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Feasibility and Effectiveness of Ultrasound Guided Caudal Epidural Block in Adolescents Undergoing Surgery for Hypospadias.

KEYWORDS: Ultrasound, adolescents, caudal epidural, pain

Dr. Punam Raghove
Assistant Professor, Dept. of Anaesthesiology & Critical Care, Pt.B.D.Sharma PGIMS Rohtak.

***Dr. Karampal Singh**
Associate Professor, Dept. of Anaesthesiology & Critical Care, Pt.B.D.Sharma PGIMS Rohtak.*

Dr. Savita Saini
Senior Professor, Dept. of Anaesthesiology & Critical Care, Pt.B.D.Sharma PGIMS Rohtak.

Dr. Sarla Hooda
Senior Professor & Head, Dept. of Anaesthesiology & Critical Care, Pt.B.D.Sharma PGIMS Rohtak.

ABSTRACT *Background: Caudal epidural block is frequently done procedure in infants and young children but it's use is comparatively less in adolescent age group due to difficulty in inserting the needle into the sacral canal through the sacral hiatus. USG guidance for caudal block have increased success rate and decreased complications in younger children. We evaluated feasibility of ultrasound guidance for caudal block in 30 children of age group 8-14 years.*

Methods: 30 male children, of age group 8-14 yrs. undergoing elective hypospadias surgery under general anaesthesia (GA) were included. 0.5ml/kg of 0.25 percent bupivacaine was injected in caudal epidural space under real time USG guidance. Success rate of block, complications and durations of pain relief were recorded.

Results: Sacral hiatus was identified in all patients. The injection proved feasible in all 30 patients. Blood reflux was noted in 3/30 patients. No cerebrospinal fluid reflux occurred. Pain relief lasted for an average of 8 hours in post-operative period. No complications were recorded during 24 hours post-operative period.

Conclusions: USG guided caudal epidural block is feasible and safe technique for post-operative pain relief in children of age group 8-14 years undergoing hypospadias surgery.

Introduction:
Regional Anaesthesia and analgesia techniques are commonly used to facilitate pain control during pediatric surgical practice, decrease parenteral opioid requirements and improve the quality of post-operative pain control and patient-parent satisfaction.

Caudal epidural (CE) block was first described in 1933, and it has established itself as most preferred regional Anaesthesia technique in pediatric Anaesthesia.[1]

Caudal Anaesthesia is recommended for most surgical procedures of the lower part of the body (mainly below the umbilicus), including inguinal hernia repair, hypospadias surgery, urinary and digestive tract surgery and orthopedic procedures on lower extremities**.**

It is usually performed in lightly anesthetized patients but can be used as the sole anesthetic regimen in fully awake ex-premature infants younger than 50 to 60 weeks of post conceptual age after local Anaesthesia of the skin covering the sacral hiatus as a single-shot technique [2, 3]

Caudal Anaesthesia is very effective in decreasing post-operative pain. It considerably decreases stress hormone response to surgery. When combined with general Anaesthesia, it reduces intraoperative inhalational or opioid agent consumption.[4, 5]

Blind technique of caudal epidural analgesia involves injection of local anesthetic via sacral hiatus into the CE space. Blind technique has failure rate as high as 25%.[6] Moreover, local anaesthetic agent may be inadvertently injected into a blood vessel, into cerebrospinal fluid (CSF), subperiosteally, subcutaneously or peri-rectally. Apart from incomplete/ failed effect of block, it may result in potentially devastating complications like systemic local anesthetic toxicity from intravascular injection or total spinal from inadvertent injection in CSF.

Although caudal epidural block is frequently used in infants and young children, It is far less commonly used in adolescents and teenagers with many Anaesthesia providers believing that age is a restrictive factor to the use of this technique. With increasing age, a sacral fat pad can develop making the sacral cornu more difficult to palpate in older children. Therefore, blind technique is more difficult and has higher failure rate in older children.

Therefore, we conducted this study to assess the feasibility and effectiveness of caudal epidural injections performed with ultrasound guidance in adolescents undergoing surgery for hypospadias.

Method:
After parental informed consent and Institutional approval, 30 male children, of age group 8-14 yrs. undergoing elective hypospadias surgery under general Anaesthesia (GA) were included. Pre- Anaesthesia check up was done in PAC clinic. Children were evaluated further on eve of surgery and were kept NPO for 6 hours for solids and 2 hour for water.

Exclusion Criteria:
Blood coagulation disorders, systemic inflammation, inflammation/infection in the area of the site of injection,

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and anatomical abnormalities of the lumbosacral spine.

Procedure
On the operating table, Intravenous line was secured and monitors were attached. General Anaesthesia was induced using glycopyrrolate 0.005mg/kg, propofol 1.5–2.5 mg/kg over 20–30 s, atracurium 0.5 mg/kg and fentanyl 2 µg/kg. Airway was secured with appropriate size LMA. Anaesthesia was maintained with oxygen, nitrous oxide and sevoflurane. After Induction of GA and securing of airway, child was placed in lateral position with knee chest position. Local site was cleaned and draped using aseptic precautions

Sonosite M- Turbo ultrasound machine with HFL 38 × 13-16 MHz 40mm broadband linear array probe was used for this block. Sterility of probe was ensured by using sleeve and transparent tegaderm on ultrasound probe. Sterile water based jelly was used as a coupling agent.

A pre-block ultrasonic imaging was done to appreciate patient's anatomy of caudal epidural region. Initially transverse view was used to identify the hiatus and measure intercornual distance. Then longitudinal view was used for visualizing caudal epidural canal and direct spread of drug. A short beveled 21 G hypodermic needle was inserted under ultrasound guidance to reach the caudal epidural space. An injection of 1 ml of saline was given and seen as turbulent flow entering the epidural space pushing the posterior dura anteriorly. After confirmation, 0.5ml/kg of 0.25 percent bupivacaine was injected in caudal epidural space.

After the procedure, child was placed in supine position and surgery started. At the end surgery, neuromuscular blockade was reversed with appropriate doses of neostigmine and glycopyrrolate intravenously. Motor function of the lower extremities and the caudal puncture site was assessed in all children on the first postoperative day.

Results
Sacral hiatus was identified in all 30 (100%) patients. The injection proved feasible in all 30 patients.

Mean duration of surgery was 45 minutes (30-72 minutes). No cerebrospinal fluid reflux occurred.

Blood reflux was noted in 3/30 patients and resolved upon needle repositioning. 28 out of 30 children were calm and pain free after arousal from surgery.

This pain relief (requiring no analgesic) lasted for an average of 8 hours in post-operative period.

No complications were recorded during 24 hours post-operative period.

Table 1: Demographic data of the study group

Demographic parameter	N=30
Age (years)	11.10 ± 1.80
Weight (Kg)	32.32 ± 10.30
Height (cm)	138.20 ± 22.40
BMI (kg m-)	17.40 ± 2.64

Data are expressed as mean ± SD or number of patients, (%) BMI: Body mass index

Table 2: Study Parameters

Intercornual distance(cm)	1.38 ± 0.51
Depth of caudal space (mm)	7.10 ± 2.32
Post-op pain relief (Hours)	8.40 ± 4.80

Data are expressed as mean ± SD

Discussion
Caudal epidural Anaesthesia is an important tool in the hands of anaesthesiologist for intra-operative anaesthetic management and to decrease post-operative pain for pediatric patients undergoing surgical procedures below umbilicus.

A successful caudal anaesthetic block affords the anaesthesiologist opportunity to reduce the intra-operative use of volatile anaesthetic agent and to use a narcotic sparing approach that ultimately provides better post-operative pain control with less nausea and vomiting.[3, 4]

Caudal block has been performed typically by blind technique using loss of resistance technique using a blunt needle. It is easily performed because the landmarks are superficial. However, the sacral hiatus is small and shallow in pediatric patients. The ability to locate the hiatus and the ability to define anatomical variations are the main factors for the success and safety of caudal epidural Anaesthesia.

Since Kapral in 1994 first described the use of real-time ultrasound-guided regional Anaesthesia, this novel technique has gained widespread recognition.[7] In adult patients, use of ultrasonography for caudal epidural block is fraught with the problem of poor penetration through calcified bony structure. Children are less likely to have bony ossification and so ultrasound provides clear image of caudal epidural space.

Failure to identify the sacral hiatus due to uncertain surface anatomy and difficulty of inserting the needle through a too narrow sacral hiatus results in failed caudal epidural block. Unrecognized Anatomic variations are another cause of failed caudal epidural. Aggarwal et al. reported various types of sacral canal defects such as fusion failure of the sacral lamina and partial agenesis in 7.89% of 114 adult cadavers.[8] Another reason of failed caudal epidural and resultant complications is termination of dural sac lower than 2nd sacral vertebra. A study of 2669 patient in Korea using magnetic resonance images showed that in 22 patients (0.8%) dural sac and spinal canal ended at or below S3.[9]

Ultrasound helps us in identification of sacral hiatus and any anatomical abnormalities present. Anatomical details of the sacral hiatus, bilateral sacral cornua, apex of the sacral hiatus, anterior and posterior walls of the sacral canal and sacrococcygeal ligament can be clearly detected under the guide of ultrasound.[10, 11] It also allows real time visualization of needle path and spread of local anaesthetic making the procedure easier and much safer.

In our study, we were able to identify sacral hiatus and place the needle under real time visualization in all 30 patients. Chen et al. demonstrated that the success rate of ultrasound guidance when used to guide caudal epidural needle placement in real time was 100% as confirmed with contrast dye fluoroscopy.[6] Wang et al. in their randomized controlled study comparing landmark-based or ultrasound-

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guided caudal epidural block for inguinal hernia repairs in 140 children found the first puncture success rate was higher in the ultrasound group (92.8% vs. 60%). They also reported lower incidence of bloody puncture with ultrasound use as compared to landmark Technique (5.7% Vs. 18.6%).[12] Blanchais et al in their study of 30 patients for caudal epidural glucocorticoid injections under ultrasound guidance, were able to identify sacral hiatus in 29 (96.6%) patients.[13] Nikooseresht et al reported a high success rate (95.8%) of caudal epidural injection under ultrasound guidance in their study of 240 adult patient for caudal epidural steroid block.[14] Thus ultrasound use in all these studies has improved success rate and decreased complications.

Conclusion

USG guided caudal epidural block is very effective and safe technique for post-operative pain relief in children of age group 8-14 years undergoing hypospadias surgery.

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