietal peritoneum, which is effectively blocked by the TAP block, making it effectivein providing prolonged post-operative analgesia.

Dalia M[11]compared USG-guided TAP block with Caudal block for post-operative pain relief in open pyeloplasty. He included 39 patients belonging to age group 6months to 6years randomly allocated into two groups. In his study, he demonstrated that the patients with TAP block had a significantly longer time to first rescue analgesia, 602min in contrast to 280min in caudal block; which is comparable to our study (TAP 516min vs Caudal 253min)

In a study conducted by Sahin L et al[12], he evaluated the analgesic efficacy of ultrasound-guided TAP block in comparison with wound infiltration, during the first 24h after surgery in children of age 2-8years undergoing inguinal hernia repair. He showed that TAP block provided prolonged duration of post-op analgesia (17hrs vs. 4.7hrs) in comparison to wound infiltration. The analgesia duration was significantly longer (17hrs)when compared to (8.6hrs) in our group. This might be because, we had not observed the pain scores in the patients after 12 postoperative hours, and they had used levobupivacaine, which provides a longer duration of sensory blockade than bupivacaine.

Tobias[13] studied efficacy of TAP block for lower abdominal surgery in 10 paediatric patients belonging to age group 10months to 8years and reported that 80% had good post-operative analgesia with the duration of analgesia lasting for 7 to 11 hours, which is consistent with the results (average of 8.6hrs)of our study.

Paleti Sophia[14] studied the efficacy of TAP block in 50 children of age 7-13years undergoing lower abdominal surgeries. The children were randomly allocated into two groups. After general anaesthesia, 25 children received TAP block and rest of the 25 received systemic analgesia. PaletiSophia showed that the mean time to first request of analgesia was 8.5 to 9 hours in TAP block, similar to the results (8.6hrs) of our study.

PAIN SCORES

The pain scores in both the groups were comparable in the immediate post-op, upto 2hrs. This shows that both caudal and TAP block are equally effective in providing pain relief in the immediate post-op. Pain scores were significantly higher in 3-5 hours in Caudal group requiring administration of rescue analgesia.

In our study, pain scores in Group T with TAP block were lower than that with Group C with Caudal block,at 3, 4 and 5 hrs post-operatively.FLACC scores were lower in TAP block group when compared to caudal block group,at all timepoints of observation upto 12 post-

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 11, 2023

operative hours.

Dalia M, who compared USG-guided TAP block with Caudal block for post-operative pain relief in open pyeloplasty, observed that FLACC pain scores were significantly less in TAP block than Caudal block at 2,4,6,8,10,12,24 hrs post-operatively, consistent with the results of our study.

In a study conducted by Neha Kanojia, who compared USG guided TAPblock with Caudal block for lower abdominal surgeries, employed 60 children of age 1-12years. They were randomly allocated into two groups, 30 in each. Neha demonstrated lower mean VAS scores in both the groups for first 3-4 hours postoperatively, similar to our study. After 3-4 hours, there was a rise in the number of patients with mean VAS score >3 in Caudal group compared to group TAP, as in our study.

Carney et al studied 40 children undergoing open appendicectomy, with twenty in each group, where one group was given TAP block and the other wasgiven placebo.[15]He observed that TAP block significantly reduced VAS pain scores at rest and on movement at all times, similar to our study.

CONCLUSION

Caudal epidural block provided better intra-operative analgesia than USG guided TAP block for inguinal hernia repair.

Ultrasound-guided TAP block provided prolonged post-operative pain relief than single shot Caudal epidural block and reduced the mean opioid consumption in the first 12 post-operative hours after inguinal herniotomy in children of age 1-7years.

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