

Comparison of Transversus Abdominis Plane Block and Caudal Block for Postoperative Analgesia in Children Undergoing Lower Abdominal Surgery

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Abstract: ***Introduction:** Providing postoperative analgesia have become imperative in pediatric anaesthesia practice. Caudal block is being used with greatest frequency for postoperative analgesia in pediatric patients. Recently there is a trend toward the use of peripheral nerve blockade. TAP block is a new and rapidly evolving peripheral nerve block technique. To date, there is paucity of literature regarding comparison of USG TAP block and caudal block. This study aimed to evaluate TAP block and caudal block for duration and quality of analgesia postoperatively in children. **Materials and methods :** 60 children aged 1- 12 years were randomly allotted into 2 groups to receive either USG TAP block with 0.3ml/kg of 0.2% ropivacaine or caudal block with 1ml/kg of 0.2% ropivacaine after induction of anaesthesia. Parameters observed included duration of analgesia by modified VAS scale, total analgesic requirement in 24 hours, quality of analgesia and adverse effects. **Results:** Mean VAS scores were lower in both the groups for first 3-4 hours postoperatively. Subsequently, number of patients with mean VAS score >3 rose more rapidly in group Caudal as compared to group TAP. Time to rescue analgesia in group TAP was 7.41 ± 0.78 hours whereas in group Caudal was 5.07 ± 0.69 hours and this difference was statistically significant. The difference was not statistically significant for total analgesic requirement between the two groups. Quality of analgesia was good in both the groups. No adverse effects were reported in both the groups. **Conclusion:** Duration of analgesia was significantly longer in children who received TAP block as compared to caudal block and it is a good alternative for providing postoperative analgesia.*

Keywords: Transversus Abdominis Plane Block'

1. Introduction

Postoperative pain management is one of the most important issues influencing the outcome of surgery. Postoperative pain, especially when poorly controlled, results in harmful acute effects such as adverse physiological responses and chronic effects like delayed long term recovery and chronic pain.¹ Thus techniques to provide post operative analgesia have become an integral part of pediatric anaesthesia practice. Of the various modalities available for post operative pain relief, regional anaesthesia, especially caudal block is being used with greatest frequency in pediatric patients. The safe and effective use of caudal block for providing intra and post operative analgesia has been established by various authors.^{2,3} However in recent times, there is a trend toward the use of peripheral nerve blockade wherever applicable, given the lower incidences of adverse effects when compared with neuraxial techniques. Furthermore there may be specific anatomic variations or abnormalities which preclude the use of caudal blockade.⁴

Of the various peripheral nerve block techniques available, the transversus abdominis plane block (TAP) is a new and rapidly evolving peripheral nerve block technique that provides effective analgesia during the post operative period following lower abdominal surgeries.⁵ The intra and post operative analgesic efficacy of TAP block has been successfully described in adult patients undergoing abdominal surgeries such as colonic resection⁶, total abdominal hysterectomy⁷ and appendectomy.⁸ Few studies on children have been done by some authors who concluded that the use of TAP block is a good alternative in pediatric patients for post operative pain management in lower abdominal and infra umbilical surgeries.^{9,10} To date, there is

paucity of literature regarding comparison of ultrasound guided TAP block and caudal block in terms of duration of postoperative analgesia in children undergoing abdominal surgeries.

2. Study Design and Methodology

In a prospective, controlled and randomized study of 60 patients, two groups of children (30 in each group) aged 1-12 years belonging to ASA I and II undergoing lower abdominal surgery were randomized to receive either USG TAP block or caudal block after induction of general anaesthesia.

Group Tap: TAP block was performed under ultrasonic guidance with 0.3 ml/kg of 0.2% ropivacaine.

Group Caudal: Caudal block was performed with 1ml/kg of 0.2% ropivacaine with the child in lateral position.

Anaesthesia Technique:

A standard anaesthesia technique was followed. Children were premedicated with 0.4mg/kg midazolam syrup and induced by inhalation of sevoflurane (6-8%) in oxygen. After the child was adequately anesthetized, intra venous access with appropriate size cannula was obtained. Injection fentanyl 1ug/kg was given for intra operative analgesia. Appropriate size LMA was placed and patients were allowed to breathe spontaneously. In case of caudal block, the child was positioned in lateral position and caudal block was performed by a skilled anaesthesiologist or resident under the supervision of consultant anaesthesiologist using aseptic technique and a short beveled 22-23G needle. After negative aspiration of blood and CSF, 1ml/kg of 0.2% ropivacaine was administered.

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In case of USG TAP block the patient was placed in supine position and the abdomen exposed between the costal margin and the iliac crest. Following skin and transducer preparation, the transducer (9-11 MHz) was placed in midline over the rectus abdominis and traced laterally to the region above the iliac crest to the lumbar triangle of Petit, bounded by the latissimus dorsi muscle posteriorly, the external oblique muscle anteriorly, and the iliac crest inferiorly. A 22G short bevelled block needle was inserted in-plane with the transducer, in an anterior – posterior direction. Correct needle tip placement and deposition of local anaesthetic is indicated by the appearance of a hypoechoic fluid pocket immediately deep to the hyperechoic fascial plane below the internal oblique, and above the transversus abdominis. After confirming correct placement of needle, 0.3ml/kg of 0.2% ropivacaine was deposited in the space. Standard hemodynamic and respiratory parameters were monitored at induction and every 5 mins thereafter till the end of the surgery.

The following parameters were assessed in PACU- Duration of analgesia by modified VAS scale at 0,0.5,1,2,4,6,12,24 hours, the total analgesia required in the first 24 hours postoperatively, quality of analgesia by direct questioning of parents/ attendants of child and adverse effects associated with the two technique. A pain score of ≥ 3 was taken as the end point of the study and rescue analgesia was administered at this time in form of syrup paracetamol 10 mg/kg orally.

3. Results

The following demographic data were obtained: age, weight, gender, surgical procedure and duration of surgery. One patient in group TAP undergoing orchidopexy was excluded from the study as the duration of surgery exceeded 90 min and incision extended from groin to scrotal region. The mean age of patients in group TAP was 6.81 ± 2.82 year whereas in group Caudal was 5.32 ± 2.91 years. All children weighed ≤ 25 kg. The children in both the groups were comparable for age, weight and duration of surgery. The number of children who underwent the different types of operations in both the groups was also comparable. Surgical procedures included herniotomy (Group TAP n=29, Group Caudal n=29) and orchidopexy (Group TAP n=1, Group Caudal n=1).

In both the groups intraoperative hemodynamic parameters (HR and MAP) were within the normal limits and did not show any significant increase ($> 20\%$) from the baseline values.

The VAS scores were analyzed at 0, 0.5, 1, 2, 4, 6, and 24 hours. As the earliest rescue analgesia was given at ≤ 6 hours (in 22 out of 30 subjects in Group Caudal), statistical comparison between the groups could be done only upto 4 hours. The VAS scores were very low (< 1) in both the groups at 0, 0.5 and 1 hr, thus indicating good quality of analgesia in the immediate post operative period in both groups. During the first 3-4 hours after surgery, all the patients (in both the groups) had satisfactory pain relief as indicated by a VAS score of ≤ 3 . Subsequently, the number of patients with adequate surgical analgesia declined much

more rapidly in group Caudal as compared to group TAP. This difference was statistically significant.

Table 3: Mean VAS Scores and standard deviation in all groups at various time intervals

Postoperative Time (hrs)	Group TAP N = 29	Group Caudal N = 30	P value
0	0.00 \pm 0.00	0.00 \pm 0.00	NA
0.5	0.00 \pm 0.00	0.00 \pm 0.00	NA
1	0.28 \pm 0.45	0.53 \pm 0.50	0.04
2	1.21 \pm 0.49	1.53 \pm 0.50	0.01*
4	1.76 \pm 0.43	2.20 \pm 0.40	0.00 [#]
6	2.10 \pm 0.31***	3.00 \pm 0.00	0.00

*significant difference between group TAP and group Caudal (p value < 0.05)

[#] Highly significant difference between group TAP and group Caudal (p value < 0.00)

***Mean VAS score of the remaining patients who had not received rescue analgesia by that time.

NA – Not Applicable.

N- Number of patient

The mean time for requirement of rescue analgesia in group TAP was 7.41 ± 0.78 hrs whereas in group Caudal was 5.07 ± 0.69 hrs. The difference was statistically significant between the two groups, the earliest need for rescue analgesia being in group Caudal.

The mean total analgesic requirement in the first 24 hours in Group TAP was 566.03 ± 170.60 mg whereas in Group Caudal was 634.67 ± 284.68 mg. However when we compared both the groups, the difference was not statistically significant. All children were comfortable in both the groups in the post operative period as obtained by direct questioning of parents/ attendant except for one child in group TAP who was uncomfortable, but not distressed. This child was excluded from the study as the duration of the surgery exceeded 90 min. No complications were reported in both the groups.

4. Discussion

In children, regional techniques such as caudal block and nerve blocks are more popular for providing post operative analgesia due to the type of surgery, lower incidence of complications and the predictability of the pain relief obtained. In recent times TAP block is emerging as an alternative nerve block technique and has been found to provide effective and prolonged postoperative analgesia.⁵

The results of the present study indicate that administration of 0.2% ropivacaine in a dosage of 0.3ml/kg through ultrasound guided transversus abdominis plane block in children undergoing lower abdominal surgeries significantly reduces postoperative pain. Good pain relief with very low VAS scores was achieved in the immediate postoperative period in both the groups. However, in children who received caudal block we found that rescue analgesia was required at a much earlier time, approximately 5 hours as compared to 7 hours in TAP group. Several authors have reported 4 to 5 hours of post operative analgesia following caudal block with ropivacaine 0.2% in children lower abdominal surgeries.^{11,12} Till date no comparative study

between caudal block and TAP block has been reported in literature.

A preliminary study by Falmer et al on use of ultrasound guided TAP block in children undergoing upper and lower abdominal surgery indicated a sensory blockade of usually 3 to 4 dermatomes and they suggested that TAP block should be offered for lower abdominal surgery only.¹³

Tobias demonstrated safe and effective use of ultrasound guided TAP block in ten pediatric patients in age ranging from 10 months to 8 years, undergoing umbilical and lower abdominal surgeries with 0.3ml/kg of 0.25% bupivacaine and 1:200,000 epinephrine.⁴ In this study, the author reported effective postoperative analgesia in 8 out of 10 patients with the first request for postoperative analgesia varying from 7 to 11 hours. In our study similar results were found with the time to first rescue analgesia at 7 hours post operatively indicating good and effective analgesia following ultrasound guided TAP block.

Fredrickson reported use of ultrasound guided TAP block in 20 children undergoing inguinal hernia surgery with 0.3ml/kg of 50:50 ropivacaine 1% and lignocaine 1% and concluded that it provided effective post operative analgesia as compared to the ilio-inguinal nerve block.⁹ Camey et al performed unilateral TAP block with 0.3ml/kg Ropivacaine 7.5mg/ml in 45 children less than 16 years of age undergoing open appendectomy and concluded that unilateral TAP block as a component of multimodal analgesic regimen provided superior analgesia in form of decreased morphine consumption in the first 48 post operative hours as compared to the placebo group.¹⁴

Thus from the findings of our preliminary study we would like to state that ultrasound guided TAP block is a good alternative for providing post operative analgesia in children undergoing lower abdominal surgery. Further we found that, USG technique was easier to perform and without any adverse effects. Duration of analgesia was significantly longer in children who received TAP block as compared to caudal block. The quality of analgesia was good in all the children following both TAP block as well as caudal block.

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