Abstract

In patients undergoing spine surgery postoperative pain management can often be complicated with side effects associated with high dose narcotic such as respiratory depression and those associated with non-steroidal anti-inflammatory drugs such as interference with bone healing process. Local anesthetics can help in both decreasing postoperative pain and minimizing side effects associated with systematically administered analgesics. This report describes the use of preoperative ultrasound guided dorsal ramus nerve block to reduce postoperative pain in six patients undergoing lumbar spine surgery under general anesthesia.

Introduction

Patients undergoing spine surgery usually experience severe postoperative pain. In the literature there are many reports describing different techniques of pain relief ranging from systemically administered analgesia to acute pain procedures such as neuraxial analgesia, paravertebral block and local anesthesia infiltration. Intrathecal morphine showed good results in postoperative analgesia for multilevel spine surgery. Epidural opioids in form of either single shot extended-release morphine or catheter placement had better safety margin in terms of respiratory depression and urinary retention. Ultrasound-guided bilateral paravertebral catheters recently have been described for postoperative analgesia in patients undergoing lumbar and thoracic laminectomy. Finally intraoperative infiltrations of local anesthesia into the wound, onto the neural root sheath or at the facet joint have also been described.

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Conflicts of Interest: None

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**Case Description**

After obtaining IRB approval we collected six patients undergoing spine surgery under general anesthesia to receive dorsal ramus nerve block for postoperative analgesia (Table 1). ASA standard monitoring was applied and oxygen was supplemented using face mask at 5 l/min. Moderate sedation with intravenous midazolam and propofol infusion was provided. All patients were lying prone with two pillows one under their pelvis and one under their head. The lumbar and lower thoracic areas of spine were prepped with Iodine and 75% alcohol. US curved probe covered with sterile sheath oscillating at 3.3 or 5 Hz and 6-7 cm depth was used. The levels were identified and labeled by marking pen by longitudinal scanning over transverse process (TP) of lumbo-thoracic vertebra by counting from the sacrum upward.

**Block method:** Longitudinal paramedian scanning of TP of thoraco-lumbar spine was obtained. Bilateral US guided block of corresponding DRN using in-plane approach with hydrodissection technique was performed. Two injections were done: for T11-L4 DRN, injections were made at the postero-superior edge of TP just lateral to the zygapophesal (ZP) joint of T and L TP. For L5 DRN, injections were made at TP of L5 and at the sacroiliac (SI) groove midway between L5 TP and sacral ala (SA) (Fig. 1, 2, 3, 4).

**Discussion**

The sensation of back pain originating from different structures is divided into two types: Segmental type is mediated by nociceptors and mechanoreceptors originating from vertebrae, intervertebral disk, dura, nerve root sleeves, facet joint capsules, muscles, ligaments, fascia and skin. Non-segmental type of sensation is mediated through sympathetic and parasympathetic innervation reaching vertebral structures via rami communicants. Both types of innervation come from DRN travelling through spinal nerve roots to reach the spinal cord.

DRN block using various imaging modalities has been described in relieving chronic low back pain. Fluoroscopy-guided DRN block appears to be a useful and safe treatment option for chronic back pain. The target point would be at the junction of TP and SAP of the sub-adjacent vertebra, midway between the superior border of the TP and the mamillo-accessory notch. CT-guidance has been described in L5 DRN block where the needle just rests between the SA and SAP of the sacrum. Finally, USG has also been described in L5 DRN block using initially longitudinal scanning over the TP of L5 than rotating the probe to perform transverse scanning of the SA and SAP of the sacrum junction to perform L5/S1 injection. To our knowledge this is the first report describing USG-guided T12-L5 DRN block for postoperative pain relief in patients undergoing lumbar spine surgery.

In cadaver dissection, the L 1-4 DRN project almost perpendicular to spinal nerves and run dorsocaudally through the intertransverse space where each divides into 3 branches: lateral and intermediate and medial. The lateral branches innervate iliocostalis lumborum then pierce the dorsal layer of thoracolumbar fascia and become cutaneous. The intermediate branches run dorsally and caudally from the intertransverse spaces forming intersegmental communicating branches that innervate longissimus thoracis muscle. Each medial branch passes dorsally and caudally through the intertransverse space towards the superior border of the root of the sub-adjacent TP. From there it continues dorsally and caudally, lying against the groove formed by the junction of the root of the TP with that of the SAP.

Having arisen from the spinal nerve it arches over the rostral and dorsal aspect of the SA, lying in the groove formed by the junction of the SA with the root of the SAP of the sacrum. Along this course it divides into two branches: medial and an intermediate. The intermediate branch innervates those fibers of longissimus thoracis which arose from the medial aspect of the dorsal segment of the iliac crest. The medial branch curves medially around the caudal aspect of the lumbosacral ZP joint, which it innervates ending in multifidus.

In ultrasound anatomy, as the spinal nerves emerge from their respective intervertebral foramina they branch mainly into ventral and dorsal rami. The ventral rami continue anteriorly into the psoas muscle and terminate as thoraco-abdominal nerves. Whereas DRN emerge posteriorly through the neural foramen and divide into medial and lateral branches at the junction of the ZP joints and the upper margin of the TP at which they divide to medial, intermediate and...
## Table 1

<table>
<thead>
<tr>
<th>Patient</th>
<th>Preoperative</th>
<th>Type of surgery</th>
<th>Block</th>
<th>Intraoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>56 yo f, asthma, low back pain 10/10 radiating to right LE</td>
<td>L5-S1 discectomy, laminoplasty, foraminotomy for disc prolapse (duration 2 h)</td>
<td>US, L4, L5 DRN, 20-G 120 mm (Quincke, Madrid) spinal needle. 20 mL, in 5 mL aliquots, of 0.5% bupivacaine with 8 mg dexamethasone (Fig. 1).</td>
<td>fentanyl 100 µg, propofol 150 mg, cisatracurium 16 mg. Maintenance with sevoflurane 1%, propofol at 1.5 mg/kg/h, with average BIS 40, BP of 100/60 and HR 55.</td>
<td>RR: pain score 3/10, l g acetaminophen iv, 25 µg fentanyl iv. POD1: 2 g acetaminophen iv. Pain score 0/10 at rest, 5/10 at ambulation.</td>
</tr>
<tr>
<td>Patient 2</td>
<td>59 yo f, HT, obesity back pain 8/10.</td>
<td>L1 lumbar kyphoplasty (duration 2 h)</td>
<td>US and NS,T11,T12 DRN 22-G 100 mm (Pajunk, Germany) block needle. 40 mL 0.5% bupivacaine with 8 mg dexamethazone, 4 injection sites, each 10 mL. (Fig. 2)</td>
<td>fentanyl 200 µg, propofol 150 mg cisatracurium 16 mg. Sevoflurane 1.5%, dexmedetomidine 0.3 µg/kg/h acetaminophen 1 g, lornoxicam 16 mg, ketamine 50 mg</td>
<td>RR: pain score 0/10, no analgesic. POD1: pain score 0/10, tramadol 50 mg.</td>
</tr>
<tr>
<td>Patient 3</td>
<td>39 yo, m pulmonary tuberculosis back pain 6/10.</td>
<td>L4-L5 discectomy, laminectomy foramenotomy (duration 2 h)</td>
<td>US, 22-G 90 mm (Quincke, Madrid) spinal needle. 30 mL 0.5% bupivacaine with 8 mg dexamethazone, 6 injection sites at L4, L5, and S1, each 5 mL. (Fig. 2)</td>
<td>fentanyl 100 µg, propofol 150 mg cisatracurium 16 mg. Sevoflurane 1.5%, propofol 2 mg/kg/h acetaminophen 1 g, lornoxicam 16 mg, ketamine 50 mg</td>
<td>RR: pain score 5/10 lornoxicam 8 mg,acetaminophen 1 g, fentanyl 25 µg. POD1: pain score 0/10, no analgesics.</td>
</tr>
<tr>
<td>Patient 4</td>
<td>45 yo, m OSA, HT, two previous back surgeries (L3-L4 disc) back pain 9/10, L5-S1 radiculopathy</td>
<td>L4-L5, L5-S1 decompression, discectomy, laminectomy foramenotomy (duration 5 h)</td>
<td>US, 22-G 90 mm (Quincke, Madrid) spinal needle. 30 mL 0.5% bupivacaine with 8 mg dexamethazone, 6 injection sites, TP L4, L5 and S1, each 5 mL. (Fig. 3)</td>
<td>fentanyl 450 µg, propofol 150 mg cisatracurium 16 mg. Sevoflurane 1.5%, propofol 2 mg/kg/h acetaminophen 1 g</td>
<td>RR: pain score 2/10, pethidine 25 mg. POD1:pain score 0/10 – 3/10 PCA fentanyl total of 105 µg and 1 g acetaminophen.</td>
</tr>
<tr>
<td>Patient 5</td>
<td>69 yo, f, HT back pain referring to LE 5/10</td>
<td>L2- L3 lumbar discectomy, anterolateral decompression, fusion instrumentation (duration 5 h)</td>
<td>US and NS, L1,L2 DRN 22-G 100 mm (Pajunk, Germany) block needle. 40 mL 0.5% bupivacaine with 8 mg dexamethazone, 4 injection sites, each 10 mL. (Fig. 4)</td>
<td>30 µg dexametomidine, propofol 150 mg cisatracurium 16 mg. Sevoflurane 1.5%, remifentanil 0.1 µg/kg/min, lornoxicam 16 mg, ketamine 50 mg</td>
<td>RR: pain score 0/10; no analgesic was given. POD1: acetaminophen 1 g PCA fentanyl 160 µg, pain score 0/10 - 4/10.</td>
</tr>
<tr>
<td>Patient 6</td>
<td>32 yo m heavy tobacco use presenting with 17 months of low back pain radiating to left LE, 8/10.</td>
<td>L5-S1 discectomy, laminoplasty foramenotomy for disc prolapse and spinal canal stenosis (duration 4 h)</td>
<td>US and NS 22-G 100 mm (Pajunk, Germany) block needle. 20 mL 0.5% bupivacaine with 8 mg dexamethazone, 4 injection sites, L4, 5, S1 TP, each 5 mL.</td>
<td>fentanyl 100 µg, propofol 150 mg, ketamine 20 mg cisatracurium 16 mg. Sevoflurane 1.5%, propofol 2 mg/kg/h.</td>
<td>RR: pain score 0/10 acetaminophen 1 g tramadol 100 mg, lornoxicam 16 mg POD1: no analgesic, pain score 0/10.</td>
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lateral branches to innervate different structures of the back including the spine (Fig. 5). Trident view of TP of lumbar spine was described in USG-guided paravertebral block. Our approach is longitudinally scanning the spine starting from medial to lateral and just when the facet joint USG image disappears and the trident view of TP starts to appear we stabilize the probe to perform the block (Fig. 6). Some of the blocks were performed with combined USG and NS eliciting muscle twitch of the paraspinous muscles, and others were done with USG-guidance. The block end point was either muscle twitch at 0.5-0.8 mA or needle tip placement at the postero-superior edge of the TP just adjacent to the SAP of the corresponding vertebra. We added dexamethasone to LA mixture to prolong block duration. Also, we intended to give relatively large volume per injection 5-10 ml in order to achieve the three branches block of the DRN at a time. It is worth nothing that there were no adverse events related to the block in any of the patients. Average time consumed for the block ranged from 20-45 minutes.

This technique was performed in patients with usual body habitus undergoing simple spine procedures. In obese patients, patients undergoing complex spine surgery and those with previous laminectomy or spine prosthesis this block may be challenging or even impossible to perform. Other disadvantages of this block include time consumption, needle-associated pain, prerequisite advanced ultrasound-guided regional anesthesia skills as well as inherent risks of the block including hematoma, infection, nerve injury and inadvertent intravenous LA injection.

In conclusion, USG guidance can be useful in blocking DRN that is the primary innervation of the back. Blocking this nerve prior to spine surgery offers preemptive analgesia to patients with many advantages. These can be stable intraoperative hemodynamics, minimal intraoperative narcotic use and have smooth emergence from GA with less side effects and better postoperative pain score. This block although has an established role in chronic back pain, its role in acute pain in patients undergoing spine surgery has not yet been investigated. We report six cases of DRN block for postoperative pain relief in simple spine surgery, however, large prospective clinical trials are deemed necessary to judge its feasibility and its efficacy.
**Fig. 4**
L2 DRN block,
TPL1: transverse process L1, TPL2: transverse process L2, TPL3: transverse process L3, D5W: Dextrose 5% in water, N: needle, LA: local anesthesia

**Fig. 5**
DRN L3,4,5 anatomy
With permission from Lipincot William and Wilkins

**Fig. 6**
Water skeletal scanning of lumbar spine
FJ: facet joint
TP: transverse process
References


BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.

Important safety information
BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nondepolarizing neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or sucking on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation to BRIDION was uncertain. In a few individuals, allergic-like reactions (e.g., flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchoscopy was reported in 2 patients and a causal relationship could not be fully excluded. Volunteer studies have demonstrated a slight (17%-22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on pre- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or concomitant condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

REFERENCES:
1. BRIDION Summary of Product Characteristics (SPC)

Please see summary of product characteristics for full prescribing information.
TAP Block And InfiltraLong
For Effective Treatment
Of Long And Deep Incisions

Sono Cannulas
For Single Shot UltraSound
Guided Nerve Blocks

SonoSystem And SonoLong Curl
For UltraSound Guided Nerve Blocks

Sprotte 2.G
The New Generation
Dura Puncture In Minimum Time

SonoEye Ophtalmic Block
For Peribulbar And Retrobulbar
Blocks Under Ultrasonic Monitoring
Thanks to AirStop in the drip chamber - the sight of a container running empty is no longer cause for alarm and no reason for energy and time to be wasted rushing around because the patient gets upset.

When the container is empty, AirStop maintains a constant fluid level. No air can get through to the patient.

Thanks to the PrimeStop at the patient connector - you can now prepare several infusions at once, quicker and more hygienic than ever before. Right away your hands are free to prepare the next infusion.
Question.
Your patient requires urgent pain medication. How can you administer this less invasively?

Answer.

References: