Caudal Epidural Anesthesia: An Anesthetic Technique Exclusive for Pediatric Use? Is it Possible to Use it in Adults? What is the Role of the Ultrasound in this Context?

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Summary: Najman IE, Frederico TN, Segurado AVR, Kimachi PP – Caudal Epidural Anesthesia: An Anesthetic Technique Exclusive for Pediatric Use? Is it Possible to Use it in Adults? What is the Role of the Ultrasound in this Context?

Background and objectives: Caudal epidural anesthesia is the most popular regional anesthesia technique used in children. With advanced age, only the relative difficulty in localizing the sacral hiatus limits its use. However, in adults this technique has been widely used to control chronic pain by adjuvant use of fluoroscopy. Thus, the ability to locate the hiatus and define anatomical variations is the main determinant of the success and safety of caudal epidural anesthesia. In this context, the use of the ultrasound in caudal epidural anesthesia has been increasing. The objective of this review was to determine the role of the ultrasound in caudal epidural anesthesia and to demonstrate that this technique, widely used in children, is also useful and can be used in adults.

Content: A review of the literature on sacral anatomy and the anesthetic technique necessary to perform caudal epidural anesthesia was undertaken. Recent studies in ultrasound-guided caudal epidural anesthesia both in children and adults were also included.

Conclusions: Despite its limitations, the ultrasound can be a useful tool to position the needle in the caudal space. It allows prompt identification of the sacral anatomy and real-time visualization of the injection. Considering it is portable, non-invasive, and free of radiation exposure, it is an attractive technique in the operating room especially in difficult cases. However, since its use in neuroaxis anesthesia is very primitive, more studies are necessary to make it a routine technique in anesthetic practice.

Keywords: Anesthesia, Caudal; Anesthesia, Epidural; Pediatrics; Ultrasonography.

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INTRODUCTION

Caudal epidural anesthesia is the most popular regional anesthesia technique used in children [1,2].

The caudal approach of the epidural space is done through the sacral hiatus [1]. The sacrum is located on the distal end of the spine being composed of five vertebrae fused into one single bone structure [3].

The sacral hiatus is located in the inferior portion of the posterior sacrum and it is formed by the lack of dorsal fusion of the posterior arches of the fifth sacral vertebra. It can be easily identified by palpating an inverted v-shaped triangular cleft above the sacrococcygeal space. It is covered by a fibrous structure formed by intertwined fibers of the superficial and deep fibers of the sacrococcygeal ligament. This structure, known as sacrococcygeal membrane, closes the distal extremity of the epidural space. Thus, the ability to locate the hiatus and to define is anatomical variations are the main factors for the success and safety of caudal epidural anesthesia. The sacral hiatus opens directly into the sacral canal, the distal extremity of the spinal canal [1].

The vertebral canal contains the cauda equina, spinal meninges, adipose tissue, and sacral venous plexus. With age, adjacent ligaments and the cornua become thicker. As a consequence identification of the margins of the hiatus becomes a challenge. Practical problems related to caudal anesthesia are attributed mainly to a wide variation in sacral size, shape, and orientation [3].

In children caudal anesthesia is usually indicated for intra- and postoperative analgesia. Procedures involving the area of T10 to S5 dermatomes in children younger than 8 years of age or weight lower than 30 kg are more adequate. Above this age only the relative difficulty in localizing the sacral hiatus limits the use of caudal epidural anesthesia [1].

In adults the technique is used mainly to control chronic pain[3]. Adults are placed in the prone position for the blockade while children are placed in lateral decubitus [3].

Recent advances in ultrasound improved significantly spinal sonoanatomy. Therefore, currently ultrasound images have been used to determine or guide central neuroaxis anesthesia. This occurs because the ultrasound is a non-invasive, safe, and simple tool. It can be readily used, it does not involve exposure to radiation, besides providing real-time images, and it

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is devoid of side effects. Thus, a pre-puncture scanning allows the operator to see the spinal anatomy, identify the midline, accurately predict the depth of the epidural space, determine the optimal site for puncture and the trajectory of the needle. In additon, when used in central neuroaxis anesthesia it also improves the success rate in the first attempt, decreases the number of punctures or the need of multiple punctures, and improves patient comfort during the procedure.[4]

Preliminary studies indicate that the ultrasound also has technical advantages in patients with abnormal spinal anatomy [4].

The objective of the present review was to elucidate the role of the ultrasound in caudal epidural anesthesia, and to demonstrate that the technique – frequently used in children – is also useful and can be used in adults. A review of the anatomy and anesthetic technique of caudal anesthesia with and without ultrasound, both in adults and children are also described.

CONTENT

Simple caudal epidural anesthesia in children

Caudal epidural anesthesia, which is relatively easy to perform as long as the correct landmarks are identified is the most popular technique used in children. Usually performed under general anesthesia, important landmarks include the coccyx and sacral hiatus located between both sacral cornua [2].

Simple caudal epidural anesthesia has been widely used with a variety of hypodermic, intravenous, spinal anesthesia, and epidural puncture needles. Most authors do not recommend the use of this non-specific material in the sacral epidural approach [1]. Thus, the ideal needle should be short-beveled 20- to 2- gauge with a stylet. One should not forget the advance of dermal or subdermal tissues into the epidural space can cause the formation of a dermoid cyst. Therefore, if using a needle without stylet it is important to perforate the skin with another needle before the puncture to prevent tissue transposition [1,3].

Before caudal anesthesia the child should be monitored with pulse oximetry, cardioscope, non-invasive blood pressure, and have a peripheral venous access available. The child is placed in lateral decubitus preferentially left lateral decubitus with legs at 90° over the hips and 45° over the knees. Head positioning should observe preservation of free airways. The sacral hiatus can be identified as the lower vertex of an equilateral triangle having its base in the posterior superior iliac spines [1].

Due to the proximity of the anus a skin antisepsis should be carefully done [1]. The needle is inserted 1-2 mm caudally half-way between both cornua, proximal to the vertex of the hiatus, at a 45° angle in relation to the skin. After the loss of resistance characteristic of passing the sacrococcygeal membrane the needle is repositioned, decreasing the angle to 20°-30° and it is inserted 2-3 mm into the vertebral canal [1,2].

Once inside the epidural space, one needs to be careful to avoid advancing the needle any further, since the dural sac in small children can extend to the level of S3-S4 (contrary to adults in which it extends to S2) leading to unintentional dural puncture [2]. Thus, intravascular or subarachnoid placement should be ruled out by gently aspirating the syringe or maintaining the needle open for 10-15 seconds. Note that negative aspiration of blood or cerebrospinal fluid in children is not reliable because of the high complacency of epidural veins and intrathecal space, which are easily collapsible [1].

A test dose of the anesthetic is then injected and after 30-60 seconds the anesthetic solution is injected slowly with frequent aspirations observing monitoring parameters [1]. The test dose (0.1 mL.kg of local anesthetic solution with adrenaline 1:200,000) should be administered despite its controversial effectivity in children. Elevations of the T-wave more than 25% of the baseline or an increase in heart rate greater than 10 bpm indicate intravascular injection of adrenaline. Systolic blood pressure can increase by 15 mmHg. However, this parameter is less reliable than T-wave changes [2].

Perforation of the dura mater is rare when the technique is properly executed. Infectious complications such as abscesses or meningitis after single-injection epidural anesthesia have not been reported in the literature. The development of infections is usually related to placement of catheter for postoperative analgesia [3].

In general, complications like neurologic damage, epidural hematoma, infection, and dural puncture are rare when the technique is properly executed [3].

Simple caudal epidural anesthesia in adults

Unlike children in whom caudal epidural anesthesia should be done with the patient anesthetized and in lateral decubitus due to easier access to the airways, in adults the prone position is used more often for caudal epidural anesthesia. Thus, with the patient in the prone position a pad should be placed below the pubic symphysis and the iliac crest to produce slight flexion of the hips. This maneuver facilitates palpation of the caudal canal [3].

The skin should be cleaned and after identification of the sacral hiatus infiltrated with 1% lidocaine [3].

If fluoroscopy is used the sacral canal appears as a translucent layer posterior to the sacral segments. The median sacral crest is seen as an opaque line posterior to the canal. The sacral hiatus is usually visualized as a translucent opening at the base of the vertebral canal, and the coccyx is seen articulating with the inferior sacral surface [3].

In adults, the 17G or 18G Tuohy needle is the ideal needle for this procedure. The needle is inserted in the midline of the canal and a slight "click" should be felt as the needle advances through the sacrococcygeal ligament. Once the needle reaches the ventral wall of the canal, it should be slowly pulled back and reintroduced cranially before being inserted in the canal. The loss of resistance technique should be used to confirm placement of the needle in the epidural space. To avoid dural puncture, its tip should be below S2, which corresponds to a mark in the skin 1 cm below the posterior superior iliac spine [3].

Subcutaneous, intravascular, or subarachnoid placement of the needle should be ruled out. If the tip of the needle is in the periosteum the resistance to the injection can be felt and the patient perceives extremely uncomfortable [3]. In clinical practice several ways of identifying the caudal epidural space exist. The most common is the characteristic "click" that indicates penetration of the sacrococcygeal ligament, although the loss of resistance is the most reliable. Correct needle positioning can be confirmed by the lack of subcutaneous edema or resistance to the injection, electrical stimulation with contraction of the anal sphincter, and determination of the clinical effects of the drug injected [4,5].

Severe complications are rare, but they include epidural abscess, meningitis, epidural hematoma, dural puncture and post-puncture headache, subdural injection, pneumocephalus and air embolism, lumbar pain, and catheter rupture [3].

Ultrasound-guided caudal epidural anesthesia

Ultrasound of the sacrum should be done to identify the relevant sonoanatomy before caudal epidural injection. Note that since the sacrum is a superficial structure a high-frequency linear transducer should be used [4].

In a transversal sonogram of the sacrum at the level of the sacral hiatus both prominences of the sacral cornua are seen as two inverted U-shaped hyperechoic structures at each side of the midline. One can see a hyperechoic band, the sacrococcygeal ligament, connecting both sacral cornua. Another linear hyperechoic structure representing the posterior sacral surface can be seen anterior to the sacrococcygeal ligament. The hypoechoic space between the sacrococcygeal ligament and the posterior surface of the sacrum is the sacral hiatus [4,5] (Figure 1).

In a sagittal sonogram of the sacrum at the level of the sacral cornua the sacrococcygeal ligament, base of the sacrum, and sacral hiatus can be clearly visualized. Above the sacral hiatus the sacrum is identified as a smooth hyperechoic band with a wide anterior acoustic shadow. If the transducer is moved cephalad maintaining the same direction the space between the sacrum and the L5 blade (paramedian sagittal scanning) represents the L5/S1 intervertebral space. This ultrasound landmark has been commonly used to identify a specific lumbar space [4] (Figure 2).

It is known that the ultrasound is more accurate than palpation to identify a given lumbar space. However, since the ultrasound identification of the intervertebral lumbar space depends on the ability of the operator to identify the L5/S1 space, this method has limitations in the presence of sacralized L5 or lumbarized S1 when the L4/L5 space can be misinterpreted as L5/S1. Therefore, since it is not possible to foresee this situation without an alternative imaging exam (X-ray, CT scan, or MRI), the L5/S1 space still is a useful ultrasound landmark. However, it is important not forget that occasionally the level of intervertebral identification could be 1 to 2 intervertebral levels distant [4].

For caudal epidural injection, a sagittal transverse scanning is done at the level of the sacral hiatus using a high-frequency (6-13 MHz) transducer as mentioned before. The needle can be inserted in plane or out of plane. For in plane insertion, sagittal scanning is done and the needle is passed through the sacrococcygeal ligament into the sacral canal in real time visualization. However, since the sacrum hinders passage of the ultrasound beam, a large acoustic shadow exists making it difficult to visualize the tip of the needle or dispersion of the injection within the sacral canal [4].

Figure 2 – Longitudinal Ultrasound Image of the Spine. Identification of the L4, L5, and Sacral Facies (continuous hyperechoic line).

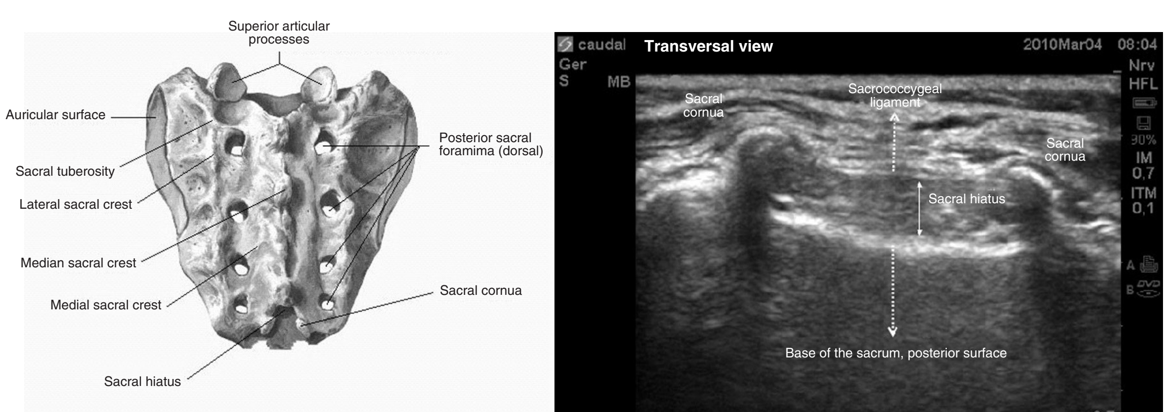

Figure 1 – Anatomical Illustration of the Sacrum and Transversal Ultrasound Image of the Sacral Region Identifying Structures Relevant for Caudal Epidural Anesthesia.

The ultrasound-guided caudal epidural technique is also described using the transducer longitudinally (Figures 3 and 4). Thus, after insertion of the needle between both cornua until the sacral hiatus and feeling the characteristic “click”, when the sacrococcygeal ligament is penetrated, the transducer is rotated 90° to obtain the longitudinal visualization of the sacrum and sacral hiatus. The needle is inserted into the sacral canal under direct real-time longitudinal visualization. However, in adults it is difficult to follow the needle if it is in the sacral hiatus. This is due to the presence of bone artifacts. Therefore, after negative aspiration for blood or CSF the injection must be done with the ultrasound to identify the turbulence in the sacral canal and cephalad dispersion of the solution injected which is not an easy task in adults [6] (Figure 5).

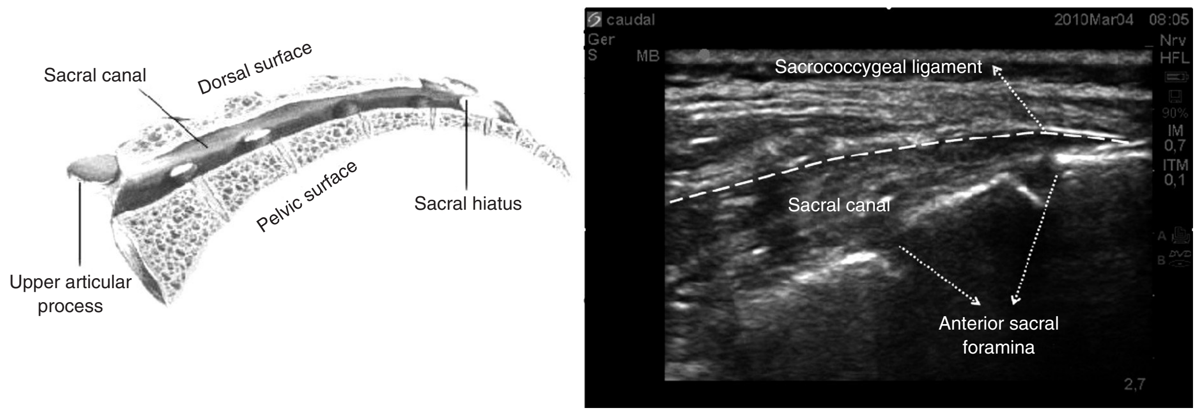

Figure 3 – Anatomical Illustration of the Sacral Canal and the Longitudinal Ultrasound View of the Sacral Canal.

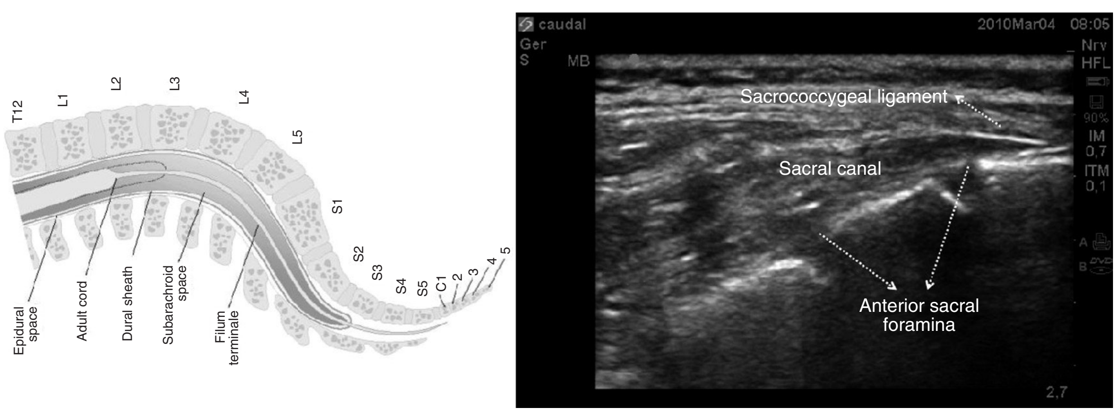

Figure 4 – Anatomical Comparison of the Structures of the Lumbosacral Region and the Longitudinal Ultrasound Image.

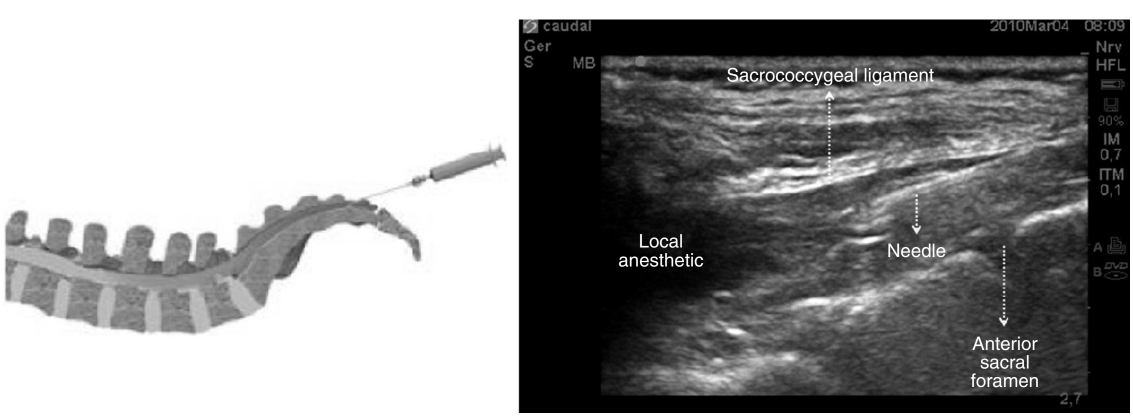

Figure 5 – Anatomical Illustration Indicating the Point of Needle Introduction for Caudal Epidural Anesthesia. Longitudinal Ultrasound Image of the Sacral Canal Visualizing the Needle Inside the Canal. Cephalad Turbulence of the Local Anesthetic after its Injection in the Caudal Epidural Space in Children with 28 Days.

Note that inadvertent intravascular injection is reported in 5% to 9% of those procedures and it cannot be detected by the ultrasound.[4] Thus, although the Doppler is not completely reliable since the turbulence of the injection can be seen as flow in several directions with different colors misinterpreting it as intravenous injection, it can be used. The author reported that fluoroscopy is the best way of ruling out intravenous or intrathecal injection. Consequently, the ultrasound can be used when fluoroscopy is not available or as a guide for placement of the needle in the sacral canal, as adjuvant to fluoroscopy [6].

In children, ultrasound-guided caudal epidural anesthesia is performed after induction of general anesthesia and placement of the child in lateral decubitus. The site where one imagines the caudal puncture should be done is marked. Afterwards, the anesthesiologist performs the ultrasound first in the transverse plane beginning at the tip of the coccyx in the direction of the sacrum to demonstrate the marking done prior to the ultrasound. This is then repeated using the longitudinal probe and the patient undergoes a sterile palpation [7].

The needle (21G regional or 20G vascular catheter) is inserted and the ultrasound probe is placed (after being sterilized) in a cephalad orientation to the injection site in the transversal plane approximately at the tip of the needle. While an assistant auscultates changes in heart rate and observes the electrocardiographic morphology, small amounts of the anesthetic solution are injected. Dilation of the caudal space and localized turbulence are noted confirming successful positioning of the needle in the caudal epidural space. Color mode is also used to indicate the flow of fluid in the caudal space [7].

Note that turbulence during injection can be more easily visualized when the depth of the ultrasound is adjusted for 2 cm. Besides, repeated ultrasounds have allowed recognition of the sacrococcygeal anatomy in children [7].

Review of the literature in ultrasound-guided caudal epidural anesthesia

Chen et al. [5] undertook a study with 70 patients with lumbosacral neuritis from August 2002 to July 2003. They used a high-frequency (5-12 MHz) transducer to identify the sacral hiatus. Initially, a transverse ultrasound image of the sacral hiatus was obtained to identify appropriate landmarks. Then, using the longitudinal view, a 21G Tuohy needle was introduced into the caudal epidural space under direct view. Appropriate needle placement was confirmed by fluoroscopy. Further introduction of the needle into the sacral hiatus and caudal epidural space was done under continuous, real-time ultrasound. A 100% success rate on placing the needle in the caudal epidural space was observed. However, the tip of the needle could not be visualized by the ultrasound after being inserted in the epidural sacral space due to bone artifacts. Aspiration was the only method used to identify the presence of CSF or blood [5,6].

Gross [8] criticized the aforementioned study saying that Chen et al. [5] demonstrated a 100% success rate in the correct identification of the caudal epidural space in the absence of a control group. This was done after they mentioned a study with 25% failure rate when caudal anesthesia was done with the loss of resistance technique. Thus, although the technique seems promising, Gross [8] suggests that an individual comparison with the loss of resistance technique should be done. And he also suggested that standardization for technical similarities among operators is necessary to establish the technical superiority of the ultrasound-guided technique.

The absence of alternative methods to aspiration to detect blood or CSF in the study by Chen [5] led Yoon et al. to evaluate the use of the Doppler in caudal injection to identify any intravenous injection. After accessing the epidural space, 5 mL of the anesthetic solution were injected while observing the flow with the high-resolution (5-12 MHz) transducer and color Doppler. The injection was defined as successful if the unidirectional flow (dominant color) of the solution was observed with the Doppler through the epidural space below the sacrococcygeal ligament. No flow could be observed in other directions (multiple colors). Correct placement of the medication was confirmed by contrast fluoroscopy. In 52 out of 53 patients evaluated the medication was successfully administered in the caudal epidural space with ultrasound guidance. Fluoroscopy of those 52 patients revealed correct placement of the drug in the caudal epidural space in 50 patients. However, three patients including one with negative Doppler and two with positive Doppler showed contrast outside the epidural space.[6]

In another study, Klocke et al. described the use of ultrasound-guided caudal epidural injection of corticosteroids. They found it useful, especially in moderately obese patients or in patients with difficulty to be placed in ventral decubitus. They reported good visualization of landmarks, but they needed a low-frequency transducer (2-5 MHz) in obese patients to achieved adequate penetration [6].

Recently, a retrospective observational study on caudal injection with 83 pediatric patients was conducted. The objective of this study was to compare the accuracy of caudal epidural needle positioning between two confirmatory tests, the “swoosh” test (auscultation with a stethoscope in the sacral region during caudal injection of local anesthetic) and real-time ultrasound image (transversal bidimensional ultrasound and color flow Doppler). The authors concluded that ultrasound is superior to the “swoosh” test as an objective confirmatory technique during caudal anesthesia in children. They reported that the presence or absence of turbulence on ultrasound during injection of the local anesthetic in the caudal space is a better indicator of successful anesthesia [6,9].

However, the lack of studies on the success rate of adequate positioning of the caudal epidural needle in children led to a comparative study between the accuracy of routine needle placement and graduation of ultrasound view regarding the efficacy of the blockade. In this context, 53 ultrasound-guided anesthesias in children ages 1-72 months undergoing low abdominal surgery were investigated. The needle was visualized in the caudal epidural space in 45 out of 53 anesthesias. The injection in the caudal epidural space was clearly seen in the 45 blockades in which the needle was visualized. Those blockades were considered successful according to intraoperative vital signs and postoperative nursing criteria. In five patients the needle was not visualized in the ultrasound, but the injection inside the caudal epidural space was seen. Those anesthesias were considered successful according to the criteria mentioned. In the three patients that neither the needle nor the injection could be visualized, the anesthesia was considered a failure both by intraoperative vital signs and postoperative nursing criteria. Thus, according to this study, ultrasound findings are related to correct prediction of success or failure ($p < 0.001$) [10].

Schwartz et al. [11] reported a case of technical difficulty on performing caudal anesthesia in an 8-month old child undergoing inguinal herniorrhaphy and postectomy. According to their report, success was achieved by ultrasound guidance. Caudal anesthesia in this child was initially impossible due to subcutaneous edema of the sacral region secondary to inadequate needle positioning, which hindered the anatomic identification necessary to perform the anesthesia. Consequently, a transversal ultrasound of the sacrum was performed (linear transducer perpendicular to the spinal axis). This allowed prompt identification of the sacral cornua and hiatus, besides marking needle placement on the skin over the sacrococcygeal ligament, midway between both cornua. Afterwards, a few centimeters above the site of the injection, a new image in the transversal plane showed the characteristic turbulence in the caudal space. The flow was also detected by the Doppler. The absence of changes in vital signs during the surgery, the presence of a partial motor blockade in the lower limbs, and a comfortable stay in the post-anesthetic recovery unit lead to the classification of the anesthesia as successful.

DISCUSSION

Caudal epidural anesthesia is the injection of drugs in the epidural space through the sacral hiatus. It is useful when anesthesia of lumbar and sacral dermatomes is necessary.

Caudal epidural anesthesia is the most popular technique of regional anesthesia used in children up to 8 years of age. Above this age, only the relative difficulty in localizing the sacral hiatus limits its use. However, in adults the technique has been widely used especially for control of chronic pain. Successful caudal anesthesia requires adequate placement of the needle in the epidural space.

The rate of failure to place the needle in the caudal epidural space can be higher than 25% even with experienced anesthetists.[5] In this context, the ultrasound has been gaining space as a guide in caudal epidural anesthesia. This happens because the ultrasound allows the identification of sacral anatomy, besides visualizing the injection in the caudal space during the anesthesia. It is a portable, non-invasive technique, making it an attractive tool in the operating room, especially in difficult cases. So, lately, several groups have described the use of the ultrasound during caudal anesthesia both in children and adults [11].

The sacrum and coccyx are formed by the fusion of eight vertebrae (five sacral and three coccygeal). As a result, a natural defect secondary to incomplete fusion in the posterior midline of the inferior portion of S4 and S5 exists. This defect is known as the sacral hiatus, and it is covered by the sacrococcygeal ligament. The hiatus is limited laterally by the sacral cornua, and its base is formed by the posterior aspect of the sacrum. However, it is important not to forget that anatomical variations of the sacrum and neurovascular bundles inside the sacral canal could be found in more than 10% of the cases. This represents a challenge during injection of drugs in the caudal epidural space. The literature reports inadvertent intravascular injection in approximately 2.5% to 9% of the cases in which negative aspiration of blood did not prove to be sensitive or specific for needle placement [6].

Moreover, intravascular injection is more common in older patients since the epidural venous plexus which as a rule ends in S4 can continue inferiorly. Once more, the literature stresses the importance of performing caudal epidural injection with real-time imaging exams in order to maximize the results and minimize complications [6].

In adults, epidural injections of local anesthetics and corticosteroids have been widely used to promote pain relief in patients with low lumbar disorders. Those injections can be done using the translaminar, transforaminal, and caudal routes. The caudal approach to the epidural space has been the preferred route for many anesthetists, since puncture of the dural sac and intrathecal injection of drugs is rare. For this reason, fluoroscopy has been commonly used to confirm placement of the needle. However, radioactive exposure has become the greatest concern of using fluoroscopy. Therefore, currently pulsatile images during fluoroscopy are preferred, since it decreases total exposure by 25% to 75%. The ultrasound has become advantageous in localizing the sacral hiatus and guiding the needle into the caudal epidural space because it is easy to use, free from radiation, and it can provide continuous, real-time images of the needle without exposure to radiation in both clinical and virtual conditions. The main disadvantage of this technique is the impossibility to visualize the needle as it becomes deeper, since ultrasound waves cannot penetrate the bone. Thus, it is necessary to verify the presence of CSF before injecting corticosteroids [5].

Note that independently of the technique real-time ultrasound is by far a more demanding intervention because a high degree of manual dexterity, hand-eye coordination, and ability to interpret the bidimensional images are necessary. Before central neuraxial intervention with the ultrasound, required abilities and familiarity with the spinal ultrasound technique, and sonoanatomy of the spine are required. Besides, one should consider patient positioning during the ultrasound. It is believed that the patient should be position in order to allow maximal manual dexterity. Consequently, the operator can use the dominant hand in the intervention and the non-dominant hand to hold the transducer. One should also pay attention to the gel used under the transducer to couple acoustics during visualization of the ultrasound image. Although it has been considered safe, a study demonstrating the safety of the gel in the meninges or in central neuraxial structures is lacking. Therefore, saline applied through rubbing or sterile gauzes can be used as an alternate coupling agent, and it also maintains the area under the transducer hydrated. During transducer preparation a fine layer of sterile ultrasound gel should be placed on it and then a sterile transparent plastic cover is applied ensuring the lack of air between the cover and the transducer. Then, saline can be used in the covered transducer or the skin. One should not forget that a slight deterioration in image quality is expected when compared to that of the scanning using the gel which can be adjusted through image gains. Strict antisepsis should be maintained during the use of the ultrasound [4].

In children, caudal epidural anesthesia is done under general anesthesia. In pediatric anesthesia, the ultrasound has proven to be an invaluable tool. It allows prompt visualization of the sacral region and familiarization with the anatomy before anesthesia. Equally important is the potential of the ultrasound to confirm the blockade, since failed anesthesia could be associated with significant morbidity especially in small children, besides the discomfort for the patient. The ultrasound also allows direct real time inspection of the caudal space and visualization of the injection as it is administered [11]. Consequently, the greatest advantage of the ultrasound as a guide in pediatrics is the possibility of direct visualization of the structures necessary for the blockade and the proximity of the needle to adjacent neural structures, avoiding damage. Thus, besides visualizing intrathecal structures, dural sac, epidural space, and cauda equina, a direct real-time visualization of the injection of local anesthetics is possible [12].

Although the ultrasound image can be hindered by ossification of the spine, in premature children it is possible to visualize all neural structures because of incomplete ossification of the spine. Consequently, despite the difficulty the ultrasound can be used to visualize the tip of the needle in the epidural space as well as the introduction of the catheter in the epidural space in small children [12].

CONCLUSION

Caudal epidural anesthesia promotes analgesia and anesthesia of lumbosacral nerve roots. In children, this is the anesthetic technique used more often. Despite the infrequent use in adults, it has been used in pain clinics with the aid of fluoroscopy.

Lately, the ultrasound has been used as adjuvant tool in caudal anesthesia because it is free of radiation and can provide real-time images. However, since its use in central neuraxial anesthesia is primitive more studies are necessary to confirm this as a routine technique in anesthesia.

Thus, based on literature data, despite its limitations, the ultrasound can be a useful adjuvant tool in placing the caudal epidural needle, both in adults and children. In adults, it has the potential to improve the technique and minimizes the rate of failure and exposure to radiation in chronic pain, deserving further investigation. In children, several studies are necessary to determine the accuracy of needle placement and grade the available ultrasound view regarding the final efficacy of anesthesia. This can be explained by the fact that the majority of the studies have reported subjective difficulty in visualizing the needle. Real-time visualization of the tip of the needle avoids damage of adjacent neural structures, which is extremely important especially since anesthesia in children is performed under general anesthesia.

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Resumen: Najman IE, Frederico TN, Segurado AVR, Kimachi PP – Bloqueo Epidural Caudal: ¿Técnica anestésica de uso exclusivo en niños? ¿Se puede realizar en Adultos? ¿Cuál es el rol del ultrasonido en ese Contexto?

Justificativa y objetivos: El bloqueo epidural caudal es la más popular entre todas las técnicas de anestesia regional en niños. Cuando la edad avanza, apenas la relativa dificultad en localizar el hiato sacral limita su uso. Sin embargo, en los adultos, la técnica ha venido siendo ampliamente utilizada para el control del dolor crónico, con la ayuda de la fluoroscopía. Por lo tanto, la habilidad en poder ubicar el hiato y definir las variaciones anatómicas es el principal factor determinante del éxito y de la seguridad en la ejecución del bloqueo epidural por la vía caudal. En ese contexto, el ultrasonido ha venido ganando espacio como guía para la realización del bloqueo caudal. El objetivo de esta revisión fue elucidar el papel del ultrasonido en la anestesia caudal, además de demostrar que el bloqueo caudal, muy utilizado en niños, también es útil y puede ser usado en adultos.

Contenido: Se hizo una revisión literaria sobre la anatomía de la región sacral y de la técnica anestésica necesaria para la adecuada realización del bloqueo caudal. Además, también se incluyeron artículos recientes sobre estudios realizados con bloqueos epidurales caudales guiados por ultrasonido tanto en niños como en adultos.

Conclusiones: El ultrasonido, a pesar de sus limitaciones, puede ser útil como una herramienta coadyuvante en el posicionamiento de la aguja en el espacio caudal. Permite la fácil identificación de la anatomía sacral, además de la visualización de la inyección en tiempo real. Su naturaleza portátil, no invasiva y libre de exposición a la radiación, lo convierte en una tecnología atractiva en quirófano, principalmente en las situaciones de emergencia de casos complicados. Sin embargo, como su uso en bloqueos centrales del neuro eje todavía es muy primitivo, se hacen necesarias más investigaciones para que se consagre como una técnica de rutina en la práctica anestésica.

Descriptores: ANESTESIA, Especialidade: pediatría; EQUIPOS, Ultrasonido; TÉCNICAS ANESTÉSICAS, Regional: peridural sacral, anestesia peridural.