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# Spinal Anesthesia with Ultrasonography (USG) Marker in Morbidly Obese Pregnant Women Undergoing Cesarean Section Surgery: A Case Report

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**A B S T R A C T**

**Background:** Spinal anesthesia is a regional anesthesia technique used to provide analgesia or numbness in the lower part of the body. This technique has long been employed in childbirth and cesarean section surgeries due to its numerous advantages for pregnant women. Obese pregnant patients often have increased adipose tissue in the back area, making it challenging to identify the appropriate interspinous space. **Case presentation:** A 26-year-old primigravida at 38 weeks of gestation with morbid obesity, standing at 158 cm tall and weighing 140 kg, with a body mass index (BMI) of 56.1 kg/m², underwent cesarean section surgery under spinal anesthesia. The identification of the spinal needle insertion site was performed using pre-procedural ultrasound (USG) marker at the L3-L4 level, with heavy bupivacaine 0.5% 12.5 mg used as the anesthetic agent. The surgery lasted for 1 hour and 20 minutes, with stable hemodynamics and a blood loss of 450 ml. A female infant was delivered, weighing 3080 grams, with a length of 50 cm and an APGAR score of 8-9-10. **Conclusion**: The use of USG markers can assist in determining the precise location for spinal anesthesia injection, thereby reducing complications from repeated needle insertions.

## 1. Introduction

During pregnancy, it may be challenging to perform neuraxial blocks using traditional landmark methods due to anatomical and physiological changes such as obesity, edema, lordosis, and scoliosis. The most common predictors of difficulty in neuraxial blocks are hard-to-find landmarks or difficulty in palpation. Difficulty in identifying the traditional spinal needle insertion point can increase the risk of injury and the difficulty in achieving effective anesthesia blockade. The gravid uterus can hinder achieving adequate lumbar vertebral flexion, and labor pain can impede parturient patients from maintaining position during the procedure. The operator's experience also plays a significant role.[1,2] The use of ultrasound guidance in spinal anesthesia procedures has become a well-accepted common practice in managing pregnant patients with obesity. Patients with high body mass index tend to have complex anatomical changes, including thick subcutaneous fat layers and bone structures that are difficult to identify clinically. In this context, USG serves as a highly useful tool for anesthesiologists to accurately visualize relevant anatomical structures, aiding in estimating the depth and angle of spinal needle insertion, thus enhancing the success and safety of spinal anesthesia procedures.[1,3]

Lumbar ultrasound technology to guide neuraxial procedures was first demonstrated by Cork et al., who described techniques for visualizing neural structures and found a strong correlation between USG predictions and needle depth to the epidural space. Grau et al., in 2000, introduced visualization through the paramedian sagittal plane.[3] Lumbar vertebra assessment with USG is typically performed just before neuraxial procedures to identify landmarks, while real-time USG guidance is still considered experimental. Curved probes with low frequency (2-5 MHz) are recommended for scanning longitudinal and paramedian transverse planes. Lumbar vertebra levels and intervertebral spaces can be identified, as well as the sacrum, articular processes, ligamentum flavum, posterior dura mater, anterior dura mater, posterior longitudinal ligament, and vertebral bodies.[2] When facing anesthesia challenges in pregnant patients with obesity, it is crucial to seek the best approach to minimize risks and maximize procedural success. The use of USG guidance in spinal anesthesia provides an additional advantage in improving needle placement accuracy and optimizing the distribution of spinal anesthesia drugs.

## 2. Case Presentation

A 26-year-old woman, G1P0A0, 38 weeks pregnant, presented to the hospital with complaints of intermittent abdominal pain, a history of vaginal discharge, and mucus mixed with blood. During observation in the delivery room, no progress was observed in the labor process, leading to the decision to proceed with a cesarean section for the patient. Upon physical examination, the patient is alert and oriented, with a blood pressure of 130/70 mmHg, pulse rate of 76 beats per minute, respiratory rate of 18 breaths per minute, room air saturation of 99%, and axillary temperature of 36.0°C. The patient's height is 158 cm and weight is 140 kg, with a BMI of 56.1 kg/m$^2$. Palpation of the interspinous space is difficult due to the thick adipose tissue covering it. The patient was diagnosed with G1P0A0, 38 weeks pregnant, and morbid obesity. Anesthesia management was performed using the spinal anesthesia technique. Premedication of intravenous ondansetron 8 mg and ringer-lactate 500 ml loading were administered. The patient was positioned in a sitting position, and then the interspinous space was identified with the assistance of ultrasound.

The initial scanning is aimed at identifying the intervertebral space where the spinal needle will be inserted. It is recommended to use a curved linear ultrasound transducer with low frequency to provide the best image with a wide field of view, thus aiding in identifying structures from multiple adjacent vertebrae. In this patient, due to limited availability of the probe, standard linear probe was used. In obese patients, identifying the midline can be challenging, so pressure can be applied on the transducer to compress the subcutaneous tissue. The first step is to hold the transducer longitudinally, so its long axis is in a vertical position, parallel to the spine (parasagittal view). Begin approximately four centimeters laterally from the midline of the spine at a level above the iliac crest. Convexly, the probe should be directed so that the cephalad aspect is on the left side of the image. Ideally, as the transducer is moved medially, a shadow of bone with a dark area will be seen, revealing the tip of the transverse process, and the psoas muscle will be visible between the transverse processes (Figure 1).

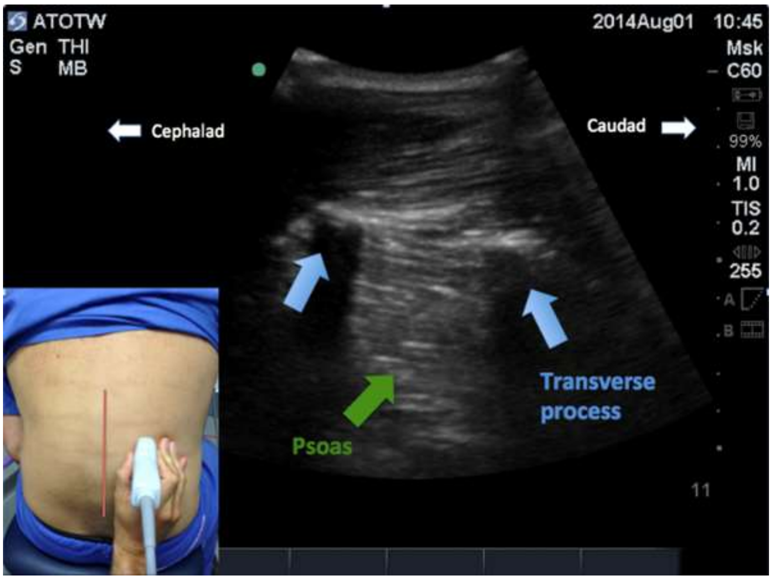


Figure 1. A parasagittal perspective positioned roughly four centimeters lateral to the midline, towards the head, and above the iliac crests reveals the transverse process tips displaying a luminous arc with a shadowy area extending further inward. The psoas muscle is observed situated between and deeper than the transverse processes, with the spine's midline indicated by a vertical red line.[4]

The transducer is then moved more medially, and a "sawtooth" pattern will be seen on the ultrasound, caused by the reflection of the ultrasound beam parallel to the articular processes of the spine, which appear as continuous bony structures (Figure 2).

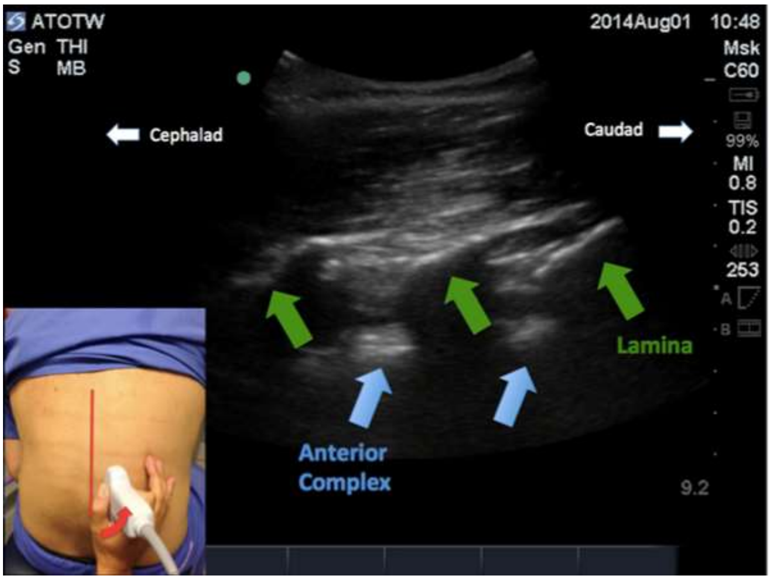


Figure 2. In the paramedian sagittal oblique perspective, tilting the probe towards the midline reveals the gaps between adjacent laminae. This view illustrates the orientation for positioning a paramedian approach during spinal or epidural anesthesia.[4]

While maintaining the probe at the same angle, the probe is then shifted caudally to identify the correct intervertebral space level. The dashed line on the caudal aspect will be replaced by a long, uninterrupted hyperechoic structure showing the sacrum. The gap between the lamina and sacrum represents the L5-S1 intervertebral space. Then, the transducer is moved cephalad according to the vertebral level where the puncture will be performed at L3-4, and marked (Figure 3).


Figure 3. The perspective showing the sacrum and L5 lamina in a paramedian sagittal oblique view.[4]

The transducer is rotated 90 degrees, aligning its midpoint with the chosen intervertebral level, creating the transverse view. This perspective is optimal for discerning the midline and gauging depth. It offers a cross-sectional glimpse of the spine. Moving the probe vertically between spinous processes and adjusting its angle slightly upwards or downwards unveils the characteristic 'flying bat' ultrasound view. Sometimes, the ligamentum flavum and dorsal dura may appear as a bright line on ultrasound. When combined with the anterior complex's bright line, they form an "=" symbol. The space between these lines reflects the spinal canal's width (Figure 4).

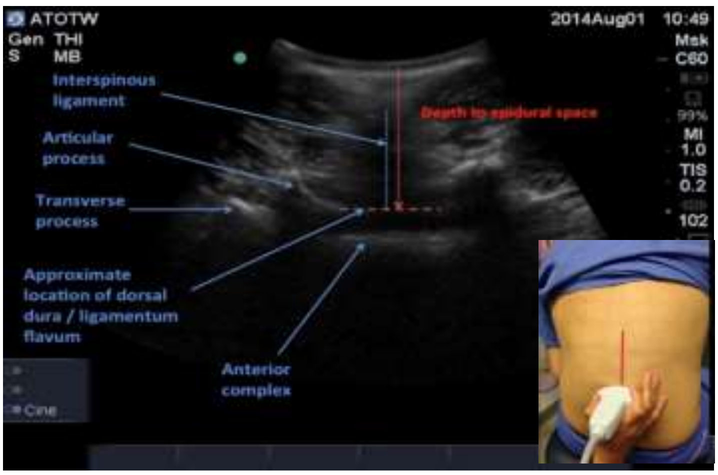


Figure 4. The ultrasound scan, taken horizontally (transverse view) amidst the spinal processes, illustrates discernible structures and measurements. The distance to the epidural cavity can be determined by referencing the scale displayed on the right side of the ultrasound monitor.[4]

In challenging or obese patients, when only the midline is visible on ultrasound, a straightforward method is available. This method includes locating the midline in a tranverse view, marking the spinous process, and inserting the needle one centimeter away, both laterally and superiorly, from the spinous process. This approach is similar to the paramedian neuraxial approach (Figure 5).

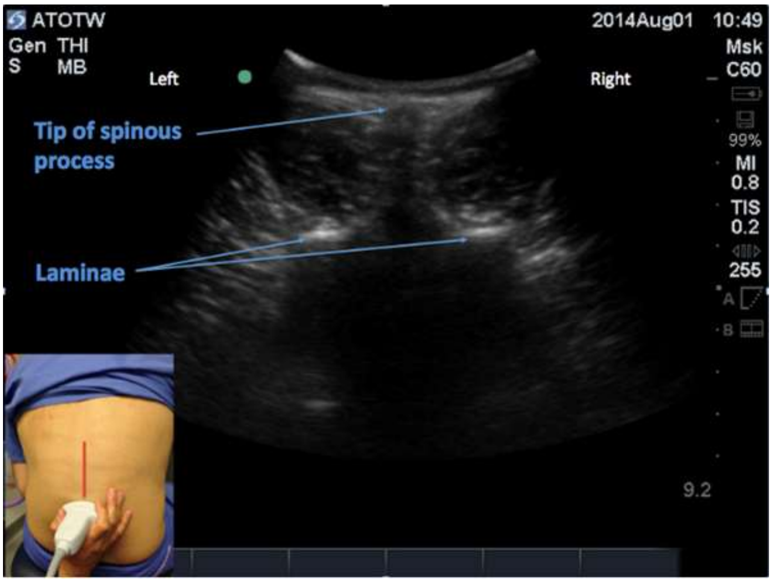


Figure 5. Transverse view with the transducer directly over a spinous process.[4]

The puncture was performed at the predetermined landmark, which was at L3-L4, with a median approach. The block was successfully administered on the first attempt without redirection or reinsertion of the spinal needle. The medication regimen used was heavy bupivacaine 0.5% 12.5 mg. Sensory and motor tests were conducted, revealing a perfect block (Bromage score 3). The operation lasted for 1 hour 20 minutes, with 450 ml of blood loss. Hemodynamics remained stable during the operation, with blood pressure fluctuations of 94-132/58-86 mmHg, heart rate of 72-102 beats per minute, respiratory rate of 16-18 breaths per minute, and oxygen saturation of 98-99% with a nasal cannula at 2 liters per minute. A female baby was born, weighing 3080 grams, with a length of 50 cm and APGAR scores of 8-9-10. Post-operation, the patient remained conscious and alert, with blood pressure fluctuations of 106-124/67-78 mmHg, heart rate of 64-89 beats per minute, respiratory rate of 14-18 breaths per minute, and $SpO_2$ of 99% with a nasal cannula at 2 liters per minute. The patient was observed in the recovery room until the Bromage score was less than or equal to 2.

**3. Discussion**

Anesthesia in obese pregnant women presents its own challenges in management. The choice of anesthesia technique is influenced by several factors, such as the indication for surgery, the patient's condition, the patient's preference, and the skill of the anesthesiologist. In the case of cesarean section, regional anesthesia techniques like spinal anesthesia are usually preferred over general anesthesia because they reduce the risk of respiratory and cardiovascular complications, which are higher in obese patients. The advantages of regional anesthesia include reducing the risk of drug exposure to the baby, decreasing the risk of aspiration pneumonia, allowing the mother to remain conscious during delivery, and helping to reduce postoperative pain. In performing spinal anesthesia, the landmark method is typically used, involving palpating the interspinous space up to the Tuffier line to ascertain the level of the gap and directing the needle into the spinal cord through the chosen location. Obesity in patients can make this technique more challenging as locating the anesthesia site markers on the body becomes difficult due to the thickness of adipose tissue, making it hard to palpate the spinous processes and intervertebral spaces.[1,5]

Ultrasound, a portable and secure technology, is progressively employed to aid in anesthesia procedures. Its utilization has become commonplace in numerous invasive techniques, including vascular access and nerve/regional blocks. The primary benefits of using ultrasound include increasing the success rate and reducing the complications of procedures.[4] The majority of patients undergoing spinal or epidural anesthesia typically have easily identifiable interspinous spaces, resulting in a low risk of injury during these procedures. However, some patients, such as those who are obese, pregnant, elderly, have spinal deformities or have a history of previous surgery, may have difficult-to-palpate interspinous spaces. This potential difficulty can make neuraxial blocks more challenging, increasing the risk of complications and injuries. Repeat needle insertions during spinal procedures can elevate the risk of paresthesia and post-dural puncture headaches.[6] The use of ultrasound can reduce difficulty levels by providing clear landmarks for needle insertion and guidance on the angle, direction, and depth of insertion. Ultrasound examination before spinal or epidural procedures has been proven to reduce the number of repeated needle insertions required to achieve the block target. It's important to note that assessment with ultrasound guidance is typically performed pre-procedure, as changes in patient posture may alter the insertion point for neuraxial blocks.[7,8]

This patient encountered difficulty in identifying the needle insertion point for spinal anesthesia due to obesity. Ultrasound (USG) was used as a guiding marker to identify the interspinous space. In obese patients, the desired structures are often deep-seated, with low-frequency curvilinear transducers providing the best images. Additionally, the wide field of view of the curvilinear probe aids in identifying structures between adjacent vertebrae. Due to equipment limitations, a standard linear probe was used, with manual pressure applied to improve visualization by compressing subcutaneous tissue. After marking the insertion site, spinal anesthesia was performed with the patient in a sitting position under an aseptic technique. The needle insertion was successful on the first attempt, demonstrating that ultrasound aids in anatomical identification, enhancing procedural success, especially when identifying challenging insertion points. This aligns with Chin et al.'s research, indicating that ultrasound assistance can minimize difficulties in central neuraxial blockade, particularly in patients with increased BMI. However, ultrasound use may have limitations in obese patients due to less clear visualization of ultrasound markers caused by thick adipose tissue.[8]

**4. Conclusion**

Using ultrasound guidance, particularly in obese pregnant patients undergoing spinal anesthesia, significantly improves the accuracy of needle placement. With ultrasound assistance, anesthesiologists can accurately identify relevant anatomical structures. This helps reduce the risk of complications and technical difficulties during the spinal anesthesia procedure, enhancing its safety and effectiveness. Additionally, using ultrasound as a marker in spinal anesthesia can also decrease anxiety levels and increase patient confidence in the anesthesia procedure.

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