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SHORT REPORT

Reversed ultrasound-guided dorsal penile nerve block in children: A retrospective study

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Pediatric penile surgery is characterized by elevated intra and postoperative pain levels. Currently, the landmark-based Dalens' technique is commonly used as a locoregional block. This method needs large volumes of local anesthetic (LA) and, in our experience, in most cases requires intraoperative administration of additional intravenous analgesia. Furthermore, hematoma, edema, intravascular injection of LA with local anesthetic systemic toxicity (LAST), glans ischemia and nerve or urethral lesions can occur.[1] Novel ultrasound (US)-guided nerve blocks in the context of pediatric urology have been introduced as alternatives to Dalens' block.

We think that the ideal technique should be an ultrasound (US)-guided in plane approach as it allows to visualize all the anatomical structures and the needle pathway. It also should be a compartment block in which LA is not directly injected into the perineurium but, in line with the philosophy of fascial blocks, spreads from the underlying structures allowing effectiveness and preventing damages.

Therefore, we conceived a new block, the "reversed ultrasound-guided dorsal penile nerve block" (RUS-DPNB). The previously described techniques do not satisfy these conditions and may be also difficult to perform.

In 2007, Sandeman described a US-guided Dalens' DPNB with an out-of-plane technique.[2]

This approach is not really safe as the needle tip is visible intermittently and often require two punctures to block the nerves bilaterally.

Suleman, in 2016, proposed an in-plane US-guided DPNB with anterior approach.[3]

This technique used a sharp traumatic needle and the LA is directly injected laterally to the dorsal artery increasing the risk of LAST and damages of the surrounding structures.

Wang et al.,[4] in 2019 described a block which may be similar to RUS-DPNB but with some important differences: LA is injected in the penile neurovascular sheath, the patient is in lithotomy position and the approach is perineal, which may be uncomfortable both for the patient and the operator.

This report describes the first applications of RUS-DPNB.

We retrospectively enrolled all consecutive American Society of Anesthesiologists 1–2 patients aged 0–18 years, undergoing penile urologic surgery from June to October 2019. The study was approved by the Institutional Ethics Committee (Protocol Number 171/2019).

General anesthesia was induced in all patients with Sevoflurane (8%) and N_2O/O_2 (50/50%). Eventually, anesthesia in spontaneous breathing with a laryngeal mask was maintained by Sevoflurane (2.5%–3%), air/O_2 (30/70%). Levobupivacaine 2.5 mg/ml was administered in a single injection (1 ml per each side) for children weighing up to 10 kg, and then an additional ml every 10 kg.[5] Two millilitre of topical Lidocaine 2% were applied to the foreskin to complete the block and ensure analgesia of the frenulum. The intraoperative requirement of additional fentanyl boluses and/or increase of sevoflurane dose was considered as a block failure.

1 | TECHNIQUE DESCRIPTION

A linear US probe is positioned along the transverse plane, between the root of the penis and the scrotum, slightly angled in a cranial direction toward the pubic symphysis (Figure 1A). In this US visualization, the anatomical structures are mirrored. For this reason, we named this technique "reversed" US-guided block. The description is referred to the mirrored image (Figure 1B,C), not to the anatomical one. Corpus spongiosum ("1") is visualized above the two corpora cavernosa ("2"). All these structures appear as hypoechoic

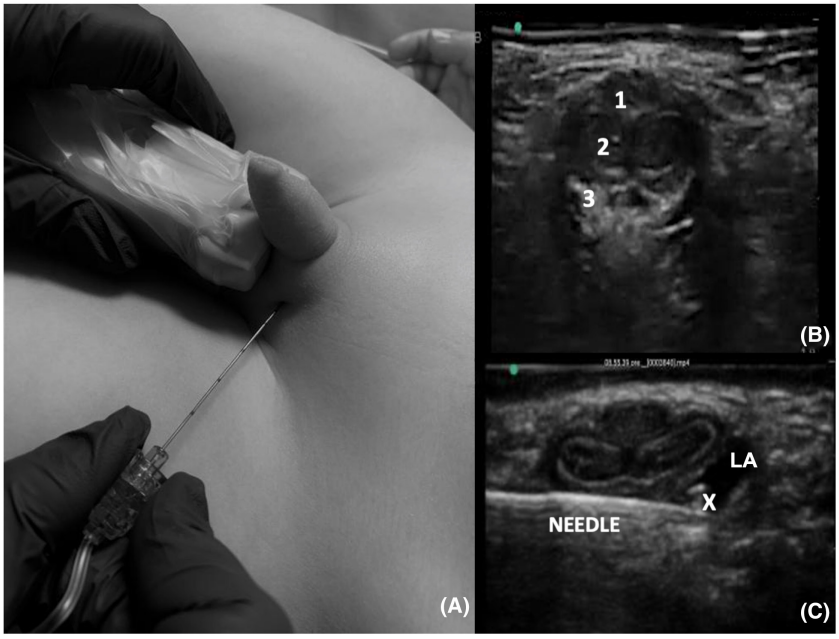

FIGURE 1 Probe position and echographic visualization of the reversed ultrasound-guided dorsal penile nerve block (RUS-DPNB). See the text for a detailed description of panels A–C. Corpus spongiosum ("1"); corpora cavernosa ("2"); Buck's fascia ("3"); RUS-DPNB target space ("X"); LA, local anesthetic.

structures encircled by a hyperechoic layer, that represents the tunica albuginea. The deep fascia of the penis (Buck's) and the superficial fascia of the penis (Dartos') are visible below the corpora cavernosa. Arteries, veins, and the two dorsal nerves of the penis run above the Buck's fascia ("3"). After all anatomical structures have been visualized, an injection is performed 0.5 cm lateral to the probe far away from the vas deferens. Use of an in-plane technique allows to visualize the needle as a hyperechoic structure. The space below the Buck's fascia ("X") is reached through slow advancement of the needle and after a negative aspiration test, the first injection delivers half the total volume of LA. LA spread is visualized as an anechoic layer, separating the deep fascia of the penis from the adjacent tissues. The needle is slowly retracted to inject the remaining LA to the other side. The panel shows the spread of LA all-around penile structures. The onset time of LA is about 10 min.

Overall, 40 patients were included, and the block was considered as failed in 11 children over 40 (27%) but only 4 of these patients (10%) required an additional fentanyl bolus for intraoperative signs of pain. Pain scores (visual analog scale and face legs activity cry consolability) after ward admission were above 0 in only 7 (17%) patients. The median execution times were 3 (2–4) min. The median times from execution to incision were 10 (10–10) min.

We showed that RUS-DPNB can be considered an effective US-guided technique. The in-plane methodology allows a safe visualization of the needle throughout the procedure and an exact injection of minimal LA amounts. The US-guided block may require a learning curve (this might explain the four patients who required additional fentanyl) and a few minutes to be completed, and it takes probably slightly longer time than the blind technique. The need for additional time to achieve a complete local anesthesia before incision might justify the remaining seven children who "failed" the block but did not ultimately require additional fentanyl. However, it allows relatively short time to be effective. In our experience, RUS-DPNB can be considered a valid alternative to currently available blocks.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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