



Local anaesthetic techniques for performing transperineal prostate biopsy

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New technical modifications enable transperineal prostate biopsy to be performed in the ambulatory setting under local anaesthesia. Although a variety of techniques for administration of local anaesthetic during transperineal prostate biopsy have been described, no consensus exists regarding the most effective method to use. Thus, ample opportunity exists for procedural innovation and future study on this topic.

Calls to abandon the transrectal approach to performing prostate biopsy are increasing. In fact, in 2021, the European Association of Urology (EAU) released a position paper endorsing the use of transperineal prostate biopsy whenever technically feasible in place of the transrectal approach¹. The main reason for this recommendation is that, by bypassing the rectal vault, the transperineal approach is inherently associated with a lower rate of infectious complications, such as cystitis, epididymitis, prostatitis and sepsis. Other advantages of transperineal prostate biopsy include a reduction in the risk of post-procedural rectal bleeding and increased cancer detection rates, particularly for anteriorly located tumours². Additionally, emerging evidence suggests that transperineal prostate biopsy can be safely performed without periprocedural antibiotic prophylaxis, improving antibiotic stewardship.

Historically, the most common method for performing transperineal prostate biopsy involved the use of a grid-based needle guide mounted to a mechanical stepper unit. One impediment to the adoption of this technique has been the need for general or spinal anaesthesia in order for patients to tolerate the required multiple needle passes through the perineal skin. Additionally, the use of a grid template restricts movement of the biopsy needle in perpendicular planes, thereby limiting sampling of the anterior and lateral aspects of the prostate, which are frequently obscured by the bony pelvis. Additionally, puncture of the urethra and corporal bodies is often unavoidable and can lead to urinary retention and erectile dysfunction, respectively.

To overcome the limitations of performing transperineal prostate biopsy with a mechanical stepper unit, the field has now largely shifted towards freehand-based approaches to this procedure. A defining element of freehand transperineal prostate biopsy is the use of

a common access cannula through the perineal skin, enabling repeated passage of biopsy needles through a relatively small number of skin puncture sites. During a typical procedure, only 1–2 needle punctures are required on each side of the perineum. Thus, with freehand transperineal prostate biopsy, a substantially smaller area of perineal skin requires anaesthetization than in the grid-based approach (FIG. 1a), making it possible to perform the procedure under local anaesthesia^{3,4}. Furthermore, compared with the use of a grid template, use of an access cannula increases the degrees of freedom of needle navigation, making it possible to avoid critical structures as well as to biopsy the prostate at oblique angles.

Knowledge of neuroanatomy of the pelvis is fundamental to performing transperineal prostate biopsy under local anaesthesia. Sensory innervation to the perineal skin, underlying soft tissue and muscles of the pelvic floor is provided by branches of the pudendal nerve (S2–S4). The trunk of the pudendal nerve travels through Alcock's canal and can be accessed just medial to the ischial tuberosity prior to it splitting into small branches that innervate the skin, soft tissue and pelvic musculature (FIG. 1b). Additionally, the prostate and prostatic capsule are innervated by sensory nerves arising from the pelvic plexus.

Local anaesthetics block the transmission of impulses from sensory nerve fibres by binding to voltage-gated sodium channels. For office-based urological procedures, 1–2% lidocaine is the most commonly used local anaesthetic. This medication has an onset of action of <2 minutes and can last up to 2 hours. The vasoconstrictor adrenaline can be added to the lidocaine solution to decrease its systemic uptake, to mean that higher maximal medication doses can be used (4.5 mg/kg without adrenaline versus 7 mg/kg with adrenaline).

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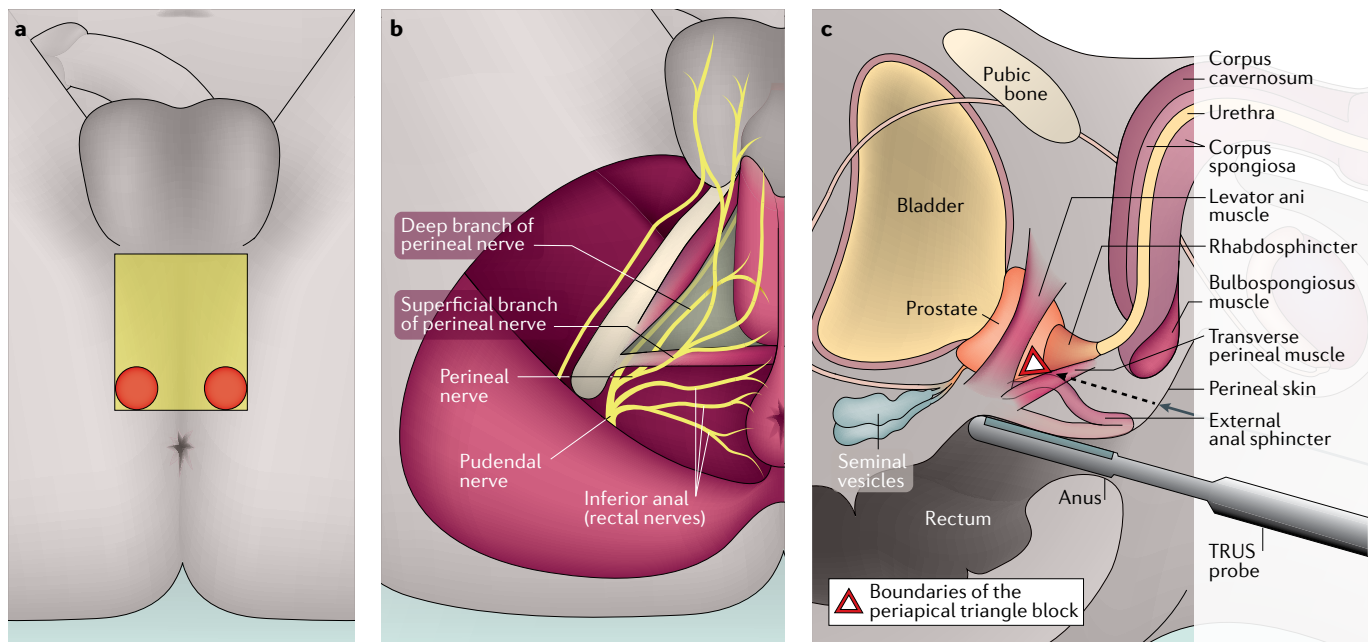


Fig. 1 | Methods for administering local anaesthesia during transperineal prostate biopsy. **a** | External inferior view of the perineum highlighting areas of skin that need to be anaesthetized for transperineal prostate biopsy with the grid-based (yellow square) and freehand (red circles) approaches. **b** | Inferior view of the perineum showing the muscles of the pelvic floor and their innervation by the pudendal nerve and its branches. **c** | Sagittal view of the male pelvis showing the location of the periapical triangle block. The periapical triangle is bounded by the medial edge of the levator ani muscle, the urethral rhabdosphincter and the external anal sphincter muscle. TRUS, transrectal ultrasonography.

However, crucially, adrenaline has a narrow therapeutic window and its use places patients at risk of systemic adverse effects such as arrhythmias, hypertension, palpitations, tachycardia, tremor, nausea and vomiting. Thus, we recommend against the routine use of this vasoactive agent and instead routinely use the alternative approach of buffering the lidocaine solution with sodium bicarbonate to increase its potency. This practice increases the relative concentration of lidocaine molecules in their active non-cationic form, increasing the speed of onset and decreasing the concentration of medication needed to achieve adequate analgesia⁵. Additionally, buffering lidocaine in this manner reduces the burning sensation often experienced by patients.

The first step in administering local anaesthesia for transperineal prostate biopsy is to **infiltrate the perineal skin in the areas of needle entry** (FIG. 1a). Next, the underlying soft tissue and muscles of the pelvic floor must be anaesthetized; this is most efficiently achieved with **direct blockade of the pudendal nerve** (FIG. 1b). Pudendal nerve block can be performed with blind infiltration of the nerve as it arises from Alcock's canal just medial to the ischial tuberosity, which can be readily palpated⁶. Alternatively, a finger can be placed in the rectum to guide the needle's trajectory. With either approach, concerns exist regarding direct intravascular injection of the anaesthetic as well as injury to the vascular structures that run alongside the nerve. To avoid this, **transrectal ultrasonography with colour-flow Doppler can be used to identify the pudendal artery and veins**. Regardless of the approach used, administration of this block can be technically challenging to perform.

In light of the concerns raised with performing the pudendal nerve block, other methods for achieving adequate anaesthetization of the pelvic floor have been developed. For example, Wang and co-workers have described a method for blocking the superficial and deep perineal branches of the pudendal nerve, which run anterior and medial to the pudendal vessels⁷ (FIG. 1b). Another technique, known as the **periapical triangle block**, achieves a similar effect by direct injection of the structures of the pelvic floor bounded by the medial border of the levator ani muscle, the rhabdosphincter of the urethra and the external anal sphincter⁸ (FIG. 1c).

Once the structures innervated by the pudendal nerve and its branches have been blocked, the prostate and its capsule are next anaesthetized. Anaesthesia of the prostate and prostatic capsule can be achieved by bilaterally injecting local anaesthetic within Denonvilliers' space near the prostatic pedicles, or more simply by medially puncturing beneath the endopelvic fascia and injecting anaesthetic between the fascia and the apex of the prostate on both sides of the gland. The first technique is known as the periprostatic nerve block^{6,9} and the latter as the prostate apex block¹⁰.

At present, relatively few studies have compared the various approaches for local anaesthesia during transperineal prostate biopsy^{6,7}, and external validation of their findings has been minimal. Thus, at the present time no consensus exists as to which method to employ. In our practice, we use a combination of the periapical triangle and prostate apex blocks using buffered 1% lidocaine, which provides adequate pain control in our patients, making it possible to routinely perform this

procedure in the office setting. However, potential for improvement still exists. Thus, as the field continues to evolve from the transrectal approach, it warrants investigating new anaesthetic techniques for performing transperineal prostate biopsy.

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Competing interests

M.J.A. is the founder and owner of Perineologic. M.A.G. is a paid consultant for bk Medical, KOELIS and Perineologic. All other authors declare no competing interests.