



Common Anesthesia Challenges in a Case of Ankylosing Spondylitis Posted for the Correction of Spinal Deformity

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Abstract

Background: Due to the rigid and brittle nature of spinal joints and multisystem involvement in patients affected by ankylosing spondylitis, they are more prone to the devotement of various complications. Different deformities generally require several surgical manipulations, accompanied by perioperative anesthetic challenges, such as difficult intubation and positioning within the operating room. Some problems faced by anesthesiologists during corrective spinal surgery of a 42-year-old male with ankylosing spondylitis are reviewed.

Keywords: Anesthesia challenge, Ankylosing Spondylitis, Ketamine, Neuromonitoring

1. Background

Ankylosing spondylitis is a chronic immune-mediated inflammatory disease, a common form of seronegative spondyloarthropathies (1). This term is characterized by inflammation and fusion of the axial skeleton and nearby joints (1-4). Ankylosing spondylitis predominantly develops in men with the peak age onset of their third decades of life and primarily those who carry the HLA-B27 allele (1, 3). The patients suffer backache and stiffness due to atlantoaxial subluxation, cervical fracture, and spinal cord compression (2). It can also be accompanied by extra-articular manifestations, such as anterior uveitis, inflammatory bowel disease, psoriasis, as well as cardiovascular and lung involvement. Restricted ventilation can account for the conclusion of severely affected thoracic and costovertebral joints (3).

In severe cases, different surgeries are required to improve their function and quality of life, for instance, knee and hip joint replacements and corrective spinal surgery for flexion deformities. These surgeries are associated with different challenges for the anesthesiologist (3, 5). It is essential to evaluate the severity of disease and extra-articular involvements with particular attention to airway complications preoperatively. Strict evaluation and documentation of perioperative neurological deficits are strongly recommended. The extent of preoperative investigation, according to the patient, includes pulmonary function tests, electrocardiography, echocardiography, and cervical spine imaging (3).

Rigid posture and restricted range of motion in different joints, especially temporomandibular joints, lead to severe challenges for anesthetists to manage the airway and general anesthesia or the administration of regional anesthesia (2, 5). Modern airway management, such as awake videolaryngoscope intubation and application of laryngeal mask airway, was defined for these groups of patients (2, 5). The proper position and maintenance of cervical alignment are recommended for their brittle and rigid spine (6). Motor-evoked potential (MEP) and somatosensory-evoked potential (SSEP) recordings are commonly used to evaluate the neurologic pathways and offer benefits for electrophysiological monitoring (5). The following case describes some anesthesia challenges for patients with ankylosing spondylitis, which was managed successfully.

2. Case presentation

A 42-year-old patient with a nine-year history of ankylosing spondylitis was admitted to the operation room on a trolley in a supine position with four pillows under his back and two under the knee joints. He developed progressive spinal deformity six years ago, could not have a spinal extension, bend forward or side, experienced severe pain, and was taking non-steroidal anti-inflammatory drugs. Some relief was obtained by keeping pillows below knee joints. He was admitted with a complaint of aggravation of pain and deformity and was a candidate for spinal correction surgery. (Figure 1. A, C).

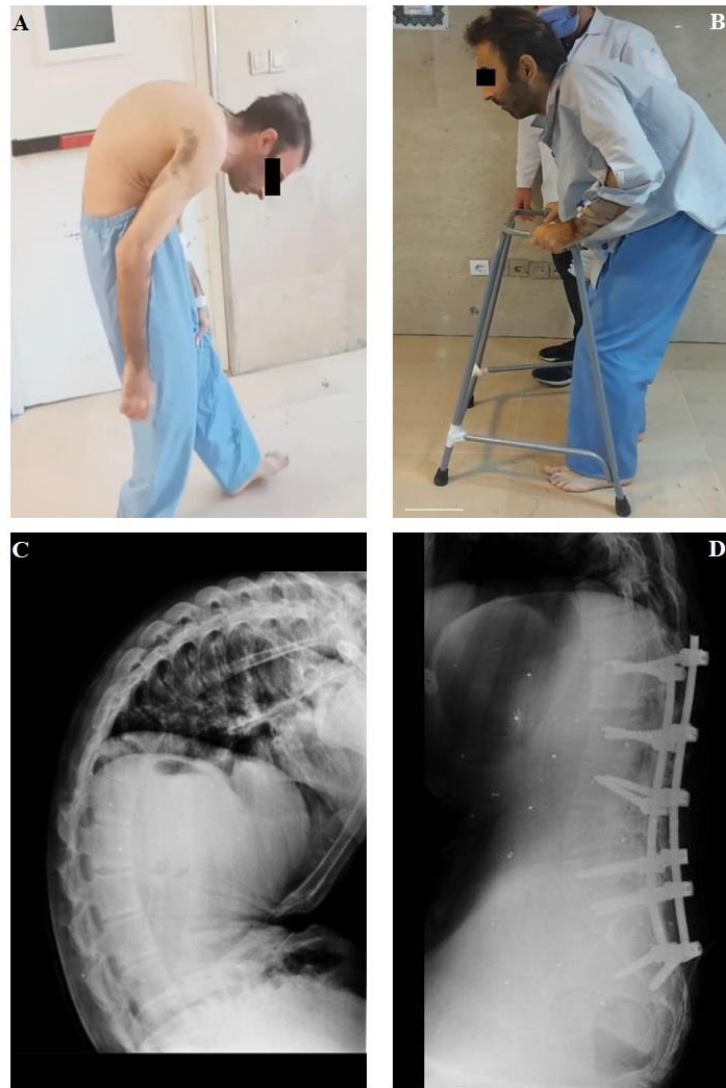


Figure 1. A) The patient before spinal correction surgery. B) The patient's posture after surgery. C) Pre-Op lateral view of the thoracolumbar vertebral column. D) Post-op lateral view of the thoracolumbar vertebral column

The performed examination pointed out that the patient had a complete set of teeth and chin-on-chest deformity. Severe kyphosis and a fixed flexion deformity of approximately 30 degrees of both hip joints were noticeable. His cardiovascular was normal on examination; moreover, hematologic and biochemical investigations were within normal limits. The preoperative assessment of the airway revealed the probability of difficult intubation due to the restriction of cervical movements, especially extension, and a Mallampati score of 4. His spirometry examination (Pulmonary function test) illustrated the obstructive and restrictive pattern. A thoracolumbar kyphosis and total ankylosis of the spine, as well as ankylosis of both hip joints, were evident in the X-ray.

After obtaining the written informed consent for regional and general anesthesia, equipment for difficult intubation was kept ready, along with a flexible fiberoptic bronchoscope. His NPO time was

adequate. His position for lumbar puncture was so tricky that the alternative plan as a nasal fiberoptic bronchoscope-assisted awake intubation was selected. He underwent standard monitoring, including pulse oximetry, invasive blood pressure, electrocardiography, capnography, and thermomonitoring; thereafter, intravenous access was checked. During preoxygenation, 3 minutes were allocated for the administration of 100% oxygen at a rate of 5 liters per minute. After sedation by 100mcg of intravenous fentanyl (Caspian Tamin brand) and 2mg midazolam (Tehran Chemi brand), by the maintenance of spontaneous breathing under the sterile condition, the airway was blocked.

The oral cavity was anesthetized using a spray containing 10% Lidocaine (Kharazmi brand). Blockage of the Superior Laryngeal nerve was achieved by inserting a needle 2 cm to the side of the upper notch of the thyroid cartilage and guided in a backward and upward direction to a depth of 1 to 1.5

cm. At this point, 2 mL of 2% lidocaine (Caspian Tamin brand) was injected, and the same process was repeated on the opposite side. Transtracheal block was performed after the identification of the cricothyroid membrane (CTM) by inserting a needle connected to a 5-mL syringe directly towards the back and slightly downward. The needle was advanced until air was drawn in, indicating proper placement, and at that moment, 4 mL of 2% lidocaine was injected.

After approximately 10 minutes, awake fiberoptic assisted nasal intubation was performed with a 6.5 mm ID cuffed endotracheal tube (Well Lead brand). General anesthesia was administered after confirming the appropriate placement of the endotracheal tube via positive end-tidal carbon dioxide and bilateral equal lung sound. Following the induction, another peripheral 16-gauge IV catheter and 20-gauge radial arterial line were

placed, and neuromonitoring electrodes were inserted to detect injured neurological pathways early. Propofol 100Mg/Kg/min (Fresenius KABL brand) and remifentanyl 0.5-1 mcg/kg/min (Exir brand) were infused as the maintenance of anesthesia. The infusion of ketamine 30mg/min (Sterop brand) and lidocaine 0.5 mg/Kg/min (Caspian Tamin brand) were used. The technician of neurologic monitoring performed a baseline test (Figure 2). During the 4 hours of operation, the patient received 1000 ml ringer lactate and 1500 ml isotonic saline, as well as two units of a packed red blood cell. His estimated blood loss was approximately 1500ml. Osteotomy of the vertebra was carried out, and the monitoring of stomatosensory and motor nerves remained satisfactory during the operation. At the end of the surgery, the patient was sent to the Intensive Care Unit and discharged after seven days (Figure 1. B, D).



Figure 2. A) Intubation of the patient in a sitting position. **B)** The patient's position during surgery

3. Discussion

It is considered that approximately %0.1-%0.5 of the population can be affected by Ankylosing Spondylitis (6). These patients may experience a high preponderance of progressive ossification and auto-fusion of vertebral joints characterized by the classical radiographic view as the "Bambo Sign" at the end stages of the disease (5, 7). Severe spinal deformities, such as the chin on the chest due to fixed cervical flexion, may cause restriction of forwarding vision, hygiene, and swallowing (3, 5). Limitations in the cervical range of motion in combination with an affected temporomandibular joint which leads to restricted mouth opening, may eventuate in significant challenges for anesthetists to intubate the patients (2). On the other hand, the pathological changes that can occur in the posterior longitudinal or interspinous ligaments may result in conversion to a continuous bony bar, making the application of epidural and spinal catheters more complex and even, in some cases, impossible (7).

In 2018, Dr. Copuroglu and Sagiroglu reported the anesthetic challenges of two cases of ankylosing spondylitis. The first case was a 47-year-old man listed for total hip replacement. He refused regional anesthesia as the first choice; nonetheless, due to unsuccessful attempts for fiberoptic bronchoscopy-assisted intubation, they awakened the patient and inserted the epidural catheter despite the previous lumbar surgery. After flowing the cerebrospinal fluid, they decided to applicate the catheter in the subarachnoid space, and the surgery was performed. For the second case, they selected epidural anesthesia on a 49-year-old woman admitted for total hip replacement, which was successfully carried out (2).

Our case was a 42-year-old man who was listed for spinal correction surgery. Due to the nature of his surgery and the patient's appearance, we decided to manage the airway by fiberoptic bronchoscope-assisted awake intubation. After blocking the nerves responsible for innervation of the airway and maintaining his breathing, the patient was

successfully intubated by a fiberoptic bronchoscope. In this respect, Irfan UI Haq et al. managed the airway of a case of ankylosing spondylitis for total hip replacement by using a fiberoptic bronchoscope which was the same as the one applied in the present study for handling the predicted difficult intubation (8). On the contrary, Kotekar et al. did not applicate awake intubation for a similar case. They published their challenges of anesthetic management for a patient affected by ankylosing spondylitis. Their attempts for epidural and subarachnoid blocks were unsuccessful due to the rigidity and deformity of the patient's spine. They chose awake intubation as the last choice; therefore, the patient was successfully intubated on the third attempt (7).

According to different deformities, the proper position of these patients was imperative due to their increased risk of iatrogenic injuries concerning osteopenia and osteoporosis. The sagittal alignment of the cervical spine should be maintained (6). The application of foam blocks, pillows, and bolsters for comfortable kyphosis and supporting the patient has been recommended. A jack table is a way to accommodate the head in chin-on-chest deformity. In addition, the reverse Trendelenburg position is required according to prolonged surgeries and the possibility of Venus retention, as well as cerebral and laryngeal edema (9).

To minimize the excessive rotation of the head, we tried to maintain the alignment of the head about the torso. Due to the patient's severe cervical flexion deformity and the elevation of the patient's face to decrease the risk of intraocular pressure, the Mayfield head frame was placed in combination with the reverse Trendelenburg position. We used several pillows to support our patients. Daniel M et al. also applicates a similar position for their patients in their institute (6), which was explained and used by Kolb et al. for positioning patients affected by ankylosing spondylitis in 2022 (9). Different deformities of the patients affected by ankylosing spondylitis require several complex spinal surgeries, sometimes prolonged or prone positions which may expose the soft tissue to extensive pressure. It is essential to monitor the neurological status in any spine surgery and manipulation (6).

Intraoperative electrophysiological recording is a noninvasive method for this purpose, as Somatosensory Evoked Potential (SSEP) and Motor Evoked Potential (MEP). The SSEP primarily evaluates the sensory pathway and dorsal horn of the spinal cord. On the contrary, MEP monitors the motor functions and the anterior column of the spinal cord. Volatile anesthesia agents and neuromuscular blockers have adverse effects, such as reducing the amplitude or increasing the latency (3, 5), whereas the infusion of propofol and remifentanyl is an acceptable regimen for the maintenance of anesthesia by allowing MEP and SSEP monitoring (5).

Nevertheless, some researchers revealed that propofol might induce dose-dependent depression in the amplitude of MEP signals. On the other hand, ketamine is considered an anesthetic drug that may enhance the amplitudes of MEP and SSEP signals by exerting less effect on the latencies; therefore, it provides a satisfactory condition during neurological monitoring when infused (10).

Our patient's endangered neurological pathways were evaluated using SSEP and MEP. During the operation, the patient received an infusion of propofol and remifentanyl in addition to ketamine and lidocaine. No changes were observed in the latency and amplitude of the neurologic monitoring. Langeloo et al. evaluated the use of MEP in a series of 16 patients during osteotomy and advocated the use of MEP monitoring during extension osteotomy (11) Andleeb et al. published their evaluation of the effect of subanesthetic doses of ketamine on MEP during spinal surgeries in 2022. They concluded that the use of ketamine gradually enhanced the signals by 24%-100% in comparison with receiving normal saline in the control group (12). We did not compare the effect of ketamine with placebo; however, in our case, we did not find any fade event in the signals after the infusion of ketamine.

Due to various involvement, ankylosing Spondylitis is challenging and carries potential risks for anesthetists. For lower limb and perineal surgeries, neuraxial blocks may be an acceptable alternative for general anesthesia, which is technically complex. Considering some challenges, such as difficult positioning or airway, cardiovascular, pulmonary, and neurologic complications are necessary during general anesthesia. It is suggested to apply MEP and SSEP monitoring to reduce neurologic complications, especially during spinal surgeries; therefore, anesthetics by minor interferences should be used. More evaluations and research are required to determine the exact influence of ketamine and lidocaine on the latency and amplitude of SSEP and MEP.

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