Original Article

Impact of erector spinae plane block on the quality of recovery after lumbar spine decompression surgery: A comparative study between addicts and non-addicts

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ABSTRACT

Background and Aims: Acute pain management in drug addicts is a critical yet understudied topic. Drug addicts have a decreased pain threshold, impairing anaesthetic pain control. This study aimed to evaluate the postoperative quality of recovery in addicts and non-addicts after receiving erector spinae plane block (ESPB) with general anaesthesia. **Methods:** Sixty males, aged 18-60 years, with an American Society of Anesthesiologists physical status I/II, scheduled for elective lumbar decompression surgery, were divided into two equal groups. Group A included 30 addicts and group N included 30 non-addicts. Both groups received bilateral ultrasound-guided ESPB with 20 mL bupivacaine (0.25%) before induction of general anaesthesia. The primary outcome was comparison of the 24-hour postoperative quality of recovery (QoR-15) score. The secondary outcomes were time to first analgesic requirement, postoperative pain scores, morphine consumption, and adverse events. **Results:** The QoR-15 score was higher in group N (median = 128.5, interquartile range = 107-136) than in group A (118 [99-130]), indicating a better recovery in group N. The visual analogue scale pain score was lower in group N than in group A, especially in the first 12 hours postoperatively. Time to first analgesic request was significantly longer in group N than in group A (mean ± standard deviation: 8.67 ± 2.74 and 5.53 ± 1.64 hours, respectively, P =0.001), Morphine consumption was significantly higher in group A than in group N (9.62 ± 3.2 and 7.08 ± 2.57 mg, respectively, P =0.041). **Conclusion:** Drug addicts experienced decreased analgesic efficacy of ESPB compared to non-addicts, with comparable postoperative QoR-15 score following lumbar decompression surgery.

Key words: Drug addicts, erector spinae block, lumbar decompression, ultrasound, postoperative pain, analgesia, anaesthesia

INTRODUCTION

Worldwide, drug addiction has become an increasingly prevalent issue especially among young urban males. Many patients are discovered to be addicted during regular preoperative history taking.[1] The main classes of abused drugs involve alcohol, opiates, cannabinoids, and stimulants. Chronic substance addiction is associated with substantial psychiatric and somatic disorders, along with additional perioperative challenges, including intravenous cannulation, airway protection, intraoperative management, and postoperative pain control.[2]

Lumbar spine surgery is a common therapeutic option for patients with spine pathology but pain management is challenging following such surgeries. Systemic analgesia is an option; however, regional anaesthesia can provide more advantages than opioids due to better pain relief and less adverse events.[3] The erector spinae plane block (ESBP) is an interfascial plane block

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with various applications as a perioperative analgesic for back, thorax, and abdominal surgeries. ESPB targets the ventral and dorsal rami of spinal nerves and sympathetic innervation on different levels.[4]

Unlike other medical conditions, patients with drug addiction do not often get satisfactory treatment in the perioperative period. This has been related to under-reporting or underasking.[5] Therefore, evaluating the addicts' recovery can be difficult. Previous studies have focused on assessment of physical outcomes, recovery durations, and postoperative adverse events in addicts.[6,7] However, it seems more appropriate to focus on the patient's viewpoint regarding quality of their recovery. The 15-item Quality of Recovery (QoR-15) scale is a frequently used self-assessment questionnaire for the early postoperative period.[8]

To our knowledge, no former study has addressed the issue of the recovery quality in addicts. Moreover, the information that guide the postoperative acute pain management in addicts is inadequate. This encouraged us to conduct this comparative study aiming to estimate the postoperative QoR-15 score in addicts and non-addicts after receiving bilateral ESPB in lumbar decompression surgeries. Present study hypothesises that local anaesthetic (LA) duration and intensity would be reduced by chronic substance addiction, affecting postoperative recovery experience.

METHODS

The institutional ethics committee approved the study and written informed consent was obtained from patients. This prospective double-blinded controlled study was performed in compliance with the Declaration of Helsinki of 1975, as revised in 2013. The patients were recruited during June 2021 to December 2021. The trial was prospectively registered in the clinicaltrials.gov (NCT04943549). Eligible patients were assigned into two equal-sized groups (number = 30).

Patients in group A had a history of drug addiction (one drug or combination of two or more) for more than one year, such as marijuana (cannabis), clonazepam, and/or tramadol. Patients in group N had no history of addiction to any substance (control group). Both groups received bilateral ESPB before general anaesthesia.

The study included 60 males, aged 18 to 60 years, who were eligible for elective lumbar spine decompression surgery under general anaesthesia, with a history of smoking and had an American Society of Anesthesiologists physical status (ASA-PS) I/II. Patients were classified as addicts based on their personal history obtained by the anaesthetist responsible of the preoperative assessment. Patients were required to have at least one year of drug consumption (as a regular habit, not as a prescribed medication) and drug withdrawal symptoms when the substance was discontinued. In contrast, subjects in the control group had no drug addiction history in the past two years. The exclusion criteria were patients with hepatic or renal dysfunction, preoperative communication disability or cognitive disorder, previous back surgery, block puncture site infection, allergy to any drug, alcohol consumption, coagulation disorders, and emergency surgery.

All addicts were encouraged to take their daily dose of the drug before surgery.

The patients were taken to the anaesthesia preparation room, 30 minutes before the procedure. Intravenous (IV) cannula was inserted and standard monitoring (electrocardiogram, noninvasive arterial blood pressure, and pulse oximetry) were applied on the patient and premedications (midazolam 0.02 mg/kg and ranitidine 50 mg) were administered. Patients had bilateral ultrasound-guided ESPBs at the lowest thoracic level (T12).

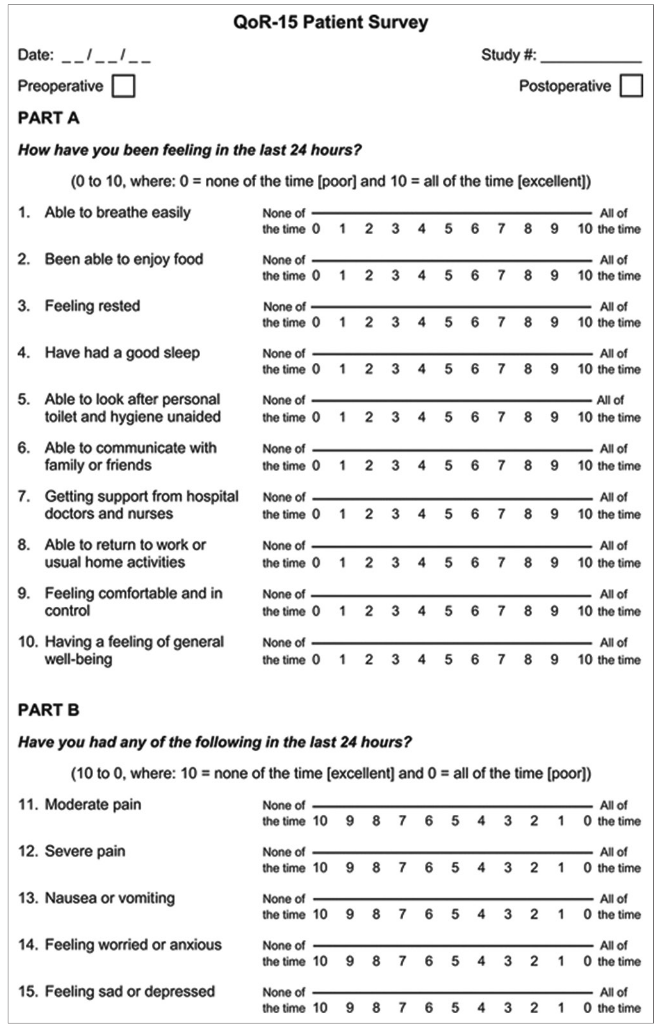
Each patient was positioned on his left side. A low-frequency, curved, ultrasound transducer (LOGIQ e, GE corporate, general electric company, United States of America) was used. After skin sterilisation, the ultrasound probe was positioned in a longitudinal alignment, 2-3 cm lateral to the midline to locate the transverse process, and identify the erector spinae muscles covering it. After LA infiltration into the superficial tissues, an 8-cm 22-gauge block needle (Perifix, B.BRAUN, Melsungen AG, Germany) was introduced cranio-caudally to make contact with the transverse process, with its tip under the erector spinae muscles. A small bolus of LA was injected to observe the muscle detaching from the transverse process and confirm the correct needle position. Bupivacaine 0.25% (20 mL) was injected deep to the erector spinae muscles. This manoeuver was repeated on the other side. Five minutes following the block, cutaneous sensation was checked by a pinprick test over the patient's back and repeated every 5 minutes until sensory loss was detected. Lack of sensory loss after 15 minutes on either or both sides was considered as failed block and the patient was excluded from the analysis.

Once the sensory loss was ensured, anaesthesia was induced using propofol 1–2 mg/kg, fentanyl 1–2 μg/kg, and muscle relaxant (cisatracurium 0.2–0.3 mg/kg). Isoflurane was used to maintain anaesthesia. Fentanyl bolus was given if heart rate (HR) or mean arterial pressure (MAP) increased more than 20% of preoperative baseline and cisatracurium booster doses were used for muscle relaxation. After surgery and reversal of muscle relaxant, all patients were moved to the postanaesthesia care unit (PACU) for at least 30 minutes. Both groups received the same postoperative analgesic treatment, including 30 mg of IV ketorolac given 30 minutes before the end of procedure and repeated every 8 hours afterward. When the visual analogue scale (VAS) score exceeded 3, IV morphine was titrated by 2-5 mg increments every 5 minutes, until pain relief (VAS ≤3) or a maximum dose of 20 mg was reached. The anaesthesiologist in charge of the surgery and evaluating physician were uninformed of the group assignment.

The primary outcome was QoR-15 at 24 hours following surgery. This recovery score compromises 15 questions that assess five clinical characteristics: physical status (5-items), emotional well being (4-items), physical independence (2-items), psychological care (2-items), and pain (2-items). Each item is scored on an 11-point numerical rating scale [Figure 1]. The sum of the 15 items' scores is from 0 to 150 and higher scores represent better recovery.[8] The questionnaire was translated to the patient by the evaluating physician.

The secondary outcomes included the onset of sensory blockade (defined as the time elapsed from the end of final injection till complete disappearance of pinprick sensation of all distributions of the nerve), intraoperative hemodynamic parameters (MAP and HR), and number of additional fentanyl boluses. Postoperative pain evaluation using VAS, during rest and movement, at PACU admission, 2, 4, 8, 12, and 24 hours, and the first time to request morphine and its dosage were also recorded. Finally, any side effects related to the block such as pruritus, nausea, vomiting, agitation, and delirium were noted.

Statistical analysis was carried out using Statistical Package for Social Sciences version 25 (International Business Machines, Armonk, New York, United


QoR-15 Patient Survey

Date: __/__/__ Study #: ___________

Preoperative ☐ Postoperative ☐

PART A

How have you been feeling in the last 24 hours?

(0 to 10, where: 0 = none of the time [poor] and 10 = all of the time [excellent])

1. Able to breathe easily	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
2. Been able to enjoy food	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
3. Feeling rested	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
4. Have had a good sleep	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
5. Able to look after personal toilet and hygiene unaided	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
6. Able to communicate with family or friends	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
7. Getting support from hospital doctors and nurses	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
8. Able to return to work or usual home activities	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
9. Feeling comfortable and in control	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	
10. Having a feeling of general well-being	None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time	

PART B

Have you had any of the following in the last 24 hours?

(10 to 0, where: 10 = none of the time [excellent] and 0 = all of the time [poor])

11. Moderate pain	None of the time 10 9 8 7 6 5 4 3 2 1 0 All of the time
12. Severe pain	None of the time 10 9 8 7 6 5 4 3 2 1 0 All of the time
13. Nausea or vomiting	None of the time 10 9 8 7 6 5 4 3 2 1 0 All of the time
14. Feeling worried or anxious	None of the time 10 9 8 7 6 5 4 3 2 1 0 All of the time
15. Feeling sad or depressed	None of the time 10 9 8 7 6 5 4 3 2 1 0 All of the time

Figure 1: The quality of recovery (QoR-15) questionnaire.[6]

States). The Shapiro-Wilk test and Q–Q plots were used to determine the normality of quantitative variables. Quantitative variables were summarized as mean ± standard deviation (SD) or median and interquartile range. Unpaired t-test was used to compare normally distributed data between the study arms, while the Mann-Whitney U test was used to compare non-normally distributed variables. Qualitative variables were summarized as numbers and percentages and compared using the Chi-squared test. P values <0.05 indicated statistical significance.

The sample size was calculated using G*power software version 3.1.9.2 (Heinrich Heine University, Düsseldorf, Germany) based on difference in QOR-15 between addicts and non-addicts. With a large expected effect size (d = 0.8), the sample size was 52 patients (26 per group). Alpha and power were adjusted at 0.05 and 0.8, respectively. The study included 60 patients to account for possible dropouts.

RESULTS

Sixty eight patients were assessed for eligibility. Eight were excluded due to refusal to participate (n = 4), meeting the exclusion criteria (n = 3), and failed block (n = 1). The remaining 60 patients were included in the analysis (30 in each group) [Figure 2].

No significant differences were reported between both groups regarding demographic characteristics (age, body mass index, and ASA PS) and operative data (length of the procedure, type and level of surgical intervention, average time to perform the block, and onset of the block) [Table 1].

No significant differences were noted regarding the lowest and highest MAP or HR recorded during the surgery. The rates of intraoperative hypotension requiring intervention and postoperative nausea vomiting were low and comparable in both the groups. In addition, both groups had no other block complications (pruritus, respiratory depression, agitation, or delirium) [Table 2].

Regarding perioperative narcotics received by the patients, the addict group was comparable to the non-addict group in fentanyl consumption intraoperatively (56.33 ± 8.8 and 54.5 ± 10.2 mg, respectively) [Table 2]. However, a significant difference was observed in the mean duration of the first analgesic requirement (8.67 ± 2.74 and 5.53 ± 1.64 hours in the non-addict and addict groups, respectively) ($P = 0.001$). Furthermore, the overall postoperative morphine dose was significantly increased in addict group than non-addict group (9.62 ± 3.20 and 7.08 ± 2.57 mg, respectively) ($P = 0.041$) [Table 3].

QoR-15 score at 24 hours postoperatively was higher (better recovery) in the non-addict group (median = 128.5, interquartile range = 107–136) than in the addict group (118, 99–130) but without statistical significance ($P = 0.067$). Also, no significant difference was reported between both the groups concerning the first ambulation time or duration of hospital stay ($P > 0.05$) [Table 3].

The VAS scores were lower in non-addicts than addicts in the first 12 hours postoperatively with significant values at 8 and 12 hours ($P < 0.05$). At 8 hours, it was significantly lower in non-addicts during rest

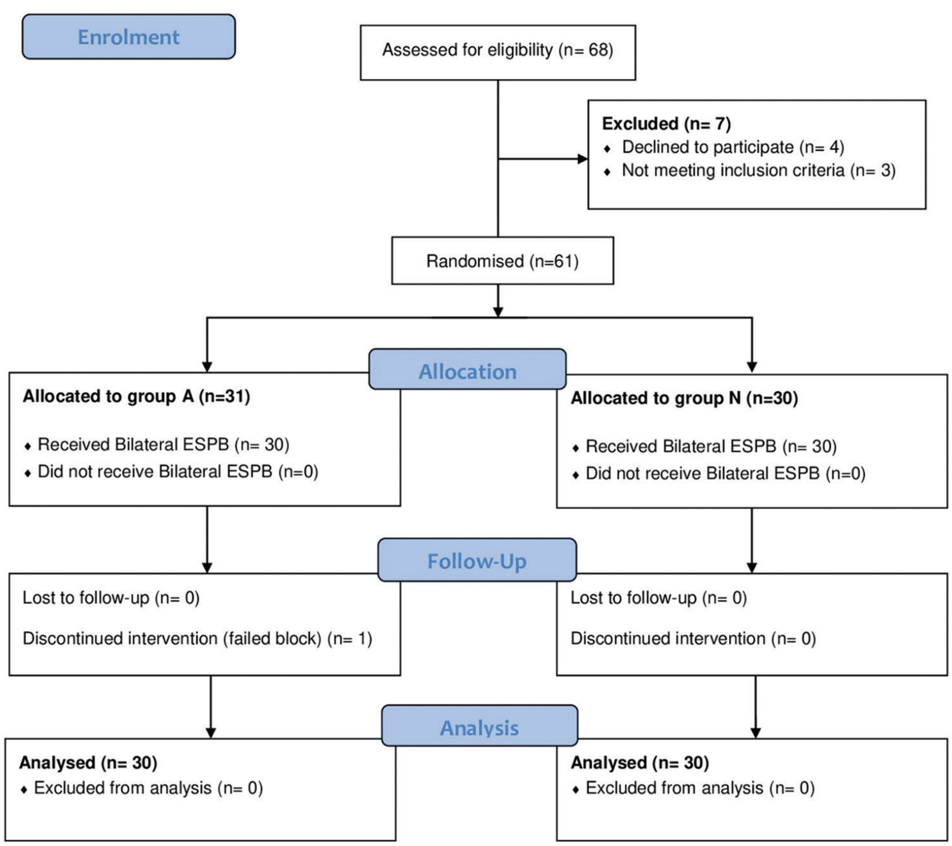


Figure 2: Consort flow diagram of the study cases.

Table 1: Demographic and clinical criteria of the studied groups

	Group A (*n*=30)	Group N (*n*=30)	*P*
Age (y)	37±9.71	36.1±9.74	0.721
BMI (kg/m^2)	25.9±4.51	25.56±3.54	0.752
ASA (*n*%)			
I	23 (76.7)	21 (70)	0.559
II	7 (23.3)	9 (30)	
Duration of surgery (min)	121.5±25.47	123.17±20.82	0.782
Type of surgery (*n*)			
Laminectomy	20 (66.7)	17 (56.7)	0.426
Discectomy	10 (33.3)	13 (43.3)	
Level of surgery (*n*)			
I	18 (60)	21 (70)	0.417
II	12 (40)	9 (30)	
Time to perform the block (min)	14.18±3.21	14.92±3.5	0.107
Onset of sensory block (min)	15.77±1.87	14.8±2.2	0.0721

Data are presented as mean±standard deviation (SD) and number (*n*) (%). BMI, body mass index; ASA, American society of Anesthesiologists.

Table 2: Intra-operative findings and adverse events in the studied groups

	Group A (*n*=30)		Group N (*n*=30)		*P*
	Mean	SD	Mean	SD	
Highest HR recorded (beat/min)	93.3	4.72	91.4	3.31	0.076
Lowest HR recorded (beat/min)	59.8	6.25	61.6	6.34	0.272
Highest MAP recorded (mm Hg)	143.36	6.11	141.57	7.27	0.672
Lowest MAP recorded (mm Hg)	86.16	3.83	84.57	3.18	0.083
Additional Intraoperative Fentanyl (μg)	56.33	8.80	54.5	10.2	0.459
Hypotension requiring intervention, (*n*)	2 (6.6)		1 (3.33)		0.553
PONV (*n*)	5 (16.7)		3 (10)		0.447
Reported block complications (*n*)	0		0		0.99

Data are presented as mean±standard deviation (SD) and number (*n*) (%). HR, heart rate; MAP, mean arterial pressure; PONV, postoperative nausea and vomiting.

Table 3: Postoperative findings in the studied groups

	Group A		Group N		*P*
	Mean	SD	Mean	SD	
Time to first analgesic request (h)	5.53	1.64	8.67	2.74	0.001*
Total morphine consumption in 24 h (mg)	9.62	3.20	7.08	2.57	0.041*
Time to ambulation (h)	18.03	6.14	16.83	4.57	0.394
Duration of hospital stay (days)	2.8	0.81	2.63	0.72	0.401
QoR-15 score	118 (99-130)		128.5 (107-136)		0.067

Data are presented as mean±standard deviation and median (inter quartile range). *Statistically significant (P<0.05).

and movement, while at 12 hours it was significantly lower only during movement. However, after 12 hours, no observed differences were found between both the groups [Figure 3].

DISCUSSION

Anaesthesiologists encounter difficulties while dealing with patients having drug abuse. Multimodal analgesia concepts apply equally well to addicts and non-addicts. Yet, regional anaesthesia has long been recommended for addicts by many anaesthesia practitioners, as a reliable anaesthetic and postoperative pain control strategy, for various procedures.[9]

This clinical trial evaluated the effectiveness of ESPB in substance abusers via the patient-centered outcome measurement (QoR-15). The study revealed a comparable recovery quality at 24 hours postoperatively between addicts and non-addicts. However, ESPB prolonged the time to first opioid request, decreased its consumption, and reduced VAS scores in non-addicts compared to addicts following lumbar decompression surgery. No significant differences were noted regarding onset of block and intraoperative or postoperative complications in both the groups.

Many studies that have investigated the effect of LA for postoperative analgesic profile in opium abusers

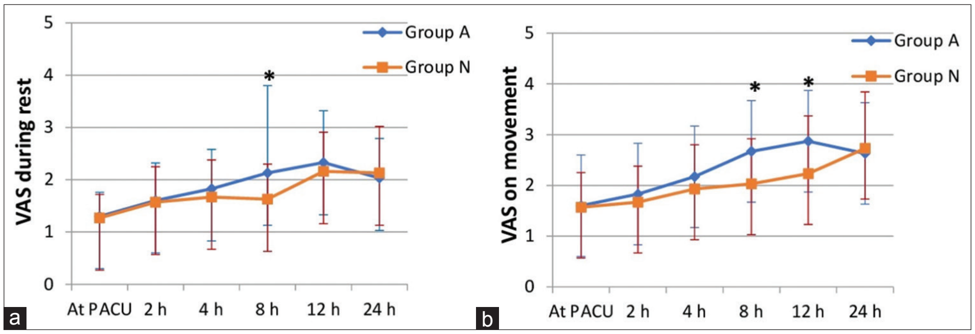


Figure 3: Visual analog scale (VAS) pain scores at rest (a) and on movement (b) in postanaesthesia care unit (PACU) during the first 24 hours.

concur with our results. Azimaraghi *et al*.[6] performed brachial plexus block on addicts undergoing upper extremity surgery. They concluded that chronic opium abusers had a shorter sensory and motor blockade duration than non-abusers. Another Iranian study reported a shorter length of anaesthesia in opium abusers who underwent suturing for hand lacerations when using lidocaine for digital block.[7] Several studies were conducted on addicts who received spinal anaesthesia for lower abdominal and lower extremity surgeries. They have demonstrated shorter sensory and motor blockade durations after intrathecal LA.[10,11]

In contrast, Majidi *et al*.[12] did not find any difference in pain reduction or duration of action between addicts and non-addicts when lidocaine was used as an anaesthetic agent for suturing skin lacerations.

The results of present study are concomitant with a retrospective study performed by Liu *et al*.,[13] who noted that cannabis users had greater pain scores and poorer sleep quality than non-users in the initial postoperative period following orthopaedic surgery. Also, a prospective study conducted by Jefferson *et al*.[14] reported higher pain scores in cannabis users and suggested increasing the postoperative pethidine doses following elective surgical procedures.

A retrospective study, conducted by Rishel *et al*.,[15] concurred with our results regarding the impact of long-term preoperative benzodiazepine usage on opioid utilization postoperatively. They reported the need for higher opioid doses in such patients.

Various mechanisms explain drug tolerance development in opium abusers. Downregulation of the number of receptors reduces the affinity for agonists and hence reduces the response to the drug.[16] The receptors of LA in different parts of the body are structurally and functionally similar to opioid receptors, hence they gain tolerance with long-term exposure to opioids.[17] Also, exposure to excessive exogenous medications causes changes in function and release of the endogenous peptides, decreasing pain threshold and increasing the response to painful stimulation.[18]

On the other hand, cannabinoid receptors (CB1, CB2) are also involved in pain modulation process. Desensitization and downregulation of the number of receptors has been reported with long-term exposure to cannabinoids.[19] Although activation of cannabinoid receptors causes inhibitory effect to pain response, these antinociceptive effects play a better role in chronic pain than acutely induced pain. In vitro studies have revealed that the binding of endocannabinoids to CB1 receptors cause pain sensitization unpredictably and even increase the risk of chronic pain.[20] Finally, studies on neuro-anatomical distribution of opioid and cannabinoid receptors revealed overlap in their locations in the central nervous system that are engaged in painful stimuli processing.[21]

ESPB has proved its ability to enhance the quality of recovery in various studies., Yao *et al*.[22] performed a preoperative ESPB with ropivacaine in patients undergoing modified radical mastectomy and reported an improvement in the QoR-15 score compared to the controls. Also, Finnerty *et al*. compared ESPB with serratus anterior plane block, in minimally invasive surgeries in thorax, and noted better scores with ESPB.[23] Furthermore, Yao *et al*.[24] adopted the QoR-40 score (the older version) to assess the influence of ESPB on recovery after video-assisted thoracic surgery and confirmed the same results.

The present study had some limitations. The sample size was small relative to the frequency of addiction. Also, the recruited patients were addicted to more than one drug, so diagnosing and defining failure was challenging. We suggest that several separate studies should be conducted to investigate efficacy of regional anaesthesia among addicts on a sample population that is only addicted to a single drug. Finally, patients' preoperative QoR-15 scores were not assessed. Thus, we had no baseline against which postoperative results could be compared. However, the QoR-15 was developed to be used after surgery and due to patients' exhaustion and surgery-related stress,[25,26] its efficacy to provide a reliable baseline in the preoperative period has been questioned. Furthermore, we used it similarly in both the groups.

CONCLUSION

Although the QoR-15 score at 24 hours postoperatively was comparable in both the groups, addicts receiving preoperative bilateral ESPB required postoperative analgesia earlier and had increased opioid consumption than non-addicts following lumbar decompression surgery.

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Conflicts of interest

There are no conflicts of interest.

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