ejpmr, 2018,5(4), 318-323

SJIF Impact Factor 4.897

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

REINVENTING ADULT CAUDAL EPIDURAL BLOCK: A RETROSPECTIVE ANALYSIS

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Article Received on 22/01/2018 **Article Revised on 12/02/2018** **Article Accepted on 05/03/2018**

ABSTRACT

Introduction: Caudal epidural block is useful to provide anaesthesia for perineal and penile surgical procedures in the adults. But, it is not popular among the anaesthetists due to the high failure rate with the landmark based technique. Ultrasound scanning helps to visualise the sacral hiatus, sacrococcygeal ligament and the caudal epidural space. Real-time needling and injection into the caudal epidural space can be done precisely under ultrasound guidance. This may improve the success rate so that it is a viable alternative. Ultrasound guided caudal blocks are regularly practiced in our institute for the last six years. **Material and Method:** Caudal blocks done in adults in the year 2016 was analysed retrospectively in this study. This included 306 patients above 18years. **Results:** The study showed a success rate of 92.19% against the 68- 75% reported for the adult caudal block by the landmark technique. It provided good and prolonged post operative analgesia. The first rescue analgesic request was a median 604 minutes with a standard deviation of 155 minutes. No incidence of Post Operative Urinary Retention (POUR) demanding catheterisation of the bladder was noted, which is common in perineal procedures done under spinal or general anaesthesia. The incidence of spinal puncture head ache of the spinal anaesthesia is totally avoided. Oral liquids were allowed up to 2 hours before the start of surgery. Post operatively oral liquids were started once the patient is out of the procedural sedation. Only 27 patients (8.8%) received intravenous fluids, of volume 300 to 1000 ml. **Conclusion:** Perineal and penile procedures can conveniently be done under caudal epidural block in adults. Ultrasound guidance improves the efficiency, safety and patient comfort of caudal block in adults; and make it a practical and viable option. It provides good and prolonged post operative analgesia. Post Operative Urinary Retention (POUR) which is common after perineal procedures done under spinal or general anaesthesia may be totally avoided. Overall, Caudal block in adults enhances the 'Enhanced Recovery After Surgery'.

KEYWORDS: ultrasound guided regional anaesthesia, caudal epidural block, Ropivacaine, Post Operative Urinary Retention (POUR), Enhanced Recovery After Surgery (ERAS).

INTRODUCTION

Though caudal epidural anaesthesia was described as early as 1910, its use in the adult population is almost nil in the recent years. This is due to its unacceptable failure rate. Paeditric caudal epidural blocks continue to be popular due to its high success rate, and also due to the ability to produce analgesia in the lower limbs and abdomen. Ultrasound guidance for the real-time needling and injection to the adult caudal space has increased the success rate to an acceptable level.

MATERIAL AND METHOD

This is a retrospective cohort study. Data of adult patients over 18 years of age, who were attempted or administered with a caudal block by different anaesthetists, under ultrasound guidance for a period of one year from 1st January to 31st December 2016 in our hospital were included in the study.

Primary Objective

To retrospectively analyse the success rate of the ultrasound guided caudal epidural block in adults.

Secondary Objectives

1. To find out the time to first rescue analgesic requirement following caudal blockade, this indicated the duration of post operative analgesia.
2. To find out the incidence of urinary retention requiring catheterization following caudal blockade

Ultrasound guided caudal block for perineal and penile procedures is well established in our hospital from 2012, and a standard technique is followed as a departmental policy. We found this technique efficient, safe and have improved patient comfort, and promoted 'Enhanced Recovery After Surgery' (ERAS).

Procedure

Clear oral liquids were allowed up to 2 hours of the surgical procedure. After voiding the urine, patient is brought to the 'Block Room'. Procedural sedation with titrated doses of up to 2 mg of Midazolam and 10 mcg of Dexmedetomidine was administered. In the prone position, scanning was done in the longitudinal axis and needling done in-plane. After the puncture of the sacrococcygeal ligament, the needle is advanced for 3-5 mm keeping the tip under the ligament and visible with the ultrasound. Rise of the sacrococcygeal ligament on injection and fall on holding it, confirms the accurate placement of the local anaesthetic. Confirmation may also be done with Colour Doppler. The volume of local anaesthetic used was generally determined by the height of the patient. Generally, 20 ml of local anaesthetic was administered to those who had a height less than 160 cm, and 30 ml to those above. Ropivacaine 0.25% is the commonly used local anaesthetic. But there was a variation in the choice of the local anaesthetic and needle, by different anaesthetists, in different patients.

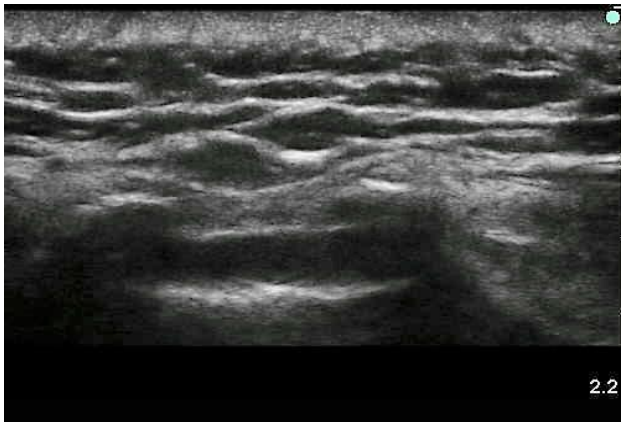

Fig. 1: Normal caudal space transverse view.

Fig. 2: Normal caudal space.

In-plane needling, longitudinal view.

Patient was put up on the operation table 30 minutes after the block, with a supplement of procedural sedation as required. For the anal procedures, peri-anal area was checked for pain in the lithotomy position with a sharp needle on all the four quadrants around the anus- anterior and posterior on right and left sides. For circumcisions, prepucial skin is checked for pain. Pain indicated failure. In these patients the procedure was done under supplementary anaesthesia, general or spinal. General Anaesthesia was supplemented with intravenous and inhalational agents in anaesthetic doses. Those who had no pain on pin prick was considered to have a successful block and received procedural sedation with small doses of Midazolam, Dexmedetomidine or Fentanyl, and sub anaesthetic doses of Ketamine or Propofol, as the situation demanded. Oral NSAIDs are started in the post operative period. Intravenous Tramadol in 25 mg aliquots is the standard rescue analgesic prescribed, and administered as the patient start to experience pain when the block wears off. Administration of intravenous fluids was not warranted unless the patient was dehydrated, or there is extra procedural blood loss.

For our retrospective cohort study, the block room register was reviewed for the caudal blocks done in one year period from 1st January to 31st December 2016. The case sheets were procured from the Records Department and charted. The data was collected in the following categories.

- Age and sex of patient.
- Local Anesthetic used, its volume of (ml) and concentration (%)
- Adjuvant used if any.
- Needle used.
- Time of block.
  Surgical Procedure, Time of start of surgery, Total duration of surgery in minutes.
- Perioperative Intravenous Fluids used if any.
- Preoperative and intraoperative medications used if any.

Midazolam (mg), Dexmedetomidine (mcg),Fentanyl (mcg), Propofol (mg), Ketamie (mg), Tramadol (mg), Buprenorphine (mcg), Morphine (mg).

- Inhalational agent used if any.
- Airway device used if any.
- Outcome- Successful/Failed?
- Time of first opioid rescue analgesic in post-operative period.
- Catheterization of the bladder in post operative period.

This data was subjected for statistical analysis.

RESULTS

Total number of 306 patients, from January through December 2016.

Table. 1. Patient Demographics.

Sex (Male)	73.9%
Age (Mean±SD)	43.5 ±13.5
Duration of surgery (min) (Mean±SD)	24.9±10

Table. 2. Local Anesthetic Used.

Ropivacaine 0.2%	1.6%
Ropivacaine 0.25%	76.2%
Ropivacaine 0.25% + Lidocaine 2% (10ml)	1.6%
Ropivacaine 0.5%	20.6%

Table. 3. Adjuvant Usage in Caudal.

Adrenaline (50mcg)	1.3%
Fentanyl (25mcg)	18.6%
Morphine (6mg)	0.7%
None	79.4%

Table. 4. Duration of Analgesia in Minutes.

Mean	534
Median	604
Standard Deviation	155
Minimum	205
Maximum	844

Success Rate: The block was not successful in 22 patients (7.19%). This result is from a group of anaesthetists in different skill levels. Success rate from the skilled anaesthetists alone will be higher.

Urinary Catheterization

None of the patients had Post Operative Urinary Retention (POUR) to warrant catheterization of bladder.

Needles Used

In 98.7% 0f cases 25G Quincke type spinal needle was used to give the block. Rest of the cases (1.3%) received block with 26G 1.5 inch long sterile hypodermic needle.

Use of Intravenous Fluids

IV Fluids were administered to 27 Patients (8.8%). Out of this 22 were those patients supplemented with general anaesthesia.

DISCUSSION

Caudal anaesthesia was first described in1901by two French physicians, Fernand Cathelin and Jean-Anthanase Sicard[10]. Three years before the advent of caudal block, on August 16, 1898, German surgeon August Bier performed surgery under spinal anaesthesia, the first documented neuraxial anaesthesia.

Caudal Epidural; the Present Practice

Success rate of caudal block by the land mark based technique in the paediatric age group is about 96%.[11,12] This high success rate with an easy landmark based technique made caudal block, a popular technique for the children, to complement general anaesthesia for the lower limb, perineal and abdominal procedures.[5]

In adults, caudal block can provide anaesthesia for the following regions - perineum, anus, rectum, vulva, vagina, scrotal skin[5], and penis. The success rate of adult caudal block is in the tune of 68 to 75%.[10,12-15] Due to the high and unacceptable failure rate in the adult population, it was not widely practiced by the Anaesthesiologists. They always preferred a more definite sub-arachnoid block[8], if regional anaesthesia is the choice.

Causes of increased failure rate for caudal block in adults by the landmark based technique

The practical problems related to caudal anaesthesia are mainly attributable to wide anatomic variations in size, shape, and orientation of the sacrum.[3]

The sacral hiatus may be almost closed, asymmetrically open, or widely open secondary to anomalies in the pattern of fusion of the sacral arches. The breadth, length and depth of the sacral hiatus vary widely among different subjects. Depth of the sacral cornua from the skin varies. In obese persons the sacral cornua are difficult to palpate. The antero-posterior depth of the osseous sacral canal may vary from less than 2 mm to greater than 1 cm^3.

Fig. 3. Caudal space- superficial, shallow and short. In-Plane needling.

The depths of the sacral canal under the sacro-coccygeal membrane, where the needle enter for the caudal block, also vary widely. Individuals with sacral canals having antero-posterior diameters less than about 3 mm may not be able to accommodate anything larger than a 21-gauge needle[1] (5% of the population). The lateral width of the sacral canal varies significantly. Since the depth and width of the canal may vary, the volume of the canal itself may also vary. Trotter found that sacral volumes varied between 12 and 65 ml, with a mean volume of 33 ml^3.

The sacral curvature also varies substantially. The curvature tends to be more pronounced in males than in females. The orientation of the sacral canal may be such that it may be difficult to enter blindly into the sacral canal with a straight needle.[1]

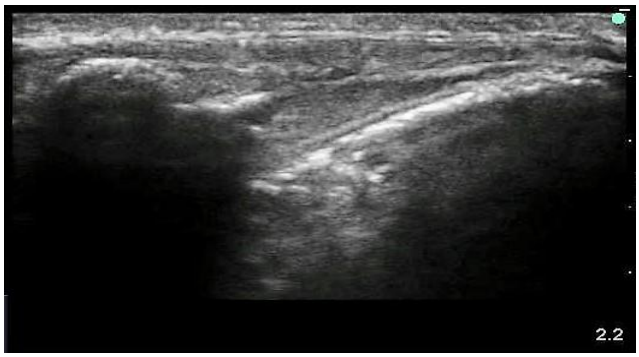

Fig. 4: Caudal space - superficial, normal depth.

Sacral spina bifida was reported in about 2% of males, and in 0.3% of females[10]. The classical approach of entering the bony sacral canal is not possible in these patients. But identification and puncture of the sacrococcygeal ligament and injection of local anaesthetic is possible under ultrasound guidance in these patients.

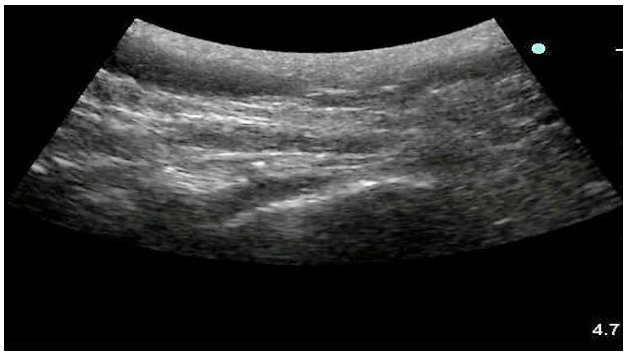

Fig. 5. Caudal space in an obese patient.

Depth of SCL is more than 3 cm.

The sacrococcygeal ligament could not be identified in 10.8% of subjects using MRI.[4] In our series of patients, recognition of the sacro-coccygeal ligament was always possible with the ultrasound.

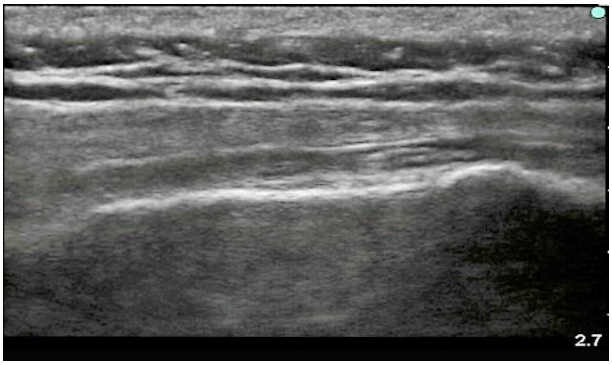

Fig. 6. Spina Bifida under a linear probe.

The posterior sacral foramina are essentially sealed by the multifidus and sacrospinalis muscles, but the anterior foramina are unobstructed by muscles and ligaments, permitting ready egress of solutions through them.[7]

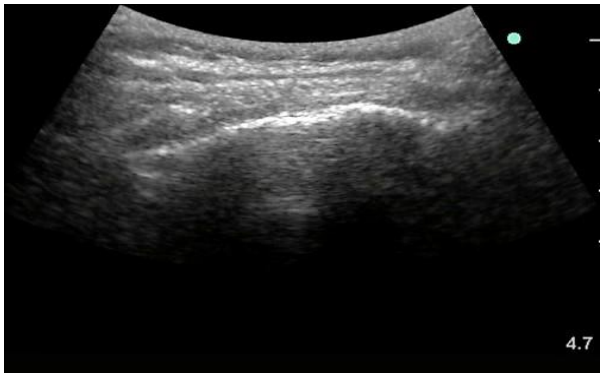

Fig. 7. Spina Bifida under a curved probe.

As individuals age, the overlying ligaments and the cornua thicken significantly.[3] The Sacrococcygeal Ligament (SCL) is thick or ossified and feels like bone when punctured. The hiatus margins often have osseous overgrowth and defy recognition by even skilled fingertips.

The posterior longitudinal ligament which lies posterior to the anterior table of sacrum is the anterior border of the caudal epidural space. If needle pierces through this ligament, the drug will be deposited out of the caudal space and do not contribute to the block. If the needle traverse further anteriorly into the sacral bone marrow, it may be absorbed fast leading to toxicity.

Pathologic adhesions in the caudal epidural space

The spread of the local anaesthetics in the caudal space tends to be patchy in a good number of elderly populations. This may be due to the dural adhesions in the caudal epidural space due to inflammatory disorders[8], mainly triggered by extruded prolapsed inter-vertebral disc. Radio-opaque epidurography has demonstrated patchy spread of the dye in these patients.[8] When there are dural adhesions and obstruction in the sacral canal, there will be an increased tendency of the drug to spill out through the sacral foramina, leading to inadequate cephalad spread of the drug and failure of the block.

All these lead to an increased rate of failure to place the needle in the caudal epidural space, or inadequate spread within the space.

How the ultrasound guidance helps

Ultrasound provides clear identification of the sacral anatomy and real-time visualization of needling and injection.[5] It is portable, non-invasive, and free of radiation exposure. This makes ultrasound an attractive technique in the Anaesthetist's armamentarium.

Thus, a pre-puncture scanning allows the operator to see the sacral anatomy, identify the midline, accurately

predict the depth of the caudal epidural space, and determine the optimal site for puncture and the trajectory of the needle.[5] The needle is advanced under real-time ultrasound guidance by the in-plane approach. The SCL is punctured under vision and advanced for 2-3 mm below it, so that needle tip is visible.

Rise of the sacro-coccygeal ligament during the injection indicates accurate injection to the caudal space. Absence of this evidence indicates an intravascular injection or injection outside the caudal space and is immediately stopped. Intravascular injection may lead to toxicity and also to failure of the block. Colour Doppler can also demonstrate spread of the drug under the ligament.

Ultrasound guidance is used by the pain physicians for caudal epidural steroid injections in patients with sciatica.[2] In the experienced hands, it is possible in the first attempt.[5] Use of a thin needle and decreased number of attempts enhances the patient comfort. Ultrasound enhances the safety of the procedure, and increases the success rate.

Post Operative Urinary Retention (POUR): Caudal block in the adult does not cause sympathetic blockade and hypotension thereof, as the sympathetic outflow is only thoraco-lumbar, and not disturbed. Intravenous fluid loading and/or vasopressors are not warranted as for spinal. Intravenous fluid administered to prevent hypotension during spinal anaesthesia lead to production of large volumes of urine, when the bladder neck is not ready to open leading to urinary retention. A single episode of bladder over distension can stretch and damage the detrusor muscle, leading to atony of the bladder wall, which ultimately leads to retention of urine. This is common in males over 50 years necessitating a catheterization. In our technique, restriction of the IV fluid administration reduced the urine formation in large amounts, before the nervous system regains the ability to initiate micturition. These patients could walk to the toilet to void urine, about 4 hours after the surgery. After general anaesthesia, pain from the ano-rectal area inhibits micturition. The general anaesthetic agents; inhalational, long acting narcotic analgesics and the anti-cholinergics increase POUR.

CONCLUSION

Perineal and penile procedures can conveniently be done under caudal epidural block in adults. Landmark based caudal block in adults had an unacceptably low success rate, making it a non-viable option. Ultrasound guidance improves the efficiency, safety and patient comfort of caudal block in adults; and make it a practical and viable option. It provides good and prolonged post operative analgesia. Caudal epidural block does not cause hypotension or spinal head ache as in the sub-arachnoid block. Intravenous fluid loading leading to extra urine formation, done along with the spinal anaesthesia, to prevent spinal hypotension is not warranted. Post Operative Urinary Retention (POUR) which is common after perineal procedures done under spinal or general anaesthesia may be totally avoided, as revealed by the study. Overall, Caudal block in adults enhances the 'Enhanced Recovery After Surgery'.

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