Regional Anesthesia and Pain

Combined paravertebral lumbar plexus and parasacral sciatic nerve block for reduction of hip fracture in a patient with severe aortic stenosis

[Une anesthésie combinée, paravertébrale du plexus lombaire et parasacrée du nerf sciatique, pour la réduction d'une fracture de la hanche chez une patiente souffrant d'une sténose aortique sévère]

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Purpose: To report the use of a combined paravertebral lumbar plexus and parasacral sciatic nerve block for reduction of hip fracture in an elderly patient with severe aortic stenosis.

Clinical features: In an 87-yr-old lady with severe aortic stenosis and fracture of the right trochanter due to a fall, a combined right-sided paravertebral lumbar plexus and parasacral sciatic nerve block was used successfully for operative reduction of the fracture. A moderate amount of phenylephrine was required to maintain adequate systemic blood pressure despite the largely unilateral nature of the blocks.

Conclusion: Combined paravertebral lumbar plexus and parasacral sciatic nerve block can be a viable alternative to general anesthesia and epidural or spinal block for hip surgery in patients with severe aortic stenosis.

Objectif: Signaler l'usage d'une anesthésie combinée, paravertébrale du plexus lombaire et parasacrée du nerf sciatique, pour la réduction d'une fracture de la hanche chez une patiente âgée qui présentait une sténose aortique sévère.

Éléments cliniques: Une anesthésie combinée, paravertébrale du plexus lombaire et parasacrée du nerf sciatique, du côté droit, a été utilisée avec succès pour la réduction d'une fracture chez une patiente de 87 ans qui présentait une sténose aortique sévère et une fracture du trochanter droit consécutive à une chute. Un quantité modérée de phényléphrine a été nécessaire pour maintenir une tension artérielle

adéquate malgré la nature largement unilatérale de l'anesthésie combinée.

Conclusion: L'anesthésie combinée, paravertébrale du plexus lombaire et parasacrée du nerf sciatique, peut remplacer efficacement l'anesthésie générale et l'anesthésie péridurale ou rachidienne pour une intervention à la hanche chez des patients qui présentent une sténose aortique sévère.

PATIENTS with severe aortic stenosis presenting for non-cardiac surgery are considered to be at increased risk of perioperative complications.¹ Due to limitation of stroke volume any sudden and major reduction in systemic vascular resistance may result in excessive fall in perfusion pressure with disastrous consequences, especially if ventricular hypertrophy is present. Therefore anesthetic techniques that produce widespread sympathetic blockade or vasodilatation must be used with caution.

Combined paravertebral lumbar plexus and sciatic nerve block produces adequate anesthesia of the ipsilateral lower limb² for surgical repair of hip fracture in the elderly.³ The sympathetic blockade resulting from the combined block should in theory be less than that

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seen after a central neuraxial block, making it an attractive alternative for anesthesia in patients with severe aortic stenosis requiring hip surgery. We report the use of a combined paravertebral lumbar plexus and parasacral sciatic nerve block for operative repair of hip fracture in an octogenarian with concomitant severe aortic stenosis, and discuss the choices of technique.

Case report

An 87-yr-old, 50-kg, 151-cm lady suffered a closed fracture of the right trochanter. She had a history of senile dementia, multiple cerebral infarcts, severe aortic stenosis, resected colonic cancer, but was otherwise in stable health. She had no known history of angina, congestive heart failure, or syncope. Her medications were acetaminophen, propoxyphene napsylate, aluminum hydroxide antacid, flupentixol decanoate (an anti-psychotic medication). History taking was difficult because of dementia. Preoperative physical examination revealed findings consistent with her valvular heart disease. Echocardiogram revealed an aortic valve area of 0.38 cm² and concentric left ventricular hypertrophy. Aortic valve pressure gradient was 70 mmHg and electrocardiogram showed left ventricular hypertrophy.

We decided that the best anesthetic for her was a regional technique that would also provide effective postoperative analgesia with minimal central nervous system effects. Given her severe aortic stenosis, an ipsilateral combined paravertebral lumbar and sacral plexus block was chosen because it theoretically results in less extensive sympathetic blockade compared to spinal or epidural anesthesia.

A propofol infusion was started at 8 µg·kg⁻¹·min⁻¹ and continued throughout the procedure. A left radial arterial catheter (20-G cannula) was inserted under local anesthesia for monitoring. The patient was then turned to the left lateral position with the hips and knees flexed to approximately 45°. Using aseptic precautions a right paravertebral lumbar plexus block was performed opposite the L3 spinous process as described previously.⁴ An 18-gauge insulated Tuohy needle (Contiplex® B Braun, Bethlehem, USA) was inserted 4 cm lateral to the midline and advanced perpendicular to the skin in all planes to contact the transverse process. The needle was then withdrawn slightly and redirected in a slightly caudal direction so as to allow the tip of the needle to pass below the transverse process. Using nerve stimulation, quadriceps contraction, i.e., knee extension, was sought and elicited at a depth of approximately 6 cm from the skin with a stimulating current of 0.7 mA. Four centimetres of an epidural catheter were then inserted beyond the tip of the insulated Tuohy needle. To confirm the position of the catheter 3 mL of

iopamiro-200 [Iopamidol; (Bracco, Milano, Italy), 200 mg·mL⁻¹, non-ionic contrast medium] were injected via the catheter and fluoroscopic imaging was performed, which demonstrated ipsilateral “psoas stripe”⁵ confirming that the catheter was within the substance of the psoas major muscle. No hard copy of the radiologic image was recorded. After negative aspiration, 15 mL of ropivacaine 0.5% were injected in aliquots over 15 min.

Meanwhile, a right sciatic nerve block was performed using the parasacral approach^{6,7} with the patient in the same position. A line was drawn between the posterior superior iliac spine and the ischial tuberosity. At 6 cm from the posterior superior iliac spine along this line, a 100-mm insulated nerve block needle (Stimuplex®, B Braun, Melsungen, Germany) was inserted and advanced to contact the bony part of the greater sciatic notch. The needle was then walked off the bone and gently advanced into the pelvis using nerve stimulation (Stimuplex® DIG, B Braun, Melsungen, Germany). At a depth of approximately 5 cm plantar flexion of the foot was elicited with a stimulating current of 0.5 mA. Ten millilitres of plain ropivacaine 0.5% were then injected in aliquots over three minutes and the patient was returned to the supine position. The combined blocks took approximately 20 min to perform.

Assessment of sensory and motor functions was made difficult by the patient's dementia. However, it was soon evident that the patient was no longer experiencing pain on moving the fractured limb. The patient was also able to move her left (contralateral) leg and complained of it being partially exposed and cold. She did not complain of pain during surgery, and remained quiet but arousable throughout. Her blood pressure tended to decrease during surgery and an infusion of phenylephrine at 2 µg·min⁻¹ was required to maintain her blood pressure at 110–130/60–70 mmHg throughout the 90-min of surgery. She lost 200 mL of blood, received 900 mL of normal saline. Urine output was 130 mL.

Postoperatively, she received a continuous infusion of bupivacaine 0.125% at 4–6 mL·hr⁻¹ via the indwelling paravertebral lumbar plexus catheter for 17 hr. She did not require any other supplementary analgesics and complained only of discomfort in the contralateral leg. She made an otherwise uneventful recovery and was discharged from hospital 18 days after her surgery.

Discussion

We report the successful use of combined paravertebral lumbar plexus and parasacral sciatic nerve block (lumbosacral plexus block) for operative repair of hip fracture in an elderly patient with severe aortic stenosis.

General anesthesia was an option in our patient. However, general anesthetic agents can depress the myocardium, produce vasodilatation and can be associated with wide swings in hemodynamic variables during periods of intense (e.g., tracheal intubation and extubation) and absent stimulation. The use of a mainly opioid-based anesthetic does not guarantee hemodynamic stability and may delay emergence.

Spinal and epidural blocks are commonly used for surgical repair of hip fracture. A recent meta-analysis of randomized controlled trials comparing general anesthesia with regional anesthesia for hip fracture surgery concluded that there are marginal benefits of using the latter in terms of early mortality and risk of deep vein thrombosis.⁸ There is also a trend towards a lower incidence of myocardial infarction, confusion, and postoperative hypoxemia in patients who receive regional anesthesia.⁸ Although the evidence favours the use of regional anesthesia, epidural and spinal blocks produce vasodilatation below the level of the block, commonly resulting in hypotension, which may be exacerbated and have negative implications in patients with severe aortic stenosis. Nevertheless, with close monitoring, careful titration of local anesthetic dose and pharmacological support, central neuraxial blocks have been used successfully in patients with aortic stenosis.^{9,10}

We chose to use a combined lumbosacral plexus block because it produces complete anesthesia of the ipsilateral lower limb effective for surgical repair of hip fracture³ and the continuous lumbar plexus block provides postoperative analgesia. Lumbar plexus block also significantly reduces blood loss preoperatively¹¹ and postoperatively¹² when used to supplement normotensive general anesthesia for total hip arthroplasty, an advantage in patients with severe aortic stenosis since they tolerate hypovolemia poorly. Moreover, due to the unilateral nature of the block there may also be a lower incidence of urinary retention and less changes in systemic vascular resistance compared to central neuraxial blocks.

Despite the unilateral nature of the paravertebral lumbar plexus and parasacral sciatic nerve blocks, the blood pressure of our patient tended to drop, necessitating low doses of phenylephrine. The degree of blood pressure drop from baseline was found in one study to be 27.5% after combined lumbar plexus and sciatic nerve block, compared to 37.8% after spinal block. Although this difference did not reach statistical significance, the spinal group required a more sustained use, hence significantly larger amounts, of ephedrine to maintain the blood pressure.³ Moreover, hypotension after spinal anesthesia was more pro-

nounced in patients over 85 yr of age,³ which was relevant in our patient. The reduction in blood pressure after a combined lumbar and sacral plexus block may be due to epidural spread of local anesthetics^{2,4,12} or subclinical hypovolemia unmasked by the sympathetic blockade, and the severe aortic stenosis. Contralateral extension of the lumbar plexus block was found in four of 45 patients studied.² The fact that our patient could move her left leg and complained of it being cold intraoperatively did not eliminate the possibility of some epidural^{2,4,12} or prevertebral spread¹³ of local anesthetic to the contralateral side resulting in a more extensive sympathetic block. The propofol infusion that was used for sedation throughout the procedure could also have contributed to the overall reduction in blood pressure. Nevertheless, hypotension was easily managed with a relatively small dose of vasopressor.

The posterior paravertebral approach to the lumbar plexus reliably blocks all components of the lumbar plexus.⁴ Although the lumbosacral trunk (L4–5) is occasionally blocked,⁴ the sacral plexus is spared.⁴ The nerve to the quadratus femoris muscle and articular twigs from the sciatic nerve also supply the hip joint.¹⁴ Therefore, in order to achieve complete anesthesia adequate for hip surgery a sciatic nerve block is essential. Without a sciatic block, one may need to supplement with a systemic medication such as N₂O¹⁵ or propofol (its use in our case was for sedation but could have contributed to surgical anesthesia). We chose to use the parasacral approach^{6,7} to sciatic nerve block because it reliably blocks the ipsilateral sacral plexus,⁶ has a high success rate (97%),⁶ and urinary retention is uncommon.⁶

Contraindications to lumbosacral plexus blocks are similar to those of neuraxial blocks except that hemostatic deficiencies are probably relative contraindications as the neurologic consequences of a retroperitoneal^{16,17} hematoma, transient lumbar plexopathy, are less severe than those of a spinal hematoma. As such, when a regional anesthesia is strongly preferred but central neuraxial blocks are contraindicated or unsuccessful, a lumbosacral plexus block should be considered. Other relative contraindications include spinal deformities or changes in the lumbar paravertebral region due to postoperative adhesions or fibrosis, which may predispose to thecal, vascular, or visceral puncture.

There are disadvantages of using a combined lumbar plexus and parasacral sciatic nerve block. It requires two injections, which are painful and more time consuming, can be technically difficult, and there is the potential for failure.³ Moreover, relative to central neuraxial blocks, larger volumes of local anesthetics are typically used

with the potential for toxicity. Nevertheless, pharmacokinetic studies of bupivacaine and lidocaine after lumbar plexus block with and without sciatic block suggest that absorption appears to be slow and safe blood levels of local anesthetic are usually produced.^{2,18} We used nerve stimulation to locate both the nerve plexuses and relatively small volumes of local anesthetic were administered in view of the patient's age and clinical condition. We are unaware of data evaluating dose responses after lumbar or sacral plexus block and further research in this area is warranted.

There are also very few trials evaluating the safety and efficacy of paravertebral lumbar plexus block,^{4,12} parasacral sciatic nerve block,⁶ or a combination of the two techniques.^{2,3} Therefore the true incidence of complications is not known. Based on published data it appears to be relatively low.^{2-4,6,7,12} Bilateral symmetrical anaesthesia^{2,4} rarely occurs after paravertebral lumbar plexus block and can develop even after the lumbar plexus is located using nerve stimulation (quadriceps muscle contraction),⁴ suggesting that medial spread of local anesthetic to the epidural space is involved. Total spinal anesthesia after posterior lumbar plexus block has also been reported.¹⁹ The resulting profound hypotension would be particularly harmful to patients with severe aortic stenosis. Accidental intravascular injection with cardiotoxicity and cardiac arrest has also been described.²⁰ Other serious complications of paravertebral lumbar plexus block include renal subcapsular hematoma,¹⁶ and psoas¹⁷ hematoma with lumbar plexopathy reported in a patient receiving low molecular weight heparin. No major morbidity has been reported to date after parasacral sciatic nerve block but since the injection is made within the pelvis there are concerns of vascular injury, neural damage and, in particular, visceral (rectal) puncture.

In summary, combined ipsilateral paravertebral lumbar plexus and parasacral sciatic nerve block is a technique that has a unique niche in our armamentarium. Our patient with severe aortic stenosis undergoing operative reduction of a hip fracture is an example of its potential usefulness. Despite the unilateral nature of the block, a moderate dose of vasoconstrictor was required to sustain a normal blood pressure.

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