

Case Report

Airway and positioning challenges in a patient with ankylosing spondylitis undergoing cholecystectomy: Role of intubating laryngeal mask airway and fiberoptic guidance

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Abstract

Ankylosing spondylitis (AS) produces progressive spinal rigidity, fixed deformity and restrictive lung disease, posing major challenges for airway management, positioning and ventilation. We report the anesthetic management of a 49-year-old man with severe AS, fixed cervicothoracic kyphosis, restrictive lung physiology and chronic voice change who presented for cholecystectomy. He could not lie supine and tolerated only a modified Fowler's position. Anticipating a difficult airway and poor pulmonary reserve, an awake fiberoptic intubation was kept as backup, but we elected to perform asleep intubation through an intubating laryngeal mask airway (I-LMA) because the patient was extremely anxious and unable to cooperate for a prolonged awake procedure in his compromised position. After meticulous padding and positioning, induction was achieved with titrated propofol and fentanyl while maintaining spontaneous breathing. An I-LMA was inserted without neck movement, ventilation confirmed, and rocuronium administered. A 7.5-mm endotracheal tube was then railroaded over a flexible fiberscope through the I-LMA, which was subsequently removed. Laparoscopic cholecystectomy had to be converted to open surgery because pneumoperitoneum and instrument mobility were limited in the extreme semi-recumbent posture. The intra-operative and postoperative courses were uneventful; neuromuscular blockade was reversed with sugammadex and analgesia provided with multimodal opioids and non-opioid agents. This case highlights the importance of individualized airway planning, careful positioning and the usefulness of I-LMA-assisted fiberoptic intubation in AS patients with combined airway and positioning challenges.

Keywords: Ankylosing spondylitis, Difficult airway, Intubating laryngeal mask airway, Fiberoptic intubation, Laparoscopic cholecystectomy, Restrictive lung disease.

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1. Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory spondyloarthropathy predominately affecting the axial skeleton, with progressive ossification of spinal ligaments and sacro-iliac joints leading to the characteristic "bamboo spine".¹ Respiratory restriction from costovertebral involvement and thoracic kyphosis, along with cardiac, renal and gastro-intestinal manifestations, further increase peri-operative risk.^{1,2} Fixed flexion deformity of the cervical spine with involvement of atlanto-occipital, temporomandibular and cricoarytenoid joints may result in severely limited mouth opening, inability to align the airway axes and a high likelihood of difficult mask ventilation and tracheal intubation.³⁻⁵ In addition, long-standing disease can cause progressive hoarseness from arytenoid arthritis, suggesting possible glottic narrowing.

Awake fiberoptic intubation is widely regarded as the gold standard for airway management in severe AS with cervical spine involvement.⁶⁻⁸ However, contemporary difficult airway guidelines emphasize that the chosen strategy must prioritize oxygenation, maintain spinal stability and be acceptable to both patient and team.⁹ Intubating laryngeal mask airways (I-LMA) and videolaryngoscopes offer additional options when mouth opening is adequate but neck movement is restricted.^{7,10} We describe a patient with severe AS, restrictive lung disease and an inability to lie flat, in whom the airway was secured using I-LMA-assisted fiberoptic intubation and the surgical plan had to be modified because of positioning constraints.

2. Case Report

A 49-year-old man having body mass index 31 kg/m² with symptomatic cholelithiasis was scheduled for elective laparoscopic cholecystectomy with 15-year history of severe AS with complete loss of cervical and thoracolumbar spine mobility. He habitually slept propped up on multiple pillows and was unable to lie supine since years. with history of progressive hoarseness of voice over the preceding year, but denied dysphagia or any stridor. He was a reformed smoker and hypertensive for five years and was taking amlodipine 5 mg once daily for blood pressure. There was no history of ischemic heart disease or chronic obstructive pulmonary disease.

Past surgical history included intramedullary nailing for a right femur fracture under spinal anesthesia in 2006, reportedly requiring multiple puncture attempts. He now ambulated with a walker and had markedly restricted movement of the right hip and knee joints. On examination, he had a fixed cervicothoracic kyphotic deformity with chin-on-chest posture. Mouth opening was 2.5 finger.

Mallampati grade III, thyromental distance could not be reliably assessed as neck extension and rotation was absent in all planes. Chest auscultation was normal and there were no added heart sounds or murmurs present.

Baseline investigations including complete blood counts, renal and liver function tests and electrolytes which were found to be within normal limits. Two-dimensional echocardiography showed normal chamber dimensions with preserved left ventricular systolic function and grade I diastolic dysfunction without valvular lesions or any pulmonary hypertension. Pulmonary function testing revealed a moderate restrictive defect with reduced forced vital capacity and preserved FEV1/FVC ratio, consistent with AS-related

chest wall restriction. Chest radiography shows bamboo-spine changes without any active pulmonary pathology.

The patient was classified as American Society of Anesthesiologists (ASA) physical status II. During pre-anesthetic counselling, the anticipated difficult airway, risk of neuraxial anesthesia failure based on past history and positioning-related issues were explained. Awake fiberoptic intubation was discussed and written informed consent obtained regarding same, along with consent for use of clinical information and images for publication purpose. A detailed difficult airway plan was formulated, including availability of videolaryngoscopes, alternate supraglottic devices and emergency tracheostomy equipment on standby.

3. Anesthetic Management

On the day of surgery as patient could not tolerate the supine position on the operating table because of back pain and underlying disease. He was therefore positioned in a modified Fowler's posture with the head-end elevated approximately 30°, supported with two pillows under the head and three pillows under the knees to reproduce his usual resting position followed by all padding of all pressure points and bony prominences with cotton rolls and bandages (**Figure 1**). Standard monitors electrocardiogram, non-invasive blood pressure, pulse oximetry and capnography were attached and an 18-gauge peripheral intravenous cannula secured.



Figure 1: Pre-operative and intra-operative positioning showing the patient in a modified Fowler's posture with multiple pillows and meticulous padding to accommodate fixed kyphosis and limited lung capacity

Because of expected need for pneumoperitoneum, we considered a supraglottic airway alone to be unsafe for the entire procedure. As Laparoscopic cholecystectomy leads to high airway pressures and head-up tilt position both of which risk leak and displacement with a laryngeal mask airway, particularly in semi-sitting postures and in patients with severe kyphosis and limited lung capacity.

On other hand endotracheal intubation provided better protection against aspiration and facilitated controlled ventilation. Awake fiberoptic intubation was kept as a rescue option; however, our patient remained extremely anxious despite counselling and was unable to cooperate for a prolonged awake procedure in this compromised position. In line with recent difficult airway guidelines, which allow an asleep intubation attempt when mask ventilation is expected to be adequate and backup plans are ready, we elected to perform intubation via an intubating laryngeal mask airway (I-LMA) while maintaining spontaneous breathing until ventilation was secured.

Along with five minutes of preoxygenation with 100% oxygen in the modified Fowler's position, patient received intravenous midazolam 1 mg (0.01 mg/kg), fentanyl 100 µg (approximately 1.2 µg/kg). Anesthesia was induced with propofol 140 mg (approximately 2 mg/kg) titrated to loss of verbal response while preserving spontaneous ventilation. Gentle mask ventilation using a cushioned mask and two-hand technique was possible without airway obstruction. A size 4 I-LMA was then inserted in a single attempt without manipulating the neck and correct placement confirmed by bilateral chest rise and capnography. After confirming adequate ventilation through the I-LMA we administer rocuronium 50 mg (0.6 mg/kg) intravenously.

Once After the onset of neuromuscular blockade, a flexible fiberoptic bronchoscope was passed through the I-LMA (**Figure 2**). The epiglottis and glottic opening were visualized, and a 7.5-mm internal diameter cuffed silicon flex metallic endotracheal tube was railroaded over the scope into the trachea under direct vision. Correct placement was confirmed with capnography and bilateral air entry on auscultation, following which the I-LMA was carefully removed while stabilizing the endotracheal tube, which was secured at 20 cm at the incisors. Volume-controlled ventilation was instituted with a mixture of oxygen and air with FiO₂ 0.5 and sevoflurane of 1–1.5 MAC, targeting tidal volumes of 6–7 mL/kg and plateau pressures below 25 cmH₂O. Additional fentanyl boluses of 25–50 µg was given at incision and as required, and intravenous paracetamol 1g was administered for multimodal analgesia.

The surgeons initially attempted laparoscopic cholecystectomy using standard trocar placement after adequate pneumoperitoneum. However, due to the extreme semi-recumbent position, restricted working space and very limited instrument mobility procedure was converted to open cholecystectomy through a right subcostal incision, with no additional positioning changes. Hemodynamic and respiratory parameters remained stable throughout.

At the end of surgery, sevoflurane was discontinued and neuromuscular function was monitored with train-of-four stimulation at the adductor pollicis. When the train-of-four ratio recovered to ≥ 0.4 , sugammadex 2 mg/kg (160 mg) was administered intravenously. The patient was extubated in the same semi-recumbent position once he was awake, obeying verbal commands and generating adequate tidal volumes. Postoperative analgesia consisted of scheduled intravenous paracetamol 1 g every 8 hours for 24 hours and rescue fentanyl 25 µg intravenously for numeric rating scale pain scores ≥ 4 . The patient's postoperative course was uneventful and he was discharged home postoperative on day 5.



Figure 2: Fiberoptic view and operating room photograph demonstrating passage of the fiberscope through the intubating laryngeal mask airway and railroading of the endotracheal tube in neutral cervical alignment

Table 1: Drug dose box

Timing	Drug	Dose	Route / comment
Pre-induction (OT)	Midazolam	1 mg (~0.01 mg/kg)	IV; anxiolysis
Pre-induction (OT)	Glycopyrrolate	0.2 mg (~0.003 mg/kg)	IV; antisialagogue
Pre-induction (OT)	Dexamethasone	8 mg	IV; antiemetic, anti-inflammatory

Table 1 Continued....

Pre-induction (OT)	Fentanyl	100 µg (~1.2 µg/kg)	IV; analgesia before induction
Induction	Propofol	140 mg (~2 mg/kg)	IV titrated to loss of consciousness
Post-I-LMA placement	Rocuronium	50 mg (~0.6 mg/kg)	IV; neuromuscular blockade
Intra-operative	Fentanyl	25–50 µg boluses	IV; at incision and as required
Intra-operative	Paracetamol	1 g	IV infusion; multimodal analgesia
Reversal	Sugammadex	2 mg/kg (≈160 mg)	IV; reversal of rocuronium after TOF ≥0.4
Post-operative (first 24 h)	Paracetamol	1 g every 8 h	IV; scheduled
Post-operative (rescue)	Fentanyl	25 µg bolus	IV; for NRS ≥4

4. Discussion

Patients with advanced AS pose multiple anesthetic challenges due to ossification of the spine and costovertebral joints leads to fixed kyphotic deformity along with reduced chest wall compliance and restrictive ventilatory defects, while cervical spine and temporomandibular joint involvement produce severe limitation of mouth opening and neck movement.^{1,3,4} These anatomical changes compounded by underlying cardiopulmonary comorbidities make bag mask ventilation, direct laryngoscopy and central neuraxial blockade technically difficult and potentially hazardous.^{1,5}

Awake fiberoptic intubation is traditionally regarded as the safest option in AS when accompanied with severe cervical spine involvement, very limited mouth opening or unstable fractures.⁶⁻⁸ Recent reports, including contemporary Indian experience, justifies its role as the gold standard, especially when both airway and regional anesthesia are challenging.^{6,7,9-12} However, awake techniques not only require patient cooperation along with adequate topical anesthesia and experienced personnel this become extremely challenging in patients who cannot lie flat and are anxious or have pre-existing respiratory compromise. In our patient, chronic hoarseness suggested possible cricoarytenoid involvement and his semi-sitting position was the only posture he could tolerate. We therefore planned awake fiberoptic intubation as a backup but chose an asleep technique that preserved spontaneous ventilation until a supraglottic airway was in place to secure airway.

The intubating laryngeal mask airway allows blind as well as fiberoptic-guided passage of an endotracheal tube without requiring alignment of the oral, pharyngeal and laryngeal axes. Successful use of I-LMA has been reported in AS patients undergoing major surgery, including coronary artery bypass grafting and spine procedures.^{13,14} I-LMA-assisted fiberoptic intubation

combines the advantages of a secure rescue ventilation device with visual control of tube placement, minimizing cervical spine movement. Our strategy adhered to the principles of the updated ASA difficult airway guidelines, which emphasize oxygenation, limiting the number of attempts and always having a clear failed-airway pathway.⁹ We deliberately withheld neuromuscular blockade until ventilation through the I-LMA was confirmed, thereby maintaining the ability to revert to spontaneous breathing if intubation had failed and avoiding need of tracheostomy.

Another crucial challenge in this case was positioning. Severe AS with fixed kyphosis prevents patients from lying supine and fractures can occur even with minor manipulations.^{1,4,9} So to overcome this challenge Our patient could be positioned only in a modified Fowler's posture, and thereby meticulous padding was essential to avoid iatrogenic nerve injury and pressure point compression. Reports of laparoscopic cholecystectomy in AS emphasize the need for tailored patient and port positions, careful control of pneumoperitoneum and close communication between surgeon and anaesthesiologist.¹⁵⁻¹⁷ In our patient, extreme kyphosis and restricted pulmonary reserve limited pneumoperitoneum and the working space, necessitating conversion to open cholecystectomy despite a secure airway was achieved.

Limitation of lung volumes and increased airway pressures during pneumoperitoneum were additional reasons for not performing the surgery with a supraglottic airway alone. Laparoscopic procedures in head-up tilt can increase the risk of regurgitation and aspiration, especially in obese or semi-sitting patients.¹⁶ Endotracheal intubation offered better sealing at higher pressures tolerability, reliable capnography and ease of suctioning. The use of sugammadex for reversal of rocuronium provided rapid and predictable restoration of neuromuscular function, reducing the risk of residual paralysis and facilitating safe extubation in a patient

where re-intubation would have been extremely challenging task.^{12,18}

This case underscores the importance of thorough pre-operative evaluation, shared decision-making and a stepwise airway plan in patients with AS. When awake fiberoptic intubation is impractical due to patients' noncooperation, I-LMA-assisted fiberoptic intubation, performed under carefully titrated anesthesia while preserving spontaneous breathing until effective ventilation is confirmed, offers a valuable alternative. Close coordination with the surgical team regarding positioning and the feasibility of laparoscopy is essential to optimize possible outcomes.

5. Conclusion

Severe ankylosing spondylitis with fixed spinal deformity and restrictive lung disease presents a complex combination of airway, positioning and ventilatory challenges. I-LMA-assisted fiberoptic intubation allowed us to secure the airway without neck movement while maintaining oxygenation in a patient who could not tolerate the supine position and in whom awake fiberoptic intubation was impractical. Careful pre-operative planning individualized positioning and availability of modern airway adjuncts and neuromuscular reversal agents were key to the successful outcome.

Author Contributions

Ankit Arora: Conceptualization, patient management, literature review, manuscript drafting, critical revision, and final approval of the manuscript.

Girish Rawat: Clinical management, data collection, manuscript review, critical revision, and final approval of the manuscript.

Harish Singh Koshiyari: Supervision, interpretation of clinical findings, manuscript editing, critical revision, and final approval of the manuscript.

Declaration of Patient Consent

Appropriate patient consent. In the consent form was taken and the patient has given his consent for reporting his clinical information and images in the journal.

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Conflicts of Interest

There are no conflicts of interest.

Use of Artificial Intelligence (AI)

AI tools were used solely for language support during manuscript preparation and were not used for the generation, analysis, or interpretation of the scientific content.

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