Ultrasonography and Pediatric Caudals

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Recently, several groups have reported using ultrasonography during caudal blocks in both adults and children. Ultrasound allows for easy identification of sacral anatomy and visualization of injectate within the caudal space during the placement of a block. Its portability and noninvasive nature make it a very attractive technology in the operating room (OR) when difficult cases arise. We present a case in which ultrasound proved helpful in placing a caudal block when a child’s sacral anatomy became difficult to define.

CASE REPORT
A 10-kg 8-mo-old male infant presented to the OR for inguinal hernia repair and circumcision. After the induction of general anesthesia and placement of an IV and laryngeal mask airway, the child was turned on its left side in preparation for a caudal block. A first-year anesthesia resident doing his first pediatric rotation attempted the block. After palpating the sacrum and confirming the site of the sacral hiatus and cornua, the resident proceeded to penetrate the sacrum with a 20-gauge angiocath. Three milliliters of 0.25% bupivacaine with epinephrine 1:200,000 were slowly injected in 1 mL aliquots while monitoring for electrocardiogram changes. A palpable mass became apparent at the site of injection, indicating subcutaneous infiltration. At this point the resident yielded to the attending anesthesiologist who resterilized the area and reattempted the block. Using the same technique, an additional 1–2 mL infiltrated the same area, extending the wheal, making anatomic identification very difficult. A Sonosite Titan (Sonosite, Bothell, WA) portable ultrasound machine was called for, and with the probe in the transverse plane (perpendicular to the spinal axis), the sacrum was scanned. The sacral cornua and hiatus were quickly identified and a needle mark made on the skin over the sacro-coccygeal ligament midway between the cornua. Six milliliters of the bupivacaine solution was eventually injected incrementally. Scanning several centimeters above the point of injection, again in the transverse plane, turbulence could be seen in the caudal space (Fig. 1). Flow was also detected using the color Doppler mode (Fig. 2). Based on the lack of vital sign changes during surgery, a partial motor block of the lower extremities on emergence from anesthesia and a generally comfortable stay in the postanesthesia care unit, the caudal block was considered successful.

DISCUSSION
This case illustrates two important uses of ultrasonography for pediatric caudal blocks. The first is the ability to quickly scan the sacral area and become familiar with the anatomy before attempting a block. The second is the confirmation that medication is being injected in the correct place. Ultrasound allows one to actually “see” the sacral cornua and sacral hiatus and correlate the image with what one feels with the palpat ing finger. In this specific case, palpation proved difficult because of the edema over the sacrum from the previous caudal attempts, and ultrasound imaging was needed to find the correct landmarks. In their discussion, Roberts et al. make a similar point regarding children with spinal dysraphism. It is very likely that further attempts in our infant would have been abandoned had ultrasound not been available to us. Because of cases such as this, we have begun using ultrasound on a more routine basis when placing pediatric caudal blocks.

Ultrasound is proving to be an invaluable teaching tool in our pediatric ORs. We encourage our residents to find sacral landmarks both by palpation and with ultrasound. Quite often, ultrasound shows the resident’s palpating finger off the mark, most times in too caudal a position. As we previously reported, images over the coccyx and sacrum are easily learned,
even by the novice. (We have named several images to help residents identify them, for example Fig. 3 “the evil eye” and Fig. 4 “Mickey Mouse ears” over the coccyx, and Fig. 5, “the two nuns” which is probably the most important anatomic view because it reveals the sacral cornua and the intervening sacral hiatus.)

Equally important is the potential for ultrasound to confirm block placement. A misplaced block can be associated with significant morbidity, particularly in small infants, and can make the patient uncomfortable. In the past, loss of resistance to injection, lack of skin infiltration, and an unchanged electrocardiogram were the only tools one had to predict correct placement. Orme et al.\textsuperscript{5–8} described the “swoosh” test as a modification of the “whoosh” test which relies on auscultation over the sacrum during injection, and we have described a “modified swoosh” which uses a hand-held Doppler stethoscope.\textsuperscript{9} Ultrasound provides a real-time, direct inspection of the caudal space, allowing one to actually see the injectate as it is being administered. Other groups studying ultrasound and caudals have used the probe in the longitudinal axis. Roberts et al.\textsuperscript{1} reported that longitudinal ultrasonography correctly identified caudal block position in
96.5% of children and was 100% successful in children younger than 2-yr-of-age. We prefer to use ultrasound in the transverse axis, both with and without the color Doppler mode.

The transducer we use is the L38/10–5 MHz broadband linear array transducer. This is applied perpendicular to the caudal canal for scanning. We adjust depth settings to suit each patient’s size, these adjustments produce different frame rates. The more superficial shallow images obtained with infants and toddlers produce higher frame rates consistent with better resolution of images. Gain settings were adjusted for optimal image quality, while the pulse repetition frequency depended on the flow sensitivity setting selected during color Doppler imaging.

In summary, we report a case in which successful caudal placement in a child was facilitated and confirmed with the aid of ultrasonography. Further studies need to be done to determine the success rate of “transverse” ultrasound in correctly predicting caudal block success in children and to compare it to other methods.

REFERENCES