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Structured Preprocedural Reassessment After Previous Inadequate Neuraxial Anesthesia for Cesarean Delivery: A Case Report

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Abstract

Inadequate neuraxial anesthesia during cesarean delivery can cause intraoperative pain and anxiety before subsequent surgery. We report a parturient undergoing her third cesarean delivery after inadequate spinal anesthesia during both previous cesarean deliveries. She expressed strong concern about recurrent intraoperative pain.

During the second cesarean delivery, combined spinal-epidural anesthesia was performed. A lower-limb motor block developed, but complete cold sensory loss was limited to L1 at 20 minutes after the initial intrathecal injection. The initial epidural catheter was replaced because malposition was suspected. The cold sensory level reached only T10 after repeat spinal injection and epidural supplementation; operative pain required local infiltration and intravenous medication.

Before the third delivery, we reviewed the anesthetic record and postoperative abdominal radiograph from the second delivery. The radiological intercristal line, joining the superior aspects of the iliac crests, crossed around L5-S1. Preprocedural lumbar ultrasonography was used to identify the lumbar interspaces. An individualized combined spinal-epidural plan included epidural supplementation and conversion to general anesthesia as rescue options. After intrathecal administration of hyperbaric bupivacaine and fentanyl at the ultrasound-identified L2-L3 interspace, bilateral loss of cold sensation to T4 was confirmed within 10 minutes. No rescue epidural supplementation, intravenous sedative or opioid, or conversion to general anesthesia was required. Planned postoperative epidural analgesia was started toward the end of surgery, before wound closure.

Previous inadequate neuraxial anesthesia for cesarean delivery should prompt structured reassessment and an individualized anesthetic plan that addresses the patient's concerns and includes predefined rescue options.

Categories: Obstetrics/Gynecology, Radiology, Anesthesiology
Keywords: cesarean section, epidural anesthesia, inadequate neuraxial anesthesia, pregnancy, spinal anesthesia, ultrasonography

Introduction

Inadequate neuraxial anesthesia during cesarean delivery may result in intraoperative pain, maternal distress, additional neuraxial procedures, supplemental analgesia or sedation, or conversion to general anesthesia [1-4]. Therefore, a history of inadequate block should prompt structured review of the previous anesthetic course, potentially contributing factors, and rescue options before a subsequent cesarean delivery [3-5]. Palpation-based identification of lumbar interspaces can be inaccurate in term parturients, and preprocedural lumbar ultrasonography may assist anatomical localization [6-10].

We report a parturient with inadequate spinal anesthesia during both previous cesarean deliveries. For her third delivery, we developed an individualized anesthetic plan by reviewing the previous anesthetic record and available imaging, considering the patient's concerns, reassessing lumbar anatomy with ultrasonography, and defining rescue options in advance. The educational contribution lies in applying established methods to reassess prior difficulties, rather than introducing a novel ultrasound technique.

Case Presentation

A 35-year-old woman (height, 158 cm; weight, 68.5 kg) at 38 weeks' gestation was scheduled for an elective third cesarean delivery. She had no history of spinal surgery or neurological disease. She reported inadequate spinal anesthesia during her first cesarean delivery at another institution, although detailed records and a more specific characterization of that experience were unavailable.

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A two-space combined spinal-epidural technique was used for both the second and third cesarean deliveries. This technique was selected to allow upper lumbar epidural catheter placement for postoperative analgesia, with spinal puncture at a separate, more caudal lumbar interspace. Epidural placement and spinal puncture were performed in the right lateral decubitus position. The epidural space was identified by loss of resistance to saline; catheter aspiration yielded neither blood nor cerebrospinal fluid, and no epidural test dose was administered. Cold sensation was assessed using ice, and the upper level of complete loss of cold sensation was recorded. Motor function was assessed qualitatively by asking the patient about movement at the ankles, knees, and hips; no formal Bromage score was obtained.

During the second cesarean delivery, interspaces were estimated by palpation. An epidural catheter was inserted at the presumed L1-L2 interspace. At the presumed L3-L4 interspace, slow cerebrospinal fluid return through a 25-gauge Quincke spinal needle (TOP Spinal Needle; TOP Corp., Tokyo, Japan) was confirmed before intrathecal administration of 10 mg (2.0 mL) of 0.5% hyperbaric bupivacaine (Marcain Spinal 0.5% Hyperbaric; Sandoz K.K., Tokyo, Japan) and 15 µg (0.3 mL) of fentanyl (Fentanyl Injection; Janssen Pharmaceutical K.K., Tokyo, Japan). A lower-limb motor block developed, but at 20 minutes after the initial intrathecal injection, the upper level of complete cold sensory loss was L1 bilaterally and symmetrically. During assessment after the initial intrathecal injection, saline was administered through the initial epidural catheter in an attempt to extend the sensory block cephalad by a volume effect (epidural volume extension). No further cephalad extension of the cold sensory block was observed. Leakage at the catheter insertion site raised concern about malposition, prompting removal and replacement of the catheter before the repeat spinal injection.

Forty-five minutes after the initial intrathecal injection, a second spinal puncture was performed at the presumed L2-L3 interspace. Cerebrospinal fluid flow was more satisfactory than during the first puncture, and the same intrathecal doses were administered; the cold sensory level remained at L1. Subsequent efforts included head-down positioning, further epidural catheter management, and divided epidural mepivacaine administration. The upper level of complete cold-sensation loss reached only T10 bilaterally, and the patient experienced pain at the skin incision and during peritoneal and uterine traction. The cumulative epidural mepivacaine dose administered before and during surgery was 410 mg, comprising 10 mL of 2% solution and 14 mL of 1.5% solution (Carbocain Injection; Sandoz K.K., Tokyo, Japan). In addition to local anesthetic infiltration at the surgical site, intravenous sedation and analgesia included a dexmedetomidine infusion at 0.7 µg/kg/h, midazolam totaling 3 mg, and fentanyl totaling 270 µg. No airway obstruction or respiratory compromise was documented during surgery.

Before the third cesarean delivery, she expressed strong concern about recurrent intraoperative pain. The second-delivery anesthetic record and postoperative abdominal radiograph were reviewed; a radiologist interpreted the intercristal line as crossing the lumbosacral junction around the L5-S1 interspace (Figure *1*).

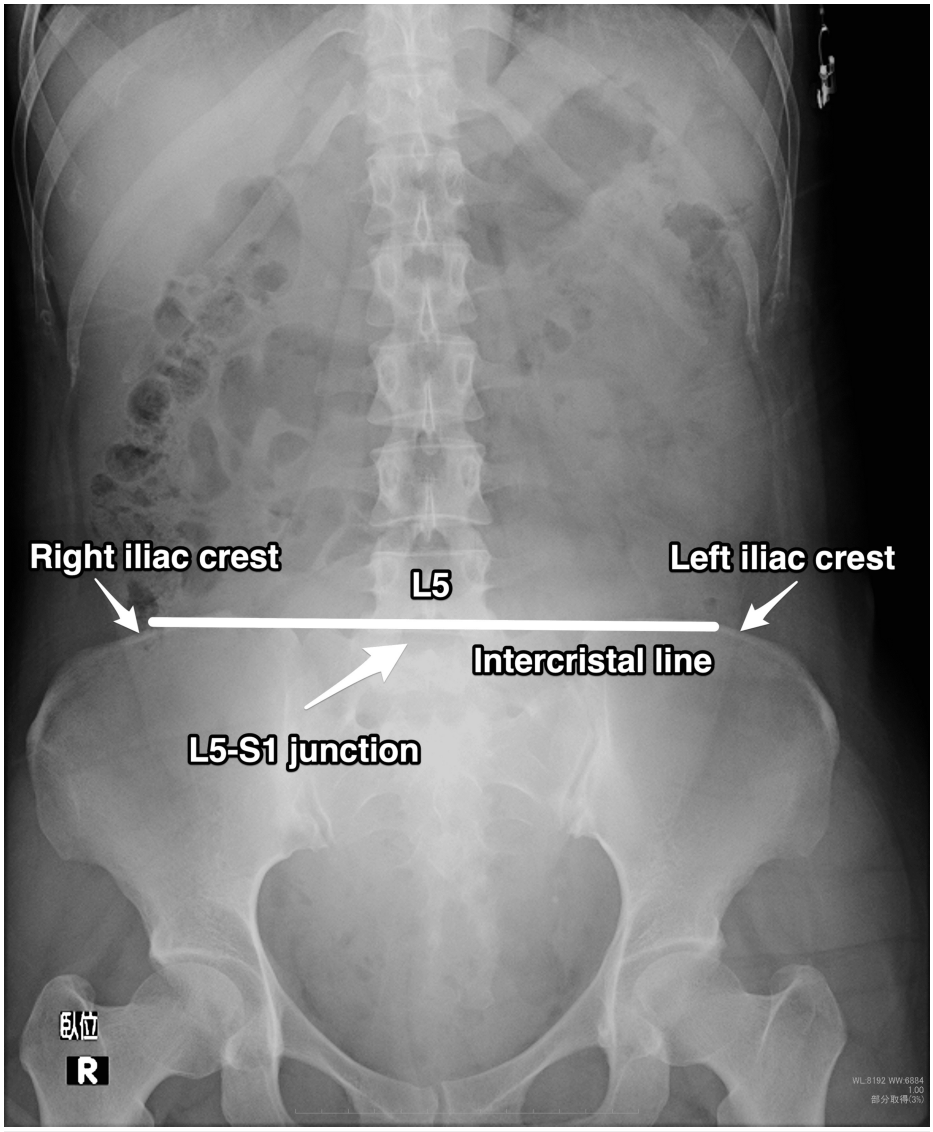


FIGURE 1: Postoperative abdominal radiograph obtained after the second cesarean delivery

The solid white line represents the radiological intercristal line joining the superior aspects of both iliac crests. The lateral white arrows indicate the right and left iliac crests, and the central oblique white arrow indicates the L5-S1 junction. The label "L5" identifies the fifth lumbar vertebral body.

Preprocedural lumbar ultrasonography was performed in the right lateral decubitus position using a low-frequency curvilinear probe. In a paramedian sagittal oblique view, the sacrum was identified, and the lumbar interspaces were counted cranially and marked. The palpated intercristal line corresponded to the ultrasound-identified L5-S1 interspace. The original ultrasound images were not archived.

The anesthetic plan included epidural local anesthetic supplementation if the spinal block proved inadequate, with conversion to general anesthesia if adequate surgical anesthesia could not be achieved or intraoperative pain persisted. Using the ultrasound markings, an epidural catheter was inserted at the L1-L2 interspace, followed by spinal puncture at the L2-L3 interspace with a 25-gauge Quincke needle. Spinal puncture was successful on the first attempt without paresthesia, and satisfactory cerebrospinal fluid return was obtained. Hyperbaric bupivacaine 10 mg and fentanyl 15 µg were administered intrathecally. During block onset, head-up positioning was used in response to rapid cephalad spread. Bilateral loss of cold sensation to T4 was confirmed 10 minutes after intrathecal injection.

No rescue epidural supplementation, intravenous sedative or opioid, or conversion to general anesthesia was required. Toward the end of surgery, before wound closure, planned postoperative epidural analgesia was initiated with a 5 mL bolus of 0.2% ropivacaine (Anapeine Injection 2 mg/mL; Sandoz K.K., Tokyo, Japan) and an infusion at 5 mL/h. This was not administered in response to intraoperative pain. The same

infusion was continued postoperatively without adjuvants or patient-controlled dosing, and the catheter was removed 60 hours after surgery. Pain scores on the numerical rating scale were 0 on return to the ward and 1 the following morning; no additional analgesics were required.

She reported satisfaction with the anesthetic management. No neurological symptoms, post-dural puncture headache, or catheter-related complications were reported in the available postoperative information. The neonatal course was uneventful.

Discussion

The practical lesson from this case is the value of structured reassessment after previous inadequate neuraxial anesthesia. We developed the anesthetic plan for the third cesarean delivery based on the previous anesthetic course, the patient's concerns, and the radiographic and ultrasound findings. Recommendations for managing intraoperative pain emphasize preoperative counseling, careful block assessment, prompt treatment, and postoperative follow-up [3-5]. Combined spinal-epidural anesthesia allows additional epidural local anesthetic administration if needed, but does not eliminate the possibility of catheter malfunction or an inadequate block. Counseling should address the benefits and risks of neuraxial and general anesthesia, possible recurrence of an inadequate block, and conversion to general anesthesia when necessary, to support informed consent [3].

The radiological intercristal line joins the superior aspects of both iliac crests and is conventionally used as a landmark for the L4 spinous process or L4-L5 interspace [6,7]. However, its actual vertebral level varies. A radiographic study found that, in women, the line most often crossed the L5 vertebral body or the superior endplate of L5 [11]. In addition to this anatomical variation, studies using ultrasonography have demonstrated inaccuracies in palpation-based identification of lumbar levels [6-8]. The vertebral level of the palpated intercristal line can also change with patient position [9]. In this patient, a radiologist interpreted the line on the postoperative abdominal radiograph as crossing near L5-S1. Subsequent ultrasonography showed that the palpated line corresponded to the same region. If this line near L5-S1 had been assumed to mark L4 or L4-L5 during the second cesarean delivery, the other lumbar interspaces would also have been identified using an incorrect reference level. A puncture believed to be at L3-L4 could therefore have been performed at a lower interspace. We considered interspace misidentification as a possible contributor to the inadequate spinal block. However, we could not confirm the actual puncture levels during the second cesarean delivery. Evidence indicates that neuraxial ultrasonography reduces needle attempts and likely improves first-attempt success [10]. In this patient, we used it to identify the lumbar interspaces before puncture.

Other explanations for the previous inadequate spinal block also require consideration. During the second cesarean delivery, lower-limb motor block and limited lumbar cold sensory loss indicated some spinal effect. Incomplete intrathecal drug delivery remained possible despite cerebrospinal fluid return. However, slow cerebrospinal fluid flow alone did not confirm incomplete drug delivery. Dose-related factors, uneven intrathecal drug distribution, variations in cerebrospinal fluid volume or distribution, patient positioning, and other pharmacological or anatomical factors may also contribute [5,12-14]. Inadequate blocks have been reported despite appreciable cerebrospinal fluid bupivacaine concentrations [15]. When managing an inadequate spinal block, repeat intrathecal dosing in the presence of residual block requires caution because of the risk of high spinal block [5,12]. The repeat injection during the second cesarean delivery is described as part of the previous anesthetic course, not as a recommended rescue regimen.

This case report has several limitations. We did not have detailed records from the first Cesarean delivery, and we did not assess lumbosacral cerebrospinal fluid volume or distribution. The original ultrasound images were not archived, so the reported sonographic identification of the lumbar interspaces could not be independently reviewed. Although no rescue epidural supplementation was required during the third cesarean delivery, planned epidural analgesia began before wound closure; the contribution of spinal anesthesia alone to the final part of surgery therefore cannot be isolated. The successful outcome does not establish that intervertebral-level misidentification caused the inadequate spinal block during the second cesarean delivery or that choosing L2-L3 was the main reason for success. This report does not advocate routine puncture at L2-L3, given variation in conus medullaris termination and the potential for neurological injury [16].

Conclusions

Previous inadequate neuraxial anesthesia for cesarean delivery should prompt structured review of the prior anesthetic course and the patient's experience. Lumbar ultrasonography may assist interspace identification as part of anatomical reassessment. An individualized plan for the subsequent delivery should address the patient's concerns, include careful assessment of block adequacy, and define rescue options in advance.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the

work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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References

1. Charles EA, Carter H, Stanford S, et al.: Intraoperative pain during cesarean delivery under neuraxial anesthesia: a systematic review and meta-analysis. Anesthesiology. 2025, 143:156-67. 10.1097/ALN.0000000000005486
2. Patel R, Kua J, Sharawi N, Bauer ME, Blake L, Moonesinghe SR, Sultan P: Inadequate neuraxial anaesthesia in patients undergoing elective caesarean section: a systematic review. Anaesthesia. 2022, 77:598-604. 10.1111/anae.15657
3. Plaat F, Stanford SE, Lucas DN, et al.: Prevention and management of intra-operative pain during caesarean section under neuraxial anaesthesia: a technical and interpersonal approach. Anaesthesia. 2022, 77:588-97. 10.1111/anae.15717
4. Orbach-Zinger S, Binyamin Y: Prevention and management of intraoperative pain during caesarean section . BJA Educ. 2025, 25:50-6. 10.1016/j.bjae.2024.09.006
5. Girard T, Savoldelli GL: Failed spinal anesthesia for cesarean delivery: prevention, identification and management. Curr Opin Anaesthesiol. 2024, 37:207-12. 10.1097/ACO.0000000000001362
6. Margarido CB, Mikhael R, Arzola C, Balki M, Carvalho JC: The intercristal line determined by palpation is not a reliable anatomical landmark for neuraxial anesthesia. Can J Anaesth. 2011, 58:262-6. 10.1007/s12630-010-9432-z
7. Lee AJ, Ranasinghe JS, Chehade JM, Arheart K, Saltzman BS, Penning DH, Birnbach DJ: Ultrasound assessment of the vertebral level of the intercristal line in pregnancy. Anesth Analg. 2011, 113:559-64. 10.1213/ANE.0b013e318222abe4
8. Hosokawa Y, Okutomi T, Hyuga S, Kato R, Kuczkowski KM: The concordance rate of L3/4 intervertebral lumbar level estimated by palpation and ultrasonography in Japanese parturients. J Matern Fetal Neonatal Med. 2020, 33:2354-8. 10.1080/14767058.2018.1550063
9. Kamimura Y, Nagai A, Nakanishi T, Tsuji T, Tanaka M, Sobue K: Intercristal line determined by palpation in parturients in the sitting and the lateral decubitus positions: a prospective observational study. J Anesth. 2022, 36:270-5. 10.1007/s00540-022-03045-8
10. Makino Y, Miyake K, Roche D, Yoshimura S, Nahara I, Sahker E, Watanabe N: Ultrasound guidance versus anatomical landmarks for neuraxial anaesthesia in adults. Cochrane Database Syst Rev. 2025, 5:CD014964. 10.1002/14651858.CD014964.pub2
11. Snider KT, Kribs JW, Snider EJ, Degenhardt BF, Bukowski A, Johnson JC: Reliability of Tuffier's line as an anatomic landmark. Spine (Phila Pa 1976). 2008, 33:E161-5. 10.1097/BRS.0b013e318166f58c
12. Fettes PD, Jansson JR, Wildsmith JA: Failed spinal anaesthesia: mechanisms, management, and prevention . Br J Anaesth. 2009, 102:739-48. 10.1093/bja/aep096
13. Carpenter RL, Hogan QH, Liu SS, Crane B, Moore J: Lumbosacral cerebrospinal fluid volume is the primary determinant of sensory block extent and duration during spinal anesthesia. Anesthesiology. 1998, 89:24-9. 10.1097/00000542-199807000-00007
14. Spiegel JE, Hess P: Large intrathecal volume: a cause of true failed spinal anesthesia . J Anesth. 2007, 21:399-402. 10.1007/s00540-007-0510-5
15. Steiner LA, Hauenstein L, Ruppen W, Hampl KF, Seeberger MD: Bupivacaine concentrations in lumbar cerebrospinal fluid in patients with failed spinal anaesthesia. Br J Anaesth. 2009, 102:839-44. 10.1093/bja/aep050

16. Reynolds F: Damage to the conus medullaris following spinal anaesthesia . Anaesthesia. 2001, 56:238-47. 10.1046/j.1365-2044.2001.01422-2.x