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Ultrasound-guided erector spinae plane block for postoperative pain management after cesarean delivery

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ABSTRACT

Cesarean section (CS) is now the most frequently performed surgery. Adequate postoperative pain control is essential to prevent complications. Regional block techniques are effective post-cesarean multimodal analgesia. The study compared the analgesic efficacy of bilateral erector spinae plane block (ESPB) with morphine-based PCA after elective CS under spinal anesthesia. The study included 40 females subjected to elective lower segment cesarean section (LSCS). They were randomly allocated to receive bilateral ESPB (ESPB Group, n=20) or morphine-based PCA (PCA Group, n=20) during the 24 postoperative hours. Paracetamol 1 gm IV infusion was given to all patients regularly every 6 hours. ESPB was performed at T9 level with the out-of-plane technique was done under sterile conditions. No complications were encountered during the performance of the blocks. Three hours after the end of surgery, patients were able to move their feet and legs freely. Sensory blockage showed the diffusion of local anesthetic from T6 level up to L1 level. The patients were monitored for pain intensity, total morphine consumption, and patient satisfaction. Starting from 2 to 6 hours and 24 hours after surgery, pain intensity was significantly lower in the ESPB group. Total morphine consumption was significantly lower in the ESPB group ($p< 0.001$). The degree of patients' satisfaction with postoperative analgesia was significantly higher in the ESPB group ($p< 0.001$). ESPB is a safe and well-tolerated procedure for postoperative pain management after cesarean delivery.

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1. INTRODUCTION

Every year, millions of patients undergo various types of surgical procedures. Most of them experience acute postoperative pain. However, approximately 30% to 75% of patients report unsatisfactory pain relief despite pain management efforts [1]. Postoperative pain management is an essential part of modern surgical practice aiming at patient comfort. Acute pain management aims to reduce pain intensity and neuroendocrine stress response, prevent postoperative complications and minimize analgesics' adverse effects. Consequently, we can facilitate patient recovery and reduce hospital stay [2], [3]. Inadequate postoperative pain control may

lead to complications including pneumonia, infection, deep vein thrombosis, and long-term consequences as chronic pain and depression [4].

Globally, cesarean section (CS) is now the most frequently performed surgery. In Egypt, the CS rate reached about 52% in 2014 [5]. Accordingly, it is crucial to investigate the ideal analgesic policy for this steeply rising surgery. Multimodal analgesia with neuraxial anesthesia and a combination of opioid and non-opioid drugs provides the best post-cesarean analgesia outcome [6]. More recently, regional block techniques as transverse abdominis plane block, erector spinae plane block (ESPB) were introduced as an effective component of post-cesarean multimodal analgesia [7], [8].

We hypothesized that bilateral ESP block could provide a better analgesic profile than patient-controlled analgesia (PCA) with morphine after elective cesarean section. The study aimed to compare the analgesic efficacy of bilateral ESPB with morphine-based PCA after elective cesarean delivery under spinal anesthesia.

2. Patients and methods

The study included 40 females subjected to elective lower segment cesarean section (LSCS) with a Pfannenstiel incision. The study applied the principles of the Declaration of Helsinki (1964) and its following revisions. It was approved by the local Institutional Review Board. Before surgery, the patients were informed about the block's technique and informed consent to participate accordingly. They were also trained to describe pain on the 0-10 visual analogue scale (VAS), where 0 indicates no pain and 10 designates the worst pain.

Inclusion criteria were age between 25 and 40 years with ASA physical status I or II. Patients with local infection at the injection site, allergy to study drugs, sepsis, or coagulopathy were excluded from the study. The patients were randomly divided into two groups using a simple randomization technique with closed envelopes. ESPB Group (n=20) received bilateral ESPB. PCA Group (n=20) received morphine-based PCA during the 24 postoperative hours.

All patients had a midline lumbar puncture using a 25-gauge quinke spinal needle at L3-L4 level and 0.5% hyperbaric bupivacaine in a volume of 1.8-2.0 ml - depending on the height of patients - plus fentanyl 15 μg was slowly injected. Surgical procedures began six minutes after the administration of spinal anesthesia. All procedures were completed within 60±15 minutes. Acetaminophen 1 gm and Ketoprofen 100 mg intravenously (IV) were administered before the end of surgery.

The patients in the PCA group were started on PCA morphine for 24 hours postoperatively. The PCA syringe contained 50 ml of morphine in saline in a concentration of 1 mg/ml. The bolus dose was 1 mL = 1 mg, and the lock-out interval was 5 minutes. The maximum dose of morphine to be delivered to the patient was 5 mg/hour and with no basal background infusion. Paracetamol 1 gm IV infusion was given to all patients regularly every 6 hours.

In the ESPB group, with the patients placed in the lateral position (left then right) after surgery, a bilateral ultrasound-guided ESPB at T9 level with the out-of-plane technique was done under sterile conditions. A linear transducer was used. The transverse process was centered on the ultrasound screen, and the transducer was positioned in a longitudinal orientation to obtain a parasagittal view. A 22-G spinal needle was introduced till it contacted the transverse process. Correct tip position was confirmed by injecting 1 mL of normal saline solution and linear fluid visualization spreading deep to the erector spinae muscle. Then, a 15 ml solution of 0.25% bupivacaine was injected at T9 level on the left, and the same solution was injected on the right.

No complications were encountered during the performance of the blocks. Three hours after the end of surgery, the patient's motor and sensory block degree was evaluated. The patients were able to move their feet and legs freely. Sensory blockage, assessed by cold sensation with an alcohol-soaked sponge and pinprick testing, showed the diffusion of local anesthetic from T6 level up to L1 level.

The patients were monitored for pain intensity using the visual analogue score (VAS) at 2, 4, 6, 12, and 24 h after surgery. Also, the total amount of morphine consumed in the 24 postoperative hours was monitored. Patient satisfaction was assessed on a 10-point scale. Adverse effects or complications were recorded.

2.1 Statistical methods

Statistical analysis was done using IBM© SPSS© Statistics version 23 (IBM© Corp., Armonk, NY, USA). Numerical data were expressed as mean and standard deviation or median and range as appropriate. Qualitative data were expressed as frequency and percentage. For quantitative data, comparison between two groups was made using independent sample t-test or Mann-Whitney test. A p-value < 0.05 was considered significant.

3. Results

There was no significant difference in the baseline characteristics between the two groups (Table 1).

Table 1: Baseline characteristics of the two studied groups

	ESPB Group n=20	**PCA Group n=20**	**p-value**
Age (years)	30.6±4.0	30.4±4.8	0.887
Height (cm)	165±4	166±4	0.824
Body mass index (kg/m^2)	27.9±3.9	27.7±3.7	0.870
Parity	2 (1-5)	2 (1-5)	0.862
No. of previous CS	1 (0-2)	1 (0-2)	0.968

CS: cesarean section

Starting from 2 to 6 hours after the end of surgery, pain intensity in the form of VAS score was significantly lower in the ESPB group. However, the VAS score was comparable after 12 hours. After 24 hours, ESPB regained a significantly lower VAS score (Table 2). Total morphine consumption was significantly lower in the ESPB group. The degree of patients' satisfaction with postoperative analgesia was significantly higher in the ESPB group (Table 3).

Table 2: Pain intensity as a VAS score of the two studied groups

	ESPB Group n=20	**PCA Group n=20**	**p-value**
VAS score at 2h	0 (0-1)	6 (5-7)	< 0.001
VAS score at 4h	0 (0-3)	5 (4-6)	< 0.001
VAS score at 6h	4 (3-4)	5 (4-5)	< 0.001
VAS score at 12h	4 (3-5)	5 (4-5)	0.056
VAS score at 24h	4 (4-5)	5 (4-5)	0.014

VAS: Visual analogue score

Table 3: Total postoperative morphine consumption and patients' satisfaction in the two studied groups

	ESPB Group n=20	**PCA Group n=20**	**p-value**
Morphine consumption (mg)	10.0 (3.0-12.0)	21.5 (16.0-25.0)	< 0.001
Patient satisfaction score	8.0 (7.6-8.6)	6.4 (5.8-7.0)	< 0.001

4. Discussion

This study demonstrated that ESPB was associated with a significant reduction in postoperative pain as evidenced by VAS concomitant with a significant decrease in the total postoperative morphine consumption. Given the rising CS rate, we examined the effectiveness of a relatively recent regional analgesic technique after spinal anesthesia. Women undergoing CS consider avoiding pain during and after delivery a high priority [9]. Besides, severe acute postoperative pain may precipitate chronic pain and delayed functional recovery [10]. Therefore, adequate analgesia is essential to a woman's ability to cope with her newborn infant [11].

Opioids, whether applied systemically or intrathecally, continue to be the main option for pain control after CS [12]. Also, intravenous administration is recommenced through Patient Controlled Analgesia (PCA) [13]. However, adverse effects of opioids, including nausea and vomiting, pruritus, excessive sedation, and respiratory depression, can limit its liberal [14].

Cesarean delivery is a distinct type of abdominal surgery that involves many special considerations. Currently, neuraxial anesthesia, especially spinal anesthesia, is the anesthetic technique of choice for this surgery [11]. In-utero drug transfer to the fetus confines using preemptive analgesia [15]. We should be careful about the potential transfer of analgesics to breastfed neonates [16]. Early postoperative mobility is essential for delivering mothers to enable optimal neonatal care [17].

Currently, multimodal analgesia is the recommended option for post-CS analgesia [11]. These include the transversus abdominis plane (TAP) block [18] and the quadratus lumborum (QL) block [19]. Another technique is erector spinae plane block (ESPB), introduced in 2016 by [20]. In this inter-fascial plane block, the local anesthetic is injected between the erector spinae muscle and the transverse process. Local anesthetic spreads into the paravertebral space cranially and caudally [20]. ESP is supposed to provide visceral and somatic analgesia for abdominal surgery [20- 22].

ESPB has been successfully used for postoperative analgesia in various abdominal surgical procedures [23-31]. In these studies, the block was performed at the level of T7. Local anesthetic spread extended from T6 to T12 dermatomes [23], [24]. The surgical producers involved cholecystectomy, splenectomy, ventral hernia, and bariatric surgery. [32] described performing the block at T8 or T9 levels for inguinal herniorrhaphy. This low level of block is more suitable for CS through a Pfannenstiel incision in the current series.

Pain during abdominal surgery consists of somatic and visceral pain. Somatic pain from the anterior abdominal wall constitutes 70–75% of the pain; it lasts 72 hours after open surgery like CS. Visceral pain is intense but short-term (24–36 h) [33]. Opioids are very useful in treating visceral pain but not so helpful for somatic pain [34]. This can explain the superiority of ESPB over morphine-based PCA, as the former exerts an analgesic effect on the larger somatic component of pain due to surgical incision of the abdominal wall.

The study has some limitations. The sample size of the study is relatively small. This is attributed to the recent analgesic technique used in the study that was not a common practice in patients subjected to cesarean section. The study can be considered one of the first studies in this aspect. That is reflected as a second limitation of lacking reasonable literature on the topic.

5. Conclusion

ESPB appears to be a safe and well-tolerated procedure for patients undergoing cesarean delivery. It significantly reduced pain and postoperative morphine consumption with limited trivial side effects. The procedure is easy under ultrasound guidance with no complications during application.

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