

ULTRASONOGRAPHY GUIDED CENTRAL NEURAXIAL BLOCK IN A CASE OF ANKYLOSING SPONDYLITIS FOR LOWER LIMB SURGERY

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ABSTRACT

Background: Ankylosing spondylitis is a chronic inflammatory disorder affecting the axial skeleton, leading to progressive spinal rigidity and altered anatomy. These changes pose significant challenges for anesthetic management, particularly in airway handling and central neuraxial block placement. Ultrasound guidance has emerged as an effective tool to improve the success of neuraxial anesthesia in such difficult cases. **Case Presentation:** We report a case of a 41-year-old male with a known history of ankylosing spondylitis who presented with a fracture of the proximal shaft of the left femur following a road traffic accident. Clinical examination revealed restricted neck movement and a stooped posture, indicating a potentially difficult airway. Radiological findings confirmed fusion of cervical vertebrae. Central neuraxial blockade was planned to avoid airway manipulation. **Methods/Intervention:** Ultrasonography was used to identify intervertebral spaces at L4-L5 and L5-S1 levels. A combined spinal-epidural technique was attempted; however, spinal anesthesia was unsuccessful. Subsequently, epidural anesthesia was successfully administered at the L5-S1 level using incremental doses of 2% lignocaine and 0.5% bupivacaine. Adequate sensory blockade up to T10 was achieved, and anesthesia was maintained via continuous epidural infusion. **Results:** The surgical procedure was completed successfully under epidural anesthesia with stable hemodynamics throughout. There were no intraoperative or postoperative complications. The patient tolerated the procedure well, and adequate analgesia was maintained postoperatively. **Conclusion:** Ultrasound-guided central neuraxial block is a safe and effective technique in patients with ankylosing spondylitis, particularly when conventional landmark-based approaches are difficult. It enhances procedural success, reduces complications, and helps avoid the risks associated with general anesthesia in difficult airway scenarios.

INTRODUCTION

Ankylosing spondylitis (AS) is a chronic, progressive, inflammatory rheumatological disorder primarily affecting the axial skeleton, characterized by inflammation of the sacroiliac joints and spine, ultimately leading to fibrosis, calcification, and ossification of ligaments and joints. The disease belongs to the group of seronegative spondyloarthropathies and is strongly associated with the human leukocyte antigen HLA-B27. It predominantly affects young males, with a male-to-female ratio of approximately 5:1 and peak onset between 20 and 30 years of age, as also highlighted in the uploaded case material. Over time, progressive ankylosis of spinal joints results in the classical

“bamboo spine” appearance, leading to marked rigidity and loss of spinal mobility.^[1]

The pathophysiology of AS involves chronic inflammation at the entheses (sites of ligament and tendon insertion), leading to bone erosion followed by new bone formation. This results in spinal fusion, reduced chest wall expansion, and compromised respiratory mechanics. In advanced stages, extra-articular manifestations may involve cardiovascular, pulmonary, and ocular systems, thereby increasing perioperative risk.^[2]

From an anesthetic perspective, patients with ankylosing spondylitis pose significant challenges. The rigid spine, ossified ligaments, and narrowed intervertebral spaces make central neuraxial block (spinal or epidural anesthesia) technically difficult.

Additionally, involvement of the cervical spine, temporomandibular joint, and cricoarytenoid joints contributes to difficult airway management. As noted in the case file, airway difficulty arises due to restricted neck mobility and joint involvement. This dual challenge difficult airway and difficult neuraxial access makes anesthetic planning complex and demands careful preoperative assessment and preparedness.^[3]

Traditionally, neuraxial anesthesia relies on surface anatomical landmarks. However, in patients with altered spinal anatomy such as those with ankylosing spondylitis, these landmarks become unreliable. Repeated attempts at blind needle insertion not only increase procedural failure but also raise the risk of complications such as epidural hematoma, dural puncture, or neural injury. Furthermore, these patients are often on long-term nonsteroidal anti-inflammatory drugs (NSAIDs), which may predispose them to bleeding complications.

Ultrasonography has emerged as a valuable adjunct in regional anesthesia, particularly in difficult cases. Ultrasound-guided central neuraxial block enables visualization of spinal structures, identification of intervertebral spaces, estimation of depth to epidural space, and determination of needle trajectory. This improves the success rate and reduces complications. In patients with ankylosing spondylitis, ultrasound guidance is especially beneficial as it helps overcome anatomical distortions and facilitates accurate needle placement. As described in the present case, ultrasonography was used to identify L4-L5 and L5-S1 intervertebral spaces, improving procedural accuracy.

Among neuraxial techniques, the paramedian approach is often preferred in ankylosing spondylitis due to ossification of interspinous ligaments. The L5-S1 interspace is typically wider and more accessible, making it a preferred site for epidural or spinal anesthesia. In the present case, despite difficulty in obtaining cerebrospinal fluid via spinal approach, successful epidural anesthesia was achieved at the L5-S1 level using ultrasound guidance.

The choice between general anesthesia and regional anesthesia in such patients requires careful consideration. General anesthesia may be associated with difficult intubation, risk of cervical spine injury, and postoperative respiratory complications. Awake fiberoptic intubation is often considered the gold standard in anticipated difficult airway, but it requires expertise and patient cooperation. Regional anesthesia, when feasible, avoids airway manipulation and reduces systemic complications. However, technical difficulty in neuraxial access may limit its use.

Ultrasound-guided neuraxial anesthesia bridges this gap by increasing the feasibility of regional techniques even in challenging anatomical conditions. It allows anesthesiologists to safely perform central neuraxial blocks with improved confidence and reduced complication rates. In addition, ultrasound guidance minimizes the number

of attempts, thereby reducing patient discomfort and procedural time.

The present case highlights the successful use of ultrasound-guided epidural anesthesia in a patient with ankylosing spondylitis undergoing lower limb surgery. It underscores the importance of preoperative planning, availability of difficult airway equipment, and use of advanced imaging techniques to enhance procedural success. This approach aligns with modern anesthetic practice, which emphasizes patient safety, precision, and minimally invasive techniques.

In conclusion, ankylosing spondylitis presents unique anesthetic challenges due to altered spinal anatomy and airway difficulty. Ultrasound-guided central neuraxial block represents a valuable and effective technique in such cases, improving success rates and reducing complications. The increasing availability and familiarity with ultrasound technology are likely to make it an essential tool in the management of complex anesthetic cases in the future.

CASE DESCRIPTION

A 41-year-old male patient presented to the orthopedic department with complaints of pain and inability to bear weight on the left lower limb following a road traffic accident that occurred five days prior to admission. The patient was a known case of ankylosing spondylitis for the past five years, which had been managed conservatively with nonsteroidal anti-inflammatory drugs. He had progressive stiffness of the spine and reduced mobility over the years. There was no history of diabetes mellitus, hypertension, or other major systemic illnesses.

On presentation, the patient's primary complaint was severe pain in the left thigh region, aggravated by movement and associated with functional limitation. Clinical examination revealed swelling and tenderness over the proximal third of the left femur, with restricted movement. Radiological evaluation confirmed a fracture of the proximal one-third shaft of the femur. The patient was planned for open reduction and internal fixation (ORIF) with long proximal femoral nail (PFN) as documented in the case file.

General examination revealed that the patient was moderately built and vitally stable. However, he exhibited a characteristic stooped or hunched forward posture due to long-standing ankylosing spondylitis. Airway assessment showed adequate mouth opening (>3 fingers) and Mallampati grade II, but neck movements were severely restricted. The thyromental distance was measured to be approximately 6 cm. The patient was unable to lie supine comfortably without support, requiring pillows to maintain a semi-recumbent position. These findings indicated a potentially difficult airway and difficult positioning for anesthesia, consistent with the clinical features described in the uploaded document.

Systemic examination of cardiovascular, respiratory, and neurological systems was within normal limits.

Laboratory investigations, including complete blood count, renal and liver function tests, were within normal limits. Chest X-ray and electrocardiogram did not reveal any abnormalities. However, radiographic imaging of the cervical spine (anteroposterior and lateral views) demonstrated fusion of cervical vertebrae, confirming advanced ankylosing spondylitis. An ENT evaluation with indirect laryngoscopy was performed and found to be normal, though airway difficulty was still anticipated due to restricted neck mobility.

Central neuraxial blockade was planned to avoid airway manipulation. Informed written consent was obtained after explaining risk and benefits. Difficult airway cart including Fiberoptic bronchoscope was kept standby. Patient's airway was anesthetized with 4% Lignocaine nebulisation.

Patient shifted to OT and monitors were attached. Vitals were noted and sitting position was given for regional anesthesia. On palpation, the intervertebral spaces in the lumbosacral region were found to be poorly defined and narrowed, making landmark-based neuraxial block difficult. Therefore, ultrasound guidance was utilized to identify anatomical landmarks. Using ultrasonography, the L4-L5 and L5-S1 intervertebral spaces were identified and marked on the skin, as described in the procedural details.

A combined spinal-epidural (CSE) technique was initially attempted using an 18-gauge needle via the midline approach at the L5-S1 level. Loss of resistance to saline was achieved at a depth of approximately 4.5 cm, confirming entry into the epidural space. However, attempts to obtain cerebrospinal fluid through the spinal needle were unsuccessful. Subsequently, an epidural catheter was advanced through the epidural needle and secured at 10 cm at the skin level.

Further attempts at subarachnoid block using the paramedian approach at L4-L5 and L5-S1 levels resulted in bloody taps, indicating difficulty and potential vascular puncture. Considering these challenges, the decision was made to proceed with epidural anesthesia.

The epidural anesthesia was administered using incremental doses. Initially, 3 mL of 2% lignocaine (Loxicard) was administered as a test dose, followed by 5 mL of 2% lignocaine and 5 mL of 0.5% plain bupivacaine. Adequate sensory blockade up to the T10 dermatome level was achieved within 12 minutes. Maintenance of anesthesia was achieved using a continuous infusion of 0.5% plain bupivacaine at a rate of 5 mL/hour through the epidural catheter, as detailed in the case document.

The surgical procedure was carried out successfully under epidural anesthesia. The patient remained hemodynamically stable throughout the intraoperative period, with no episodes of hypotension, bradycardia, or respiratory compromise. There were no complications related to the neuraxial block or the surgical procedure.

The postoperative period was uneventful. The patient was monitored in the recovery area and later shifted to the ward. Adequate analgesia was maintained through the epidural catheter, and no neurological deficits or complications were observed.

The differential diagnosis in this case primarily revolved around causes of spinal rigidity and difficult airway; however, the known history of ankylosing spondylitis, radiological findings of cervical vertebral fusion, and clinical presentation confirmed the diagnosis. The final diagnosis was a case of ankylosing spondylitis with fracture of the proximal femoral shaft, managed successfully with ultrasound-guided epidural anesthesia.

This case highlights the importance of ultrasound guidance in managing difficult neuraxial access in patients with ankylosing spondylitis. It also emphasizes the need for meticulous preoperative planning, availability of difficult airway equipment, and adaptability in anesthetic technique to ensure patient safety and successful outcomes.



Figure 1: Patient in supine position



Figure 2: Xray lumbosacral spine in AP and LATERAL view showing BAMBOO spine

Figure 3: Xray neck AP and LATERAL view

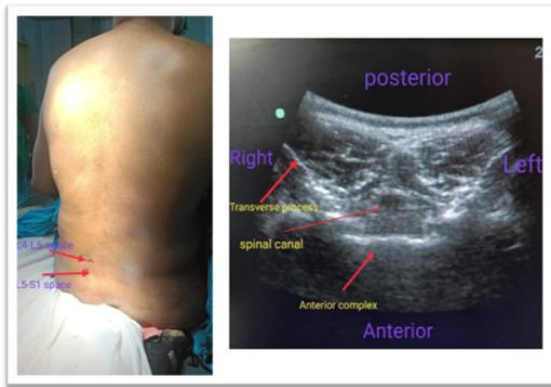


Figure 4: Marking of intervertebral space at L4-L5 and L5-S1

Figure 5: USG guided transverse view of lumbar spine

DISCUSSION

Ankylosing spondylitis (AS) is a chronic inflammatory disease characterized by progressive ossification of spinal ligaments and joints, leading to rigidity of the axial skeleton. The anesthetic management of patients with AS is particularly challenging due to two major concerns: difficult airway management and difficulty in performing central neuraxial blocks. The present case highlights the successful use of ultrasonography-guided epidural anesthesia in a patient with advanced ankylosing spondylitis undergoing lower limb surgery, thereby avoiding the risks associated with general anesthesia.

In the current case, the patient was a 41-year-old male with a known history of ankylosing spondylitis for five years, consistent with the epidemiological pattern of AS, which predominantly affects males in the third to fourth decade of life. Similar demographic findings have been reported by Samali et al. (2022),^[13] who described AS as a disease with early adult onset and strong male predominance. The progressive nature of the disease results in spinal rigidity and deformity, as observed in this patient who presented with a hunched posture and restricted neck mobility.

Airway management in AS patients is often difficult due to involvement of the cervical spine, temporomandibular joints, and cricoarytenoid joints. Restricted neck extension and limited mouth opening can complicate intubation. In the present case, although the mouth opening was adequate (Mallampati grade II), neck movement was significantly restricted, indicating a potential difficult airway. Thomas et al. (2020),^[7] highlighted that cervical spine rigidity and reduced atlanto-occipital extension are major contributors to difficult intubation in AS patients. In such cases, awake fiberoptic intubation is often recommended as the gold standard; however, it requires expertise and patient cooperation.

Considering these challenges, regional anesthesia becomes an attractive alternative as it avoids airway manipulation. However, neuraxial anesthesia in AS

patients is technically difficult due to ossification of interspinous ligaments, narrowing of intervertebral spaces, and altered spinal anatomy. In the present case, palpation revealed poorly defined intervertebral spaces, consistent with findings reported by Theerthaan et al. (2024),^[4] who described difficulty in identifying landmarks in AS patients. Repeated attempts at blind neuraxial block may lead to complications such as epidural hematoma, dural puncture, and neural injury.

Ultrasonography has emerged as a valuable tool in such difficult scenarios. It allows visualization of spinal anatomy, identification of intervertebral spaces, and estimation of depth to the epidural space. In this case, ultrasound was used to identify the L4-L5 and L5-S1 spaces, which facilitated successful epidural catheter placement. Yoo et al. (2020),^[6] demonstrated that ultrasound-assisted neuraxial blockade significantly improves success rates and reduces the number of attempts in patients with difficult anatomy. Similarly, Li et al. (2020),^[12] emphasized the role of ultrasound in enhancing the safety and efficacy of neuraxial anesthesia.

The L5-S1 interspace is often considered the most accessible level in patients with ankylosing spondylitis due to relatively less ossification. In the present case, the epidural space was successfully accessed at the L5-S1 level with a loss of resistance at 4.5 cm. This observation is consistent with previous reports by Baş et al. (2020),^[10] suggesting that the L5-S1 space remains wider and more amenable to neuraxial techniques. Despite attempts, subarachnoid block was unsuccessful, and bloody taps were encountered during paramedian attempts. This highlights the difficulty of spinal anesthesia in such patients and supports the preference for epidural anesthesia.

The use of the paramedian approach is often advocated in AS patients because ossification of the interspinous ligament makes the midline approach difficult. However, in this case, both midline and paramedian approaches posed challenges, necessitating reliance on ultrasound guidance. Mishra et al. (2025),^[3] reported that ultrasound guidance improves needle trajectory, increases first-attempt success, and reduces failed attempts in difficult neuraxial blocks compared to landmark-guided techniques.

Epidural anesthesia was successfully achieved using incremental doses of lignocaine and bupivacaine, with a sensory block up to the T10 level. The patient remained hemodynamically stable throughout the procedure. This is consistent with findings by Kang et al. (2021),^[1] who noted that ultrasound-guided regional anesthesia techniques provide effective analgesia with stable hemodynamic parameters in lower limb surgeries. Moreover, avoiding general anesthesia reduces the risk of airway-related complications, postoperative respiratory compromise, and cervical spine injury.

Another important consideration in AS patients is the increased risk of complications due to repeated

attempts at neuraxial block. Chronic use of NSAIDs in these patients may predispose them to bleeding, increasing the risk of epidural hematoma. In the present case, ultrasound guidance minimized the number of attempts, thereby reducing such risks. Zheng et al. (2020),^[9] demonstrated that ultrasound-guided neuraxial blocks significantly reduce complications and allow better control of local anesthetic dosing.

Peripheral nerve blocks have also been described as alternative anesthetic techniques in such patients. Koçoğlu et al. (2020),^[2] and Cao et al. (2025),^[11] reported successful use of combined lumbar plexus and sciatic nerve blocks for lower limb surgeries in patients with ankylosing spondylitis and spinal deformities. However, these techniques may require higher expertise and may not always provide adequate surgical anesthesia compared to central neuraxial blocks.

The present case also underscores the importance of thorough preoperative preparation. A difficult airway cart was kept ready, and informed consent was obtained. Multidisciplinary planning and preparedness are essential in managing such complex cases. The availability of advanced airway devices and imaging modalities enhances patient safety and improves outcomes. Asgerally (2020),^[8] emphasized that individualized anesthetic planning is crucial in patients with anatomical anomalies such as ankylosing spondylitis.

In summary, ankylosing spondylitis presents significant anesthetic challenges due to difficult airway and altered spinal anatomy. While general anesthesia carries risks related to airway management, neuraxial anesthesia is technically difficult due to ossification and loss of landmarks. Ultrasound guidance serves as an invaluable adjunct in such cases, improving success rates and reducing complications. The successful management of this case demonstrates that ultrasound-guided epidural anesthesia is a safe and effective alternative in patients with ankylosing spondylitis undergoing lower limb surgery.

CONCLUSION

Ankylosing spondylitis poses significant challenges to anesthetic management due to the dual difficulty of airway control and central neuraxial access resulting from spinal rigidity and anatomical distortion. This case demonstrates that ultrasonography-guided epidural anesthesia is a safe, effective, and practical alternative to conventional landmark-based techniques in such patients. The use of ultrasound facilitates accurate identification of intervertebral spaces, improves first-attempt success rates, and minimizes complications associated with multiple needle insertions. In the present case, successful epidural anesthesia at the L5-S1 level provided adequate surgical anesthesia with stable hemodynamics, while avoiding the risks associated

with difficult airway management under general anesthesia. Careful preoperative assessment, availability of difficult airway equipment, and flexibility in anesthetic planning remain essential components in the management of these patients. Overall, ultrasound-guided neuraxial block should be strongly considered as a valuable tool in the anesthetic management of patients with ankylosing spondylitis undergoing lower limb surgeries.

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