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Case series
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Ultrasound-guided caudal epidural anaesthesia for MRI-targeted transperineal prostate biopsy

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Abstract

Magnetic resonance imaging (MRI)-targeted transperineal prostate biopsy allows a more precise sampling of suggestive lesions. We describe a series of 10 cases for MRI-targeted transperineal prostate biopsy, of which 8 were successfully performed under ultrasound-guided caudal epidural anaesthesia. With the appropriate local anaesthetic volume and concentration, caudal epidural provides ideal conditions for this day case procedure.

Keywords: prostate biopsy, ultrasound-guided caudal epidural

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Introduction

Prostate cancer is the second most diagnosed cancer in men, with approximately 1.4 million new cases worldwide annually.[1] This high incidence is related to advances in prostate cancer screening including increasing public awareness, the use of prostate-specific antigen (PSA) testing, and improvements in prostate biopsy (PBx) techniques[2]. As a result, PBx is one of the commonest procedures performed by the urologist, with several surgical and concurrent anaesthesia techniques developed over the last few decades.[3]

A PBx technique that has recently generated interest is magnetic resonance imaging (MRI)-targeted transperineal prostate biopsy, which allows the clinician to target precise areas suggestive of cancer whilst avoiding those without any visible lesions on the MRI, thereby reducing the number of unnecessary biopsies and sampling errors.[4] MRI-targeted PBx has a similar or better ability to detect clinically significant cancer than standard biopsy techniques.[5,6]

The importance of effective anaesthesia for PBx regardless of technique cannot be understated. Men who undergo PBx have considerable psychological distress caused by the fear of cancer itself in addition to the anticipated procedural pain around a sexual organ and the anal route of penetration.[7] It is therefore now considered mandatory for anaesthesia to be administered during PBx. Over the years, various anaesthetic techniques have been described, including intrarectal lubricant agents, periprostatic nerve blocks, pelvic plexus blocks, pudendal nerve blocks, caudal blocks, intraprostatic anaesthesia, and general anaesthesia.[3]

In this article, we describe a case series on our experience in the use of ultrasound-guided caudal epidural anaesthesia for MRI-targeted transperineal PBx in a tertiary centre. To the best of our knowledge, there has been no description so far of utilising ultrasound-guided caudal epidural anaesthesia for this PBx approach.

Case series

We obtained informed consent from all patients included in this interventional case series as well as ethics approval from the Ethics Committee of Gleneagles Hospital Medini Johor. We describe the management of 10 cases of MRI-guided prostate biopsy with single shot caudal anaesthesia between August 2021 to January 2022.

The inclusion criteria were male adult patients, American Society of Anesthesia (ASA) physical statuses 1, 2, and 3, and scheduled for day case elective MRI-targeted

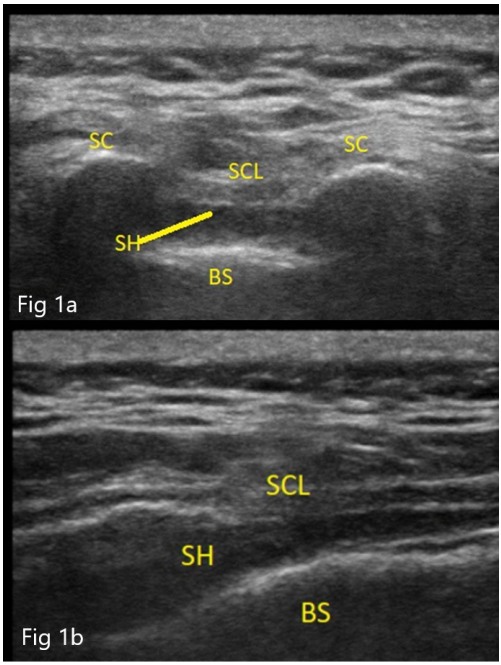

Fig 1. (a) Sonoanatomy in the tranverse view: base of sacrum (BS), sacral cornua (SC), sacral hiatus (SH) and sacrococcygeal ligament (SCL). *(b)* Sonoanatomy in the longitudinal view: BS, SH, and SCL.

transperineal PBx. The exclusion criteria were contraindications for neuraxial block, *e.g.*, antiplatelet therapy and inability to lie in prone position.

All patients had an intravenous cannula inserted and monitored with pulse oximetry, 3-lead electrocardiogram, and non-invasive blood pressure. Patients were then placed in the prone position. The procedures were performed by 3 experienced anaesthesiologists who routinely perform ultrasound-guided regional anaesthesia.

A scout scan was done to identify the anatomical landmarks and caudal epidural space target. A high-frequency linear probe (HFL38, Sonosite Inc. 6–13 Mhz) was placed in the transverse view across the sacrum to visualize the sacral median crest. The probe was slid caudal to view the base of the sacrum (BS), sacral cornua (SC), sacral hiatus (SH), and sacrococcygeal ligament (SCL) (Fig. 1a). The probe was then rotated to a longitudinal orientation to view the SH and SCL (Fig. 1b).

The equipment for caudal epidural anaesthesia is depicted in Figure 2a. The technique was performed under full aseptic technique. After skin infiltration with 2% lignocaine, a 50 or 100 mm Sonoplex needle (Pajunk, Geisingen, Germany) was inserted using the in-plane approach to pierce the SCL (Fig. 2b). An Infiniti Plus™ Disposable Needle Guide (CIVCO, Coralville, IA, USA) was used to improve the

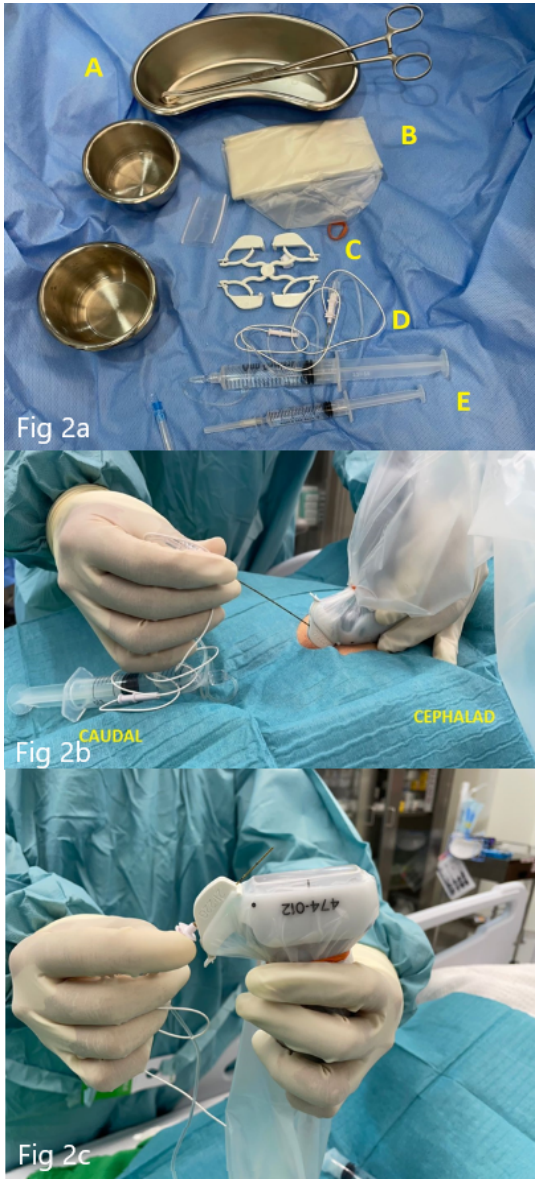

Fig. 2. (a) Kidney dish (A), ultrasound probe cover (B), CIVCO needle guide (C), Pajunk Sonoplex 50 mm/100 mm block needle (D), and local anaesthetic solutions (E). *(b)* Block needle point of insertion. (c) Fifty mm block needle placed in the needle guide.

procedural efficiency by aligning the block needle into the ultrasound beam (Fig. 2c). The advancement of the needle tip into the caudal epidural space was confirmed by ultrasound (Fig. 3). After negative aspiration, a few millilitres of the local anaesthetic (LA) solution were injected, while observing for the expansion of the epidural space. An LA solution of 17 to 20 ml was injected into the caudal space.

The patient was then turned supine and placed in lithotomy position as per surgical procedure. S1 dermatome hypoesthesia to pinprick was tested in to indicate sensory loss and initial success of the block. The transperineal PBx was performed using the iSR'obot™ MONALISA (Biobot Surgical, Singapore) robotic prostate biopsy navigation system. Five to 20 samples were taken depending on the evaluation of the urologist. If the surgeon noted that the patient was unable to keep still during the procedure, the anaesthetic technique was converted to general anaesthesia. The caudal block was considered successful if there was not a need to convert to general anaesthesia. One to 2 mg of midazolam was administered to all patients as anxiolysis.

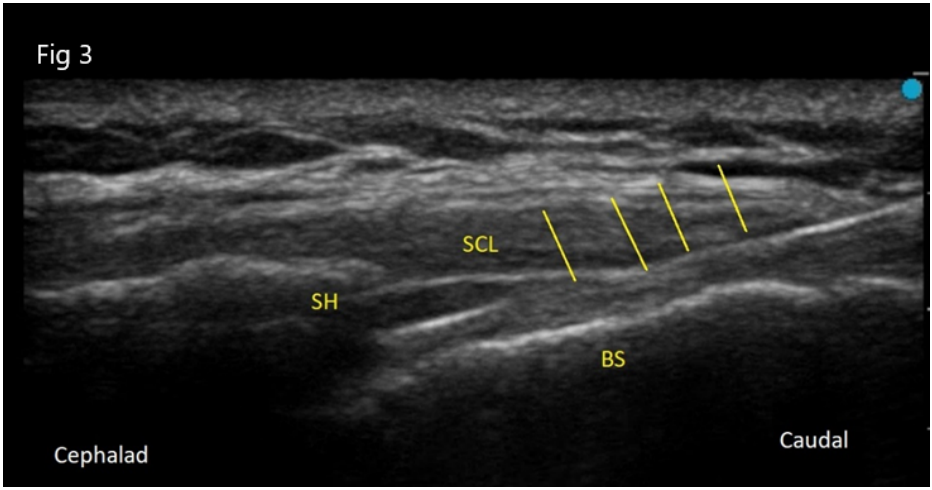

Fig. 3. Needle directed into the caudal space with ultrasound guidance. Base of sacrum (BS), sacral hiatus (SH), and sacrococcygeal ligament (SCL).

Table 1. Demographics and interventions for all patients included in the case series

No.	Age	ASA	Comorbidities	LA solution	Total volume	Complications
1	71	2	HT, IHD	0.2% ropivacaine	20 ml	Nil
2	75	3	HT, CHF with EF: 30%	0.2% ropivacaine	20 ml	Nil
3	71	3	HT, DC	0.2% ropivacaine	20 ml	Nil
4	52	1	Nil	1.5% lignocaine	20 ml	Converted to GA
5	72	2	Asthma	0.5% ropivacaine	20 ml	Nil
6	75	2	HT	1.5% lignocaine	17 ml	Nil
7	51	2	HT, smoking	0.375% ropivacaine	20 ml	Nil
8	73	2	HT	0.375% ropivacaine 2% lignocaine	10 ml 10 ml	Converted to GA
9	72	1	Nil	1.5% lignocaine	20 ml	Nil
10	74	2	HT, smoking	1.5% lignocaine	20 ml	Nil

ASA: American Society of Anaesthesia physical status; LA: local anaesthesia; HT: hypertension; IHD: ischaemic heart disease; CHF: chronic heart failure; EF: ejection fraction; DC: dilated cardiomyopathy; GA: general anaesthesia

Demographics and interventions for all patients are summarized in Table 1. In all cases, the duration of the surgical procedure was 20–45 minutes. Two of the 10 patients had to be converted to general anaesthesia. The 8 successful blocked patients did not report any discomfort whilst the procedure was performed. After the procedure was completed, the patients were observed in outpatient recovery. All patients were discharged home on the same day, and none experienced any serious complications warranting extended hospital stay or admission.

Discussion

In the last few decades, there has been progressive improvement in anaesthetic techniques that have led to PBx being a more accepted procedure. Indeed, studies have shown that anxiety around PBx is predominantly linked to symptoms rather than the actual diagnosis, with pain being closely related to high anxiety levels irre-

spective of biopsy outcome.[8] This underlines the importance of effective anaesthesia for the different approaches of PBx according to the urologist's preference.

We worked with a single consultant urologist in our centre who performs MRI-targeted transperineal PBx surgery. We believe that this allows for less confounding factors in our case series and for standardisation of biopsy technique.

The characteristics of the ideal anaesthesia technique for PBx are sufficient relaxation of the anal sphincter to allow manoeuvring of the rectal probe, prevention of pain during biopsy needle insertion ensuring immobilisation of patient during the procedure, low cost, and low incidence of side effects to ensure suitability for outpatient surgery.[9]

Our initial default anaesthetic technique was general anaesthesia. However, we quickly realised that this was less than ideal for elderly males presenting often with multiple comorbidities. In addition, there were other potential problems of general anaesthesia in this population including postoperative drowsiness and nausea/vomiting resulting in delayed discharges.

To mitigate these problems, we considered using various sedation techniques. Procedural sedation theoretically holds several advantages over general anaesthesia, including the maintenance of adequate spontaneous ventilation and cardiovascular function.[10] However, we also rapidly discovered issues with adequate pain control and immobilisation during PBx requiring increasing depth of sedation and its associated problems.

Spinal anaesthesia was also considered. Despite achieving dense sensory and motor blockade for the procedure, we found that this was again less than ideal for outpatient surgery, with delays in the return of motor function and prolonged urinary retention. Even with advances in spinal anaesthesia for ambulatory surgery with the use of agents such as hyperbaric prilocaine, the time to discharge can still take up to approximately 4 hours following administration.[11] Spinal anaesthesia saddle block technique could mitigate some of these issues; however, we found that the onset time for a saddle block with patients needing to be in a sitting position is comparable to the onset time of a caudal epidural injection, which is approximately 5 to 10 minutes. A major advantage of a caudal epidural injection in this regard is that once the injection has been performed, patients could be moved onto the lithotomy position and draped for surgery while the block is taking effect, as compared to a saddle block technique where the patient is required to be in a sitting position to achieve a true saddle block.

Caudal blocks have previously been described for transrectal ultrasound guided prostate biopsy, but not for a transperineal approach.[12] This approach allows the blocking of sacrococcygeal nerves, effectively providing anaesthesia to the perianal region, rectum, prostate gland, and perineum. The pudendal nerve arising from the ventral rami of spinal nerves S2 to S4 to innervate areas of the rectal canal, anus, perineum, and external genitalia is blocked by a caudal epidural injection, making this a suitable technique for anaesthesia in transperineal approaches to PBx.[13]

Despite being well described and more commonly used in paediatric anaesthesia and interventional chronic pain management, caudal epidural anaesthesia is less commonly used in adults. In fact, failure due to incorrect needle insertion has been reported to occur in up to 38% of cases, largely due to anatomical variation caused by ageing.[14] Ultrasonographic examination allows the clinician to appreciate these anatomical variations, reducing the number of attempts as well as improving success rates.[15] We have therefore utilised ultrasound in all our caudal epidural injections allowing us to achieve a success rate of 80% in this series. In our case series, 2 cases required conversion to general anaesthesia due to a failed caudal block, owing to the LA solution being erroneously injected into the SCL rather than within the caudal space. Nevertheless, our aim in this case series is to demonstrate that this anaesthesia technique is feasible for outpatient transperineal prostate biopsy surgery.

Therefore, an obvious obstacle to this anaesthetic technique is the requirement of operator training and experience in the use of ultrasound as well as the availability of the equipment itself. Knowledge in sonoanatomy of the SC, SC, and the SCL is crucial in the performance of this block, given the anatomical variations adult patients can present with.

When successful, however, caudal epidural anaesthesia achieves many of the aims of the ideal anaesthetic for transperineal PBx. This technique provides good analgesia and relaxation of the anal sphincter, with minimal side effects and minimal motor blockade of the lower limbs.

Sympathectomy causing hypotension is unlikely and the risk of dural puncture, particularly in adults, is extremely low, consistent with previous studies looking at the use of caudal blocks for transrectal PBx and anorectal procedures.[12]

Post-procedure urinary retention can be brought upon by caudal epidural injections, which not only interferes with patient comfort, but also necessitates insertion of a urinary catheter while also delaying postoperative urodynamic testing occasionally required by our urologist. Our initial experience did indeed demonstrate this side effect with the use of longer acting LA agents such as ropivacaine, resulting

in approximately 70% urinary catheterisation rate.

We are currently using a shorter acting LA, such as lignocaine, which resulted in a significant reduction in urinary catheterisation rates, but without any compromise on postoperative analgesia. In our experience, 17–20 mL of a shorter acting LA such as 1.5% lignocaine significantly reduces the risk of postoperative urinary retention. The volume of LA used for this indication can be further refined as we have more data on sensory block height. Further studies are therefore required for this.

Conclusion

Our case series has shown that ultrasound-guided caudal epidural anaesthesia is a feasible option for outpatient, MRI-targeted transperineal PBx procedures. With the appropriate LA volume and concentration, we believe that this technique provides ideal conditions for this surgical procedure with minimal side effects while allowing early ambulation and discharge.

Declarations

Ethics approval and informed consent
The authors declare that informed consent by all patients has been taken with due diligence. Ethics approval by the Gleneagles Hospital Medini Johor ethics committee has been confirmed.

Consent for publication
The authors declare to have received informed and sufficient consent from the patients to use their clinical information and images in the article.

Competing interests
Dr. Shahridan Mohd Fathil serves as Deputy Chief Editor of Malaysian Journal of Anaesthesiology. Dr. Mohd Fathil has not been involved in any part of the publication process prior to manuscript acceptance; peer review for this journal is double blind. The remaining authors state no conflict of interest.

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