The Journal of Obstetrics and Gynecology of India
https://doi.org/10.1007/s13224-024-01947-z

ORIGINAL ARTICLE

Evaluation of Bupivacaine Injection Instillation Directly in the Rectus Sheath in LSCS Cases as an Effective Analgesia Method

Tripti Dubey[1] · **Shivangi Dubey Yadav**[2] · **Amey Kundawar**[2]

Received: 27 July 2023 / Accepted: 5 January 2024

Abstracts

Background An ideal post-cesarean section analgesic plan should aim for high-quality pain relief with minimal side effects, no risk of transfer through breast milk, and a faster return to normal maternal functioning. This study is aimed to assess the efficacy of analgesic action of direct infiltration of bupivacaine in patients undergoing LSCS.

Methods This was a retrospective cross-sectional record analysis, assessing the medical records of 49 patients who were included from the medical records department of Apollo hospital, Belapur, Navi Mumbai.

Results 49% patients did not require analgesics in the first 12 h postoperatively. The mean time of first demand of analgesia was 3.44 h (SD = 5.45). 61.2% patients were mobilized in 14 h or less postoperatively. In 69.4% patients, oral intake was initiated within 3 h of the surgery. 73.5% patient's initiated breastfeeding immediately after the surgery. At 4 h after surgery, the pain score was an average of 0.49 (SD = 0.79). 79.6% patients did not report postoperative nausea and vomiting. No patients reported wound infection or dehiscence post-surgery.

Conclusion Bupivacaine infiltration post-cesarean section is a safe, effective and convenient method since it requires minimal available resources and no additional skills or supervision from medical experts. Hence, it is more suitable, especially in developing countries and rural/peripheral hospitals/maternity centers where the availability of equipment like USG machine may be difficult, making cheap, accessible yet effective analgesic options the need of the hour in post-LSCS patients.

Keywords Analgesia · Bupivacaine infiltration · Post-caesarean section

Introduction

Lower segment cesarean section (LSCS), despite being the most common surgery performed worldwide, stands out amongst others, as its poor recovery period can negatively affect both the mother and the baby [1]. Postpartum period is a time of lots of emotional and physical turmoil to the mother and the family. In situations like this, effective pain management is associated with benefits like enhanced recovery, faster mobilization of the patient and shortened duration of hospital stay, thereby sparing precious resources [2] and helping patients financially by decreasing number of medications and their side-effects and reducing hospital stay duration. Adequate maternal pain relief offers the best advantages for mother–baby bonding, improved outcomes for breast feeding and prevents the risk of long-term consequences like postpartum depression, chronic pain and dependence on opioids [1–3].

An ideal post-LSCS analgesic plan should consist of agents providing high-quality pain relief along with minimal side effects and risk of transfer through breast milk, enabling an immediate return to normal functioning for the mother [1]. At present, there are numerous options available for post-LSCS pain relief, all accompanied with their own set of drawbacks. Commonly used opioids, although considered effective, are associated with nausea, vomiting, sedation, itching, and risk of delayed maternal respiratory depression [4].

Transverse abdominal plane block (TAP) is highly recommended but requires an ultrasound machine and higher skills. There are more chances of postoperative hematoma formation and duration of anesthesia and operation is increased. There have been several studies where continuous

✉ Tripti Dubey
triptidoc@gmail.com

[1] Apollo Hospital, Navi Mumbai, India

[2] Seth G.S Medical College, KEM Hospital, Mumbai, Maharashtra, India

Published online: 28 March 2024

local anesthetic infusion was done with the help of indwelling catheter within the incision. This method requires constant patient monitoring, multiple infusions within the incision site. There are increased chances of wound infection and inadequate wound healing, making it incompatible with the goals of fast recovery or early mobilization post-surgery [5]. In developing countries, especially in ill-equipped remote medical centers, effective and cheap pain management following cesarean section remains a challenge in routine clinical practice [6].

Pfannenstiel incision placed for lower segment caesarean section (LSCS) involves the lumbar 1 to lumbar 2 ($L1$–$L2$) dermatomal area. Ilioinguinal and iliohypogastric nerves supply the sensory innervation for $L1$–$L2$ dermatomes. Ilioinguinal nerve arises from thoracic 12 ($T12$) and $L1$ nerve roots and emerges from lateral border of psoas muscle, just below iliohypogastric nerve between the transversus abdominis and internal oblique muscle. The blockade of these nerves provided somatic pain relief, but is ineffective for visceral pain, as the viscera are innervated by nerve roots from thoracic 10 ($T10$)–$L1$ segments [7].

Local anesthetics (LA) are used in regional anesthesia, epidural anesthesia, spinal anesthesia, and local infiltration. They act by blocking the generation of an action potential in nerve cells through increasing the threshold for electrical excitation [7]. Bupivacaine is a potent local anesthetic with unique characteristics from the amide group of local anesthetics, available in concentrations of 0.25%, 0.5%, and 0.75% [8].

Bupivacaine promotes differential conduction blockade. It imparts sensory blockage more than motor blockade, thus playing an important role in the postoperative pain control. Instillation of bupivacaine should be done with the utmost caution, always checking the positioning of the needle (by aspirating the syringe ensuring that the needle bevel is not intravascular) [9].

The dose of bupivacaine requires established depending on the procedure, the vascularity of the tissues, the area, the number of segments blocked, the depth or duration of anesthesia needed, and the patient's physical condition.

Methemoglobinemia is a serious side effect associated bupivacaine, but it is extremely rare. Other common adverse effects include nausea, vomiting, chills or shivering, headache, back pain, dizziness, restlessness, anxiety, vertigo, tinnitus, blurry vision, tremors [7].

Infiltration of bupivacaine directly into the rectus sheath is a viable alternative for high-quality analgesia as it does not require extra resources or ultrasound equipment. It is a time-saving technique, lasting only 5 min and can be performed during closure of the abdomen under direct vision, bypassing the need for extensive procedures.

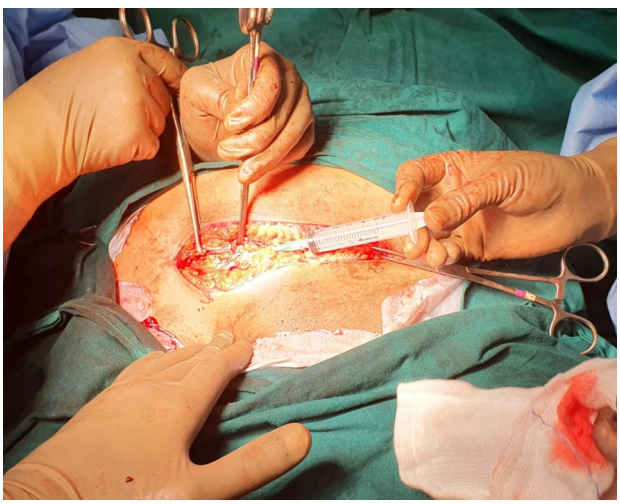
The aim of this study was to assess the efficacy of direct infiltration of bupivacaine in the rectus sheath as an analgesic, in patients undergoing LSCS by studying the following variables: interval at which the first intravenous analgesic was requested by patients postoperatively, the number of doses required, time passed until postoperative mobilization, initiation of oral intake and immediate breastfeeding, duration of surgery and of hospital stay.

Methods

This retrospective record analysis study included 49 patients who had undergone cesarean section. All patients underwent a comprehensive evaluation that included a detailed medical history, clinical examination, physical examination, and airway examination. Preoperative investigations were performed. Prior to surgery, informed consent was obtained from patients, who received preoperative hydration, antibiotic coverage, intravenous antacids, and antiemetics. These procedures were performed as part of the standard treatment protocol.

Irrespective of age, weight, parity, prior LSCS, emergency or elective LSCS, varied presentations, BMI, or any other comorbidities, all pregnant females undergoing LSCS were included. Patients with a history of bupivacaine hypersensitivity were excluded from this study.

During abdominal closure, a solution containing 20 ml of 0.5% bupivacaine was carefully instilled within the layers of the rectus sheath, mainly targeting both angles. Special care was taken to avoid injecting the drug into the blood vessels by aspirating the medication before it was injected into the sheath.



In the immediate postoperative period, all patients were administered a single dose of diclofenac 100 mg or tramadol 100 mg suppository for alleviating visceral pain.

The level of pain experienced by the patients was assessed by visual analog pain score (VAS). VAS is a validated,

subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10-cm line that represents a continuum between "no pain" and "worst pain". Apart from this, measuring the time interval between surgery and the first dose of intravenous analgesia requested by the patient and the number of intravenous analgesic doses required postoperatively were also taken into consideration.

The study also recorded the time taken for patients to ambulate after surgery and the time at which they were shifted to oral fluids and diet. Any side effects that occurred within the first 24 h after surgery, such as nausea, vomiting, and sedation, were noted.

This study only involves the retrospective analysis of patient data which are recorded routinely. Patient data records were obtained from the medical records department of Apollo hospital, Belapur, Navi Mumbai, following ethical clearance from the ethics committee.

Results

The average age of the participants was 32.33 years (standard deviation (SD) = 4.25), while the average gestational age was 37.57 weeks (SD = 1.85). About 42.9% of cases had one prior LSCS, compared to 51.0% who had never had a caesarean section. The surgeries lasted for an average duration of 54.69 min (SD = 14.52). The time of the first bowel movement after surgery was reported after an average of 9.8 h (SD = 4.84), and the average duration of hospital stay after surgery was 3.10 days (SD = 0.62) (Tables 1, 2 and Fig. 1).

Table 1 Demographic characteristics of study participants

Parameter	Value ($n = 49$)
Age (years)	32.33 ± 4.35
Gestational age (weeks)	37.57 ± 1.85
Previous LSCS	24
Gestational diabetes mellitus	15
Pregnancy-induced hypertension	7
Hypothyroidism	9
Anemia	3
Meconium	8

Table 2 Pain score on VAS scale at 4 h. post LSCS

Pain score	No. of cases	Percentage (rounded off)
0	33	67.0%
1	12	24.0%
2	3	6.0%
3	1	2.0%
Total	49	100.0%

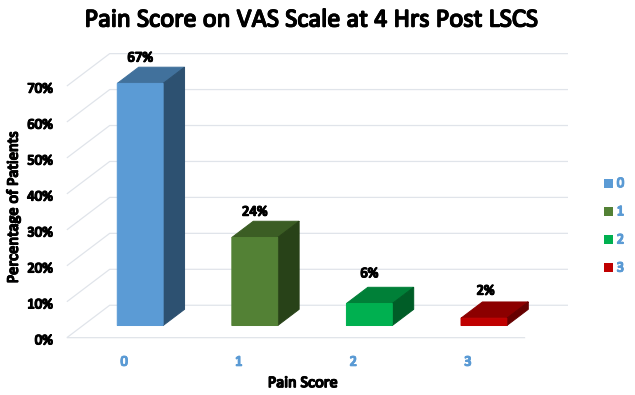


Fig. 1 Graph representation of pain score on VAS scale at 4 h post LSCS

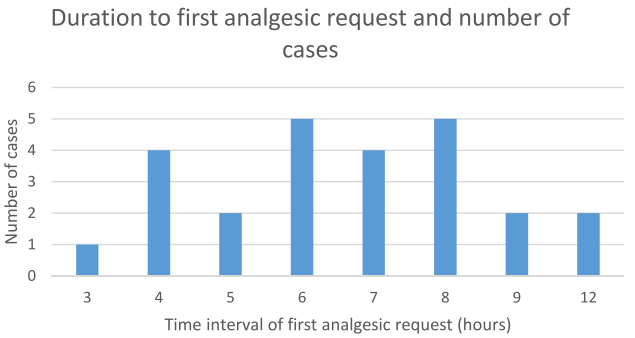


Fig. 2 Graph representing duration to first analgesic request and the number of cases

Most of the patients (i.e., more than 90%) felt almost no pain within 4 h of LSCS, and the rest of the patients (i.e., 8%) felt very minimal pain. At 4 h after surgery, the pain score was an average of 0.49 (SD = 0.79). Patients could rate their level of pain on VAS (0 for no pain, 1 to 10 indicating increasing severity of pain) (Fig. 1).

49% patients did not require analgesics in the first 12 h postoperatively. 55.1% patients did not require even a single dose of IV paracetamol, one dose was provided to 32.7% patients, and two doses were provided to 12.2% patients. 89.8% participants did not require IV diclofenac. One and two doses of IV diclofenac were provided to 4.1% patients, each. Only 2% patients required three doses of IV diclofenac (Fig. 2).

Majority (61.2%) of the patients were mobilized in 14 h or less postoperatively. 36.7% patients were mobilized within 14–18 h of the surgery. Only one patient took 20 h to ambulate (Fig. 3).

In majority (69.4%) patients, oral intake was initiated within 3 h of the surgery, while the remaining patients started it within 5 h of the surgery. 73.5% patients initiated breastfeeding immediately after the surgery (Fig. 4).

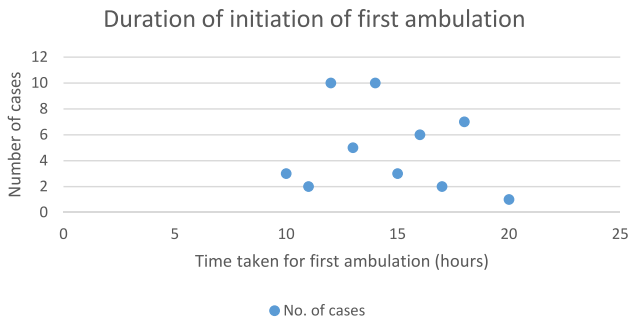


Fig. 3 Graph representing duration taken to initiate first ambulation

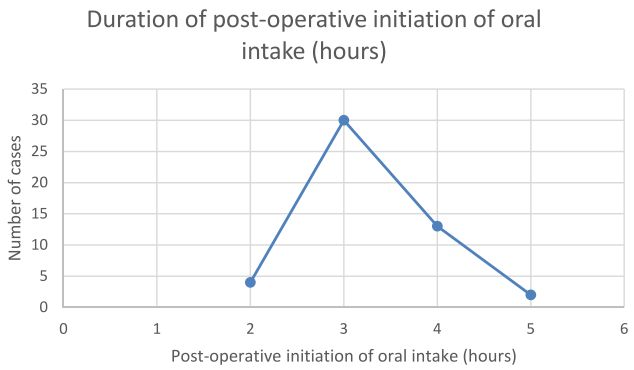


Fig. 4 Graph representing duration taken to initiate oral intake post-operatively

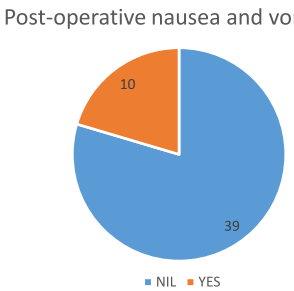


Fig. 5 Graph representing occurrence of post-operative nausea and vomiting

79.6% patients did not report postoperative nausea and vomiting (Fig. 5). There were no reports of wound infection, seepage, or dehiscence.

Discussion

The procedure-specific postoperative pain management (PROSPECT) working group of the European Society of Regional Anesthesia and Pain Therapy supported by the Obstetric Anesthetists' Association issued guidelines (2020) for optimum pain management during cesarean delivery, recommending the use of LA for wound infiltration, advocating for non-steroidal anti-inflammatory drugs (NSAIDs) as well [10].

The rationale behind such a recommendation could be explained through a hypothesis supporting the use of local anesthetics for surgical wound infiltration. The tissue injury caused by surgery releases local inflammatory mediators that aggravate sensitization of peripheral nociceptors (primary hyperalgesia) and increase the excitability of central nervous system neurons as a result of repetitive nociceptive stimulation (secondary hyperalgesia). Peripheral sensitization and central sensitization are thought to contribute to acute and chronic postoperative pain [3].

The long-acting local anesthetics such as bupivacaine and ropivacaine are used to provide prolonged perioperative pain relief and to diminish the occurrence of postoperative sensitization that manifests with hyperalgesia after the anesthetic effect has dissipated. When infiltrated around the surgical wound, such local anesthetics exercise intrinsic anti-inflammatory proprieties; reducing local and systemic expression of inflammatory mediators and preventing the generation of action potentials from pain receptors by blocking sodium channels, thereby inhibiting afferent nociceptive input from peripheral nerve fibers to the central nervous system [3, 9].

Majority of the patients did not require doses of IV diclofenac and IV paracetamol for postoperative pain relief. The mean pain score obtained was 0.49 at 4 h after surgery, indicating postoperative pain of very mild intensity. These findings were supported by another study which concluded that patients who underwent bupivacaine infiltration required significantly less doses of diclofenac compared to controls, for postoperative pain relief [11]. Another study found that the VAS scores were lower in the intervention group comprising of bupivacaine infiltration compared with the control group at 2 h, 4 h, 6 h, and 12 h, although the differences were not significant. However, the mean VAS score at 24 h after the operation was significantly lower in the intervention group [12].

A study by Saboo et al. [11] found that majority of the patients (86.15%) who were administered bupivacaine infiltration were mobilized in less than or at 12 h postoperatively as they were relatively pain free while in the current study, majority (61.2%) of the patients were mobilized in

14 h or less postoperatively. In this study, majority of the patients were administered spinal anesthesia (SA), hence to avoid post-SA headache, ambulation before 12 h was not attempted. The Foleys catheter was kept in place for an average duration of 15.27 h (SD = 3.167). For the patient's convenience and comfort, Foleys catheter was not removed during the evening hours following LSCS, leading to a slight delay in ambulation. However, ambulation post-LSCS in patients provided with bupivacaine infiltration can be initiated even within 12 h [11]. Early mobilization of the mother improves satisfaction as well as ability to care for the newborn. Early oral intake is another important determinant for hastening of bowel function, improving maternal satisfaction, and helps in early ambulation and discharge, while preventing the risk of thromboembolism and venous stasis [13].

A prospective cohort study by Zewdu et al. proved that wound site infiltration with bupivacaine significantly prolonged the duration to first request of analgesia and reduced the severity of pain for parturient undergoing elective cesarean delivery. It also significantly decreased the total postoperative tramadol analgesia required as compared to controls. They recommended the use of wound infiltration technique as a part of postoperative analgesia management in resource-limited settings [6].

A systematic review and meta-analysis comparing the use of TAP block versus local anesthetic wound infiltration for post-CS analgesia observed that wound infiltration provides postoperative analgesia similar to TAP block [5]. A review article by Gabriel et al. recommended the use of surgical wound infiltration in those patients who do not receive neuraxial opioids. They observed that it would be easier to perform surgical infiltration versus a regional anesthetic block given that the surgeons would already be present in the field, and thus, an additional procedure outside of surgery would not be needed [14].

The wound infiltration technique has not led to increased rates of wound dehiscence or infection. Local anesthetics, especially bupivacaine, may impede antimicrobial activity as it has been reported that bupivacaine could inhibit the growth of numerous bacteria and fungi under various conditions [12].

Analgesic infusion through an indwelling catheter requires increased supervision and is associated with infections and delayed scar healing; all these factors combined can lengthen hospital stay and interfere with early mobilization [9]. In this study, no cases of wound infection or dehiscence were reported, which can be attributed to the positive effects of a single session bupivacaine infiltration. A study found the excretion of bupivacaine through breast milk to be less than 1% (less than 10% is considered to be unlikely for clinical concern) therefore, suggesting minimal risks for breastfeeding healthy, term neonates after the administration of this combination of local anesthetics to mothers [2].

Limitation

Pain threshold differs from person to person, making pain assessment very subjective. Also, many patients could not differentiate whether their pain was due to the surgical wound or of abdominal origin due to uterine contractions or as a result of hyperacidity. This being a single-center study was limited due to a small sample size. A larger sample size involving more hospital/maternity homes and a diverse group of participants would present with better results which can be generalized pan-India.

Conclusion

Effective postoperative analgesia following LSCS surgery is most crucial to help facilitate early mobilization, improve patient satisfaction and encourage mother–baby bonding. This study reported longer pain relief, reduced demand for analgesics, faster mobilization, shortened hospitalization, optimum wound healing and overall better recovery for the patient. The findings of this study support the application of bupivacaine infiltration during LSCS surgery as a safe, effective and convenient method for surgeons as well as patients. This method of post-LSCS analgesia requires minimal resources and no additional skill set or supervision from medical experts. This is a very important factor to provide effective pain relief to post-LSCS patients, especially in developing countries and rural/peripheral hospitals/maternity centers where the availability of equipment like ultrasound sonography (USG) may be difficult, making cheap, accessible yet effective analgesic options the need of the hour.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Neall G, Bampoe S, Sultan P. Analgesia for caesarean section. BJA Educ. 2022;22(5):197–203.
2. Mustafa HJ, Wong HL, Al-Kofahi M, et al. Bupivacaine pharmacokinetics and breast milk excretion of liposomal bupivacaine administered after cesarean birth. Obstet Gynecol. 2020;136(1):70–6.

3. Gómez-Ríos MÁ, Codesido-Barreiro P, Seco-Vilariño C, et al. Wound infusion of 0.35% levobupivacaine reduces mechanical secondary hyperalgesia and opioid consumption after cesarean delivery: a prospective, randomized, triple-blind placebo-controlled trial. Anesth Analg. 2022;134(4):791–801.
4. Wang J, Zhao G, Song G, et al. The efficacy and safety of local anesthetic techniques for postoperative analgesia after cesarean section: a bayesian network meta-analysis of randomized controlled trials. J Pain Res. 2021;14:1559–72.
5. Grape S, Kirkham KR, Albrecht E. Transversus abdominis plane block versus local anaesthetic wound infiltration for analgesia after caesarean section: a systematic review and meta-analysis with trial sequential analysis. Eur J Anaesthesiol. 2022;39(3):244–51.
6. Zewdu D, Tantu T, Olana M, et al. Effectiveness of wound site infiltration for parturients undergoing elective cesarean section in an Ethiopian hospital: a prospective cohort study. Ann Med Surg. 2021;64:102255.
7. Krishnegowda S, Pujari VS, Doddagavanahalli SR, et al. A randomized control trial on the efficacy of bilateral ilioinguinal-iliohypogastric nerve block and local infiltration for post-cesarean delivery analgesia. J Obstet Anaesth Crit Care. 2020;10(1):32–7.
8. Shafiei FT, McAllister RK, Lopez J (2023) Bupivacaine. In: Dubey T (ed.) StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing
9. Abrão J, Antunes M, Garcia LV. Local anesthetics infiltration and wound healing process. Top Local Anesthet. 2020. https://doi.org/10.5772/intechopen.89278.
10. Roofthooft E, Joshi GP, Rawal N, et al. PROSPECT guideline for elective caesarean section: updated systematic review and procedure-specific postoperative pain management recommendations. Anesthesia. 2021;76(5):665–80.
11. Saboo V, Biswas D, Naz A, et al. Local infiltration of bupivacaine along the incision line following cesarean section reduces postoperative pain and analgesia requirement: a double-blinded randomized controlled study. J South Asian Fed Obstet Gynaecol. 2022;14(5):596–601.
12. Garmi G, Parasol M, Zafran N, et al. Efficacy of single wound infiltration with bupivacaine and adrenaline during cesarean delivery for reduction of postoperative pain: a randomized clinical trial. JAMA Netw Open. 2022;5(11): e2242203.
13. Patel K, Zakowski M. Enhanced recovery after cesarean: current and emerging trends. Curr Anesthesiol Rep. 2021;11(2):136–44.
14. Gabriel RA, Burton BN, Curran BP, et al. Regional anesthesia abdominal blocks and local infiltration after cesarean delivery: review of current evidence. Curr Pain Headache Rep. 2021;25(5):1–8.