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Case Series

Efficacy of Lumbar Erector Spinae Plane Block for Postoperative Analgesia in Hip Arthroplasty Patients– A Prospective Case Series

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Abstract

The thoracic erector spinae plane block (ESPB) has been incorporated in multimodal analgesia protocols since 2016. In a series of 20 total hip arthroplasty (THA) patients, done under spinal anaesthesia, we studied the efficacy of lumbar erector spinae plane block (L-ESPB) for post operative analgesia. L-ESPB was administered at L4 with Ropivacaine 0.2% (0.4 mg/kg). Time to first analgesia (TTFA) request (mean 15.03 hours) and total opioid consumption in first 24 hours (mean 27.5 mg Tramadol) was noted. A median NRS at TTFA was 3.5. Our study demonstrates L-ESPB as an effective alternate technique for postoperative analgesia in THA patients.

Keywords: Lumber ESP block, Hip Arthroplasty

Introduction

Excellent analgesia after a total hip arthroplasty (THA) leads to better outcome, early discharge from PACU and patient satisfaction. Traditionally, Lumbar epidural analgesia is the gold standard for postoperative analgesia for THA [1]. Lumbar plexus block is an alternative technique [2]. Despite excellent analgesia, both techniques are shown to be associated with adverse effects [3]. Introduced at the thoracic level in 2016 [4], the erector spinae plane block (ESPB) is the deposition of local anaesthetic deep to the anterior sheath of erector spinae muscle and superficial to the tip of transverse process. ESPB is widely studied in thoracic, abdominal, shoulder, breast and spine surgeries [4, 5]. A lumbar ESP block (L-ESPB) is a fairly a new technique performed under ultrasonography (USG) guidance at the level of transverse process of L4 vertebra for hip arthroplasty [6]. Isolated case reports suggest [16, 15] that L-ESPB have favourable outcomes in hip arthroplasty.

Aim

Primary objective was to assess the duration of analgesia i.e., the time to first analgesia (TTFA) requested by patient and the efficacy of the block by noting Numerical rating score (NRS) for pain. Secondary objectives were to assess opioid requirement in the first 24 hours after surgery and to observe for adverse effects.

Description

All patients undergoing Unilateral THR from January 2020 to May 2020 were enrolled. Twenty patients (male 11; female 9) with age group of 18 – 75 years and ASA I–ASA III were included in the study. Patients requiring general anaesthesia and revision hip surgery were excluded. Patients with neuropathic joint, symptomatic spine disease, history of allergic reaction to local anaesthetic, neurological disorder/muscular disorders, coagulopathy and infection at the site of injection qualified for exclusion. All patients received spinal anaesthesia (Inj. Bupivacaine 0.5% Heavy 3 - 3.5 ml) as a primary anaesthetic in lateral position with the operative side dependant. Ten minutes later patients were repositioned with operative side non-dependant. Unilateral THR was performed through posterior approach. At the end of surgical dressing, with the patient still in the lateral position, L-ESPB at L4 level was administered.

Inj. Ropivacaine (0.2%) 0.4 mg/kg with clonidine 0.5

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mcg/kg was injected under USG guidance for L-ESPB.
In the postoperative period, NRS were noted at 0, 2, 4, 8, 12, 24 hours and (TTFA) was noted. At TTFA, intravenous (IV) paracetamol 1 gm was administered and repeated every 8 hourly thereafter. If NRS persisted more than 4, IV IV tramadol (0.5 mg/kg) in 100 ml normal saline was administered. Total amount of tramadol in mg infused in 24 hours was noted. Patients were followed for any lower limb neurological adverse effects on postoperative day 1 and at the time of discharge (Post operative day 4).

Technique of ultrasound guided L-ESPB.

The L-ESPB was performed after surgical dressing at the end of the operation, with the patient's operated side in non-dependent position. After taking all the aseptic precautions, a low frequency curvilinear USG probe (5-2 MHz, M-Turbo Sonosite), covered with sterile dressing (3M TegadermTM HP) was deployed in the medial sagittal plane in the longitudinal axis to identify the L5-S1 level, followed by cephalad scan to identify the L4 spinous process. The probe was rotated in transverse axis and shifted superiorly towards the flank and positioned between the iliac crest and the 12th rib on the mid-axillary line in transverse axis (Figure 1). After obtaining the classical "Shamrock" view, USG probe was shifted slightly posteriorly to have a wider view of erector spinae muscle at L4 transverse process level [8, 7]. The distance from skin to the tip of transverse process (TP) was calculated and noted (predetermined distance). A 22-gauge (Stimuplex Ultra, 100 mm, B-Braun) needle was inserted in plane to the curvilinear probe placed in the Shamrock position [9]. The needle was advanced in a postero-anterior direction towards the L4 transverse process until it encountered the tip of the transverse process (Figure 2). After confirming negative aspiration, injection Ropivacaine (0.2%) 0.04 mg/kg with Clonidine 0.5 mcg/kg was injected in small aliquots deep to the anterior sheath of erector spinae muscle and superficial to the tip of transverse process of L4 [11]. The spread of LA was noted deep to the anterior sheath of erector spinae and superficial to the transverse process in all patients (Figure 3). Ultrasound images were saved in the ultrasound machine hard-drive. The archived images were downloaded in separate folder in the computer.

Results

Twenty patients participating in the study included 11 males and 9 females; mean age was 56.65 years, and mean weight

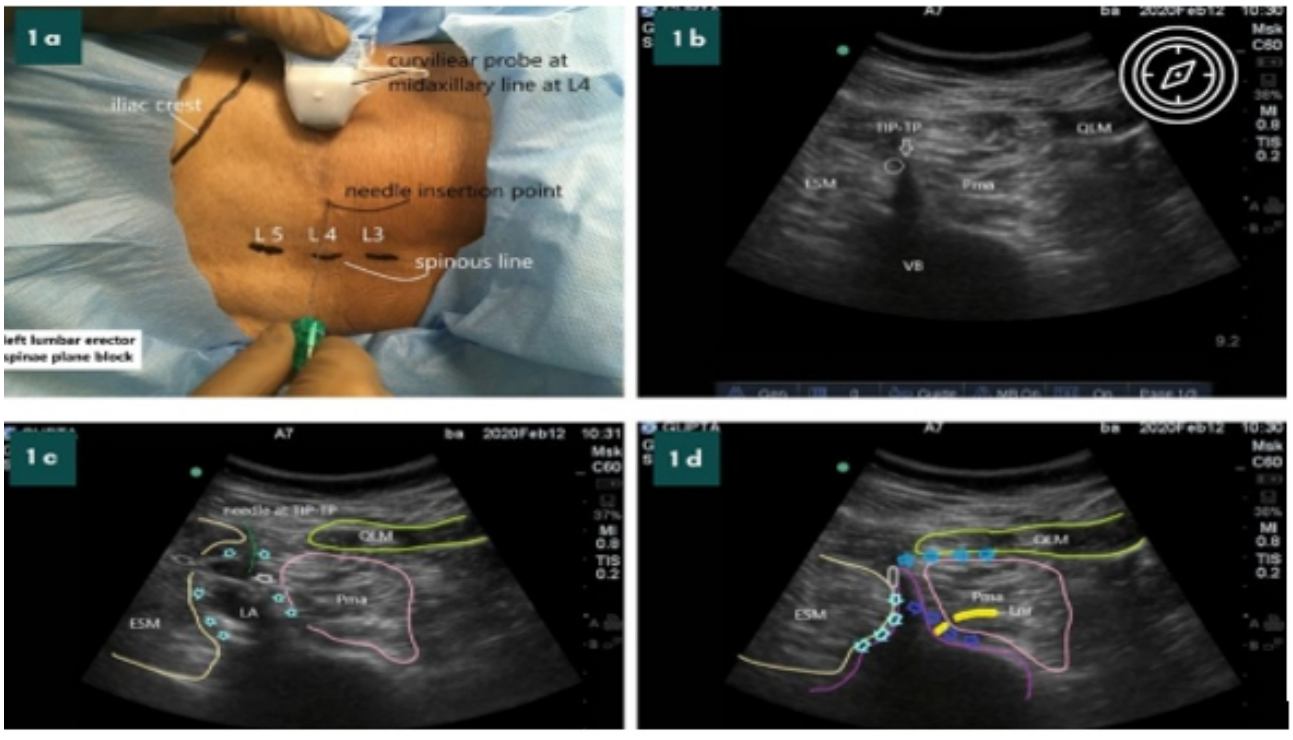

Figure 1 a: Left L-ESPB depicting probe & in-plane needle placement with Shamrock approach at the level of L4; L5 L4 L3- spinous processes, **; Figure 1 b:** Axial scan with Shamrock approach depicting the Paravertebral sonoanatomy. Oval behind transverse process represents definitive needle tip placement. ESM- Erector Spinae muscle, QLM- Quadratus Lumborum muscle, VB- vertebral body, TP – transverse process**; Figure 1 c:** Distribution of local anaesthetic posterior to transverse process and deep to lumbar erector spinae muscle in the lumbar erector spinae plane, Light blue arrows indicate LA spread in erector spinae plane posterior to transverse process and deep to erector spinae muscle. LA- local anaesthetic, PMa - Psoas Major muscle **; Figure 1 d:** Possible LA spread demonstrated in various planes 1) dark blue arrows = spread in anterior Quadratus lumborum plane 2) very dark arrows = anterior to the transverse process and, 3) light blue arrows = deep to erector spinae muscle and superficial to the transverse process; Lnr- Lumbar nerve root, Arrow- drug spread

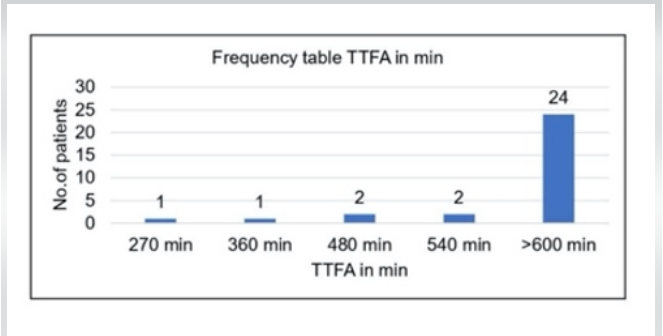

Figure 2: Frequency table of TTFA in minutes & number of patients, TTFA – time to first analgesia

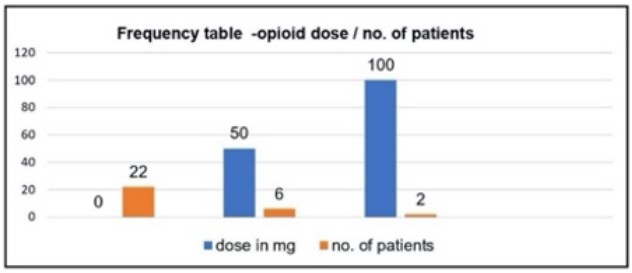

Figure 3: Frequency table of opioid dose (tramadol in mg) and number of patients

was 77.75 kg with a mean BMI 29.345(25.3-37.9). One patient was excluded as he required conversion to General anaesthesia. All L-ESPBs were performed without technical difficulty.

The mean TTFA was 15.05 hours (903 min.). One patient reported TTFA of 25 hours. Mediab NRS for pain at 0, 2, 4, 8, 12 and 24 hours were 0, 0.35(0-3), 0.2(0-2), 0.7(0-4), 1.2(0-4) and 1.6(0-2) respectively. The median NRS for pain at TTFA was 3.5(2-6). Out of 19 patients, 17 patients (89.4%) patients had TTFA over 10 hours, 1 patient (5.3) had TTFA of 8 hours, 1 patient (5.3%) had TTFA of 4.30 hours. The mean consumption of IV Tramadol was 27.5 mg in 24 hours, among 19/19 patients. None of the patients had any adverse effects.

Discussion

Our study demonstrates block efficacy of 89% in terms of TTFA with a mean of 15.05 hours and a mean NRS of 3.5. The mean tramadol consumption was 27.5 mg in first 24 hours.

The effectiveness of L-ESPB at the level of L4 was reported in a single case of THA with 30 ml of 0.25% bupivacaine and it was found to be as effective as epidural or Lumbar plexus block but with lower complication risk due to non- proximity to Neuro vascular structures [6]. In another case series of patients undergoing hip and proximal femoral surgeries, an USG L-ESPB was performed with 40 ml volume [14]. A single CT contrast performed in the same study demonstrated a spread from T12 to S1, dorsal to TP, an intervertebral foraminal spread at the level of L1-2, psoas spread at the L3 and the L5 contrast engulfed the femoral and obturator nerves [14]. Though LESPB was found to provide effective analgesia in first 12 hours, mean total dose of tramadol required was as high as 96+/- 45 mg [14]. In contrast, our study with 10-20 ml (mean volume 17.1 ml) (0.4 mg/kg) of 0.2% ropivacaine resulted in a mean duration of 15.05 hours of analgesia (TTFA), when patients received intravenous paracetamol 1gram and 8th hourly thereafter, and tramadol was used only as rescue analgesic and its mean consumption was 27.5 mg. In another case series [17], 15 high risk patients were administered L-ESPB at the level of L4 and were supplemented intraoperatively with a propofol infusion and low dose ketamine as per requirement. The probable mechanism of action is spread of local anaesthetic to L2-L5 roots and even to epidural space as depicted in MRI study.

Literature mentions that volume of 3.6 ml/vertebral level was adequate at thorac**ic** level, but no clinical studies remark on the volume/vertebral levels in the lumbar region [13]. In an observational fresh frozen cadaveric study 20 ml coloured dye solution with radio-contrast was injected under ultrasonography at the transverse process of L4. In 16% specimen, the solution travelled ventrally from the transverse process and stained the spinal nerves [20]. The study explores the probable mechanism of action that governs the spread of solution and comment rightfully the difficulties in extrapolating cadaveric results to clinical studies.

Providing effective analgesia without motor blockade can lead to early ambulation after a hip surgery. Though L-ESPB demonstrates safe placement of needle away from neurovascular structures [17] and hence gained popularity, we exert caution that prolonged loss of knee and ankle reflexes has been reported in a clinical-contrast study with catheter based LESP block [18]. The spread of LA has been demonstrated in at least 2 lumbar nerve roots. Nevertheless, in our case series, we administered single-shot LESP block and did not encounter any lower limb neurological compromise, as assessed on post-operative day 1 and at the time of discharge.

The small case series (only 20 cases) is a major limitation. (In our study the volume of LA injected was 10-20 ml (0.4 mg/kg) for all patients resulting in inadequate analgesia in 2 patients weighing 50 and 80 kgs. Peer reviewed studies mention 30-40 ml volume for LESP block; we need to compare higher volume per kg in further studies. B From our data, we feel that 0.4 mg/kg volume may not be adequate and we should increase the Local anaesthetic volume to 0.6 mg/kg to get consistent duration of postoperative analgesia. The

sensory delineation was not possible with spinal anaesthesia as the primary technique. All patients were followed for 24 hours postoperatively, beyond which pain scores and analgesic requirements were not evaluated.

Conclusion

As a part of multimodal analgesia, the L-ESPB can be integrated as an effective modality for postoperative analgesia in THA, without any adverse effects. The simplicity, safety and easy reproducibility makes LESP block more favourable ahead of lumbar epidural and lumbar plexus blocks.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

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