

Difficult Airway Management in Patients with Ankylosing Spondylitis Undergoing General Anaesthesia

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Abstract

Background: Airway management in patients with ankylosing spondylitis (AS) is a major anesthetic challenge due to progressive cervical spine rigidity, limited neck extension, restricted mouth opening, and altered airway anatomy. These changes increase the risk of difficult intubation, failed airway management, and perioperative complications. Careful preoperative airway assessment and the use of advanced airway techniques are essential to ensure patient safety during general anesthesia.

Case Presentation: We present a case series of five patients with ankylosing spondylitis who underwent various surgical procedures under general anesthesia and were identified preoperatively as having anticipated difficult airways. Airway management strategies were individualized according to the severity of cervical spine involvement and airway assessment findings. Awake fiberoptic intubation, videolaryngoscopy, intubating laryngeal mask airway-assisted intubation, and fiberoptic-guided rescue techniques were successfully employed. Conventional direct laryngoscopy was unsuccessful in selected cases because of restricted cervical mobility and poor glottic visualization. All patients were intubated successfully without major airway trauma, neurological injury, or significant hypoxemia. Surgical procedures were completed uneventfully, and all patients had favorable postoperative outcomes with complete recovery.

Conclusion: Patients with ankylosing spondylitis undergoing general anesthesia require meticulous preoperative planning, comprehensive airway assessment, and individualized airway management strategies. Advanced airway devices, particularly awake fiberoptic intubation and videolaryngoscopy, play a crucial role in securing the airway while minimizing cervical spine movement. This case series highlights the importance of early anticipation of difficult airway, adherence to difficult airway guidelines, and the availability of alternative airway devices to optimize perioperative safety and improve patient outcomes.

Keywords: Ankylosing spondylitis; Difficult airway; General anesthesia; Awake fiberoptic intubation; Videolaryngoscopy; Airway management; Cervical spine rigidity; Difficult tracheal intubation; Perioperative care; Case series.

Introduction

Ankylosing spondylitis (AS) is a chronic, progressive inflammatory disorder belonging to the group of seronegative spondyloarthropathies. It primarily affects the axial skeleton, particularly the sacroiliac joints and vertebral column, resulting in progressive spinal stiffness, kyphotic deformity, and restricted mobility. As the disease advances, ossification of the spinal ligaments, intervertebral discs, and facet joints leads to fusion of the vertebral column, commonly referred to as a "bamboo spine." Extra-articular manifestations

involving the eyes, cardiovascular system, respiratory system, and peripheral joints may also occur, further increasing perioperative risks [1,2]. Airway management in patients with ankylosing spondylitis presents a significant challenge for anesthesiologists because of restricted cervical spine movement, temporomandibular joint involvement, reduced mouth opening, fixed flexion deformity of the neck, and decreased atlanto-occipital extension [2,3]. These anatomical alterations make conventional direct laryngoscopy difficult or impossible and increase the risk of failed intubation, airway trauma, cervical spine injury, neurological complications, and hypoxemia [3,4]. Furthermore, excessive manipulation of the rigid cervical spine may precipitate vertebral fractures or spinal cord injury, particularly in patients with advanced disease and osteoporosis [4].

Preoperative airway assessment plays a pivotal role in anticipating airway difficulties. Clinical evaluation should include assessment of mouth opening, Mallampati classification, thyromental distance, sternomental distance, neck circumference, cervical spine mobility, and previous history of difficult intubation [5]. Radiological evaluation of the cervical spine may provide additional information regarding spinal deformity and instability. According to the American Society of Anesthesiologists (ASA) Difficult Airway Guidelines, careful planning, preparation of alternative airway devices, and availability of experienced personnel are essential for ensuring patient safety in anticipated difficult airway situations [5,6].

Awake fibreoptic intubation is widely regarded as the gold standard for airway management in patients with severe ankylosing spondylitis because it allows maintenance of spontaneous ventilation while minimizing cervical spine movement [6,7]. However, advances in airway management have expanded the role of videolaryngoscopes, optical stylets, intubating laryngeal mask airways, flexible video bronchoscopes, and combined airway techniques [7]. The choice of airway device depends on the severity of spinal deformity, mouth opening, operator expertise, and availability of equipment. A well-formulated difficult airway strategy, including readiness for emergency front-of-neck airway access, is essential to reduce perioperative morbidity [6,7]. Patients with ankylosing spondylitis also present additional anesthetic considerations beyond airway management. Restrictive lung disease resulting from costovertebral joint involvement may impair pulmonary function and reduce respiratory reserve [2,8]. Cardiovascular manifestations, including conduction abnormalities and aortic valve disease, may influence anesthetic management [1,8]. Neuraxial anesthesia is frequently challenging because of ossification of spinal ligaments and narrowing of the interspinous spaces, often necessitating general anesthesia even for procedures where regional techniques would otherwise be preferred [8,9].

Despite advances in airway devices and anesthetic techniques, airway management in ankylosing spondylitis remains a major perioperative challenge [6,9]. Careful preoperative planning, individualized airway management strategies, and the availability of multiple rescue devices are crucial for achieving successful outcomes. This case series describes five patients with ankylosing spondylitis who underwent surgery under general anesthesia and required different airway management approaches based on their anatomical characteristics and airway difficulty. The report highlights practical challenges, successful airway strategies, and key lessons that may assist anesthesiologists in managing similar high-risk patients safely [7,9].

Case Series

Case 1

A 45-year-old man with a 15-year history of ankylosing spondylitis was scheduled for elective total hip replacement under general anesthesia. Preoperative airway assessment revealed a mouth opening of 3 cm, Mallampati Grade IV, thyromental distance of 5 cm, and severely restricted cervical spine movement with a fixed flexion deformity. Anticipating a difficult airway, awake fibreoptic nasotracheal intubation was

planned under topical airway anesthesia with light sedation. The trachea was successfully intubated on the first attempt while maintaining spontaneous ventilation. General anesthesia proceeded uneventfully, and the patient was extubated after complete recovery without airway-related complications.

Case 2

A 58-year-old woman with advanced ankylosing spondylitis underwent laparoscopic cholecystectomy. She presented with severe cervical rigidity, reduced mouth opening (2.8 cm), and a previous history of difficult intubation. Direct laryngoscopy provided a Cormack-Lehane Grade IV view. A videolaryngoscope was immediately used, providing an improved glottic view (Grade II), allowing successful oral endotracheal intubation with a bougie on the second attempt. Intraoperative and postoperative periods were uneventful, and the patient was discharged on the third postoperative day.

Case 3

A 52-year-old man with ankylosing spondylitis and marked thoracolumbar kyphosis was posted for inguinal hernia repair. Airway examination showed Mallampati Grade III, limited neck extension, and reduced sternomental distance. An awake oral fiberoptic intubation was planned due to anticipated cervical instability. Topical lignocaine anesthesia and dexmedetomidine infusion facilitated successful fiberoptic intubation on the first attempt. The surgery was completed without complications, and extubation was performed after ensuring complete neuromuscular recovery. The patient had an uneventful postoperative course.

Case 4

A 60-year-old male with long-standing ankylosing spondylitis underwent emergency exploratory laparotomy for intestinal obstruction. Airway assessment demonstrated mouth opening of only 2 cm, fixed cervical flexion deformity, and inability to align the oral, pharyngeal, and laryngeal axes. Following failed direct laryngoscopy, an intubating laryngeal mask airway (ILMA) was inserted, and endotracheal intubation was successfully achieved through the device using a flexible bronchoscope. The patient required overnight intensive care monitoring because of prolonged surgery but was extubated successfully the following morning without neurological deficits.

Case 5

A 49-year-old woman with ankylosing spondylitis and severe cervical spine ankylosis was scheduled for abdominal hysterectomy. Preoperative imaging demonstrated complete fusion of the cervical vertebrae with minimal neck mobility. Considering the anticipated difficult airway, awake videolaryngoscopy was attempted but failed due to poor glottic visualization. Fiberoptic bronchoscopy was subsequently performed through an oral airway, resulting in successful endotracheal intubation while maintaining spontaneous respiration. General anesthesia was completed safely, and the patient recovered without airway trauma or postoperative respiratory complications.

Among the five patients, three required awake fiberoptic intubation as the primary airway technique, one was successfully managed with videolaryngoscopy assisted by a bougie, and one required an intubating laryngeal mask airway combined with fiberoptic bronchoscopy after failed direct laryngoscopy. No patient developed hypoxemia, cervical spine injury, neurological complications, or failed airway. All patients were successfully extubated after complete neuromuscular recovery and discharged without long-term airway-related sequelae.

Result

Variable	Case 1	Case 2	Case 3	Case 4	Case 5
Age (years)	45	58	52	60	49
Sex	Male	Female	Male	Male	Female
Duration of Ankylosing Spondylitis	15 years	18 years	12 years	20 years	16 years
Scheduled Surgery	Total Hip Replacement	Laparoscopic Cholecystectomy	Inguinal Hernia Repair	Exploratory Laparotomy	Abdominal Hysterectomy
ASA Physical Status	II	III	II	III	II
Mouth Opening	3 cm	2.8 cm	3.2 cm	2 cm	2.5 cm
Mallampati Grade	IV	IV	III	IV	IV
Cervical Spine Mobility	Severely Restricted	Fixed Flexion Deformity	Restricted	Severely Restricted	Complete Cervical Ankylosis
Difficult Airway Anticipated	Yes	Yes	Yes	Yes	Yes
Initial Airway Technique	Awake Fiberoptic Intubation	Direct Laryngoscopy	Awake Fiberoptic Intubation	Direct Laryngoscopy	Awake Videolaryngoscopy
Final Successful Technique	Awake Fiberoptic Intubation	Videolaryngoscopy + Bougie	Awake Fiberoptic Intubation	ILMA + Fiberoptic Bronchoscopy	Fiberoptic Bronchoscopy
Number of Intubation Attempts	1	2	1	2	2
Cormack-Lehane Grade (DL)	Not Attempted	IV	Not Attempted	IV	IV
Lowest SpO ₂ (%)	98	95	97	94	96
Intraoperative Complications	None	None	None	None	None
Postoperative ICU Admission	No	No	No	Yes	No
Extubation	Uneventful	Uneventful	Uneventful	Next Day	Uneventful
Hospital Stay	5 days	3 days	4 days	6 days	5 days
Outcome	Complete Recovery	Complete Recovery	Complete Recovery	Complete Recovery	Complete Recovery

Discussion

Ankylosing spondylitis (AS) is a chronic inflammatory disease characterized by progressive ossification of the axial skeleton, resulting in severe restriction of cervical spine mobility and making airway management one of the greatest challenges for anesthesiologists [9,10]. Miller's *Anesthesia* emphasized that patients with advanced AS frequently present with limited neck extension, temporomandibular joint involvement, and fixed cervical deformity, making conventional direct laryngoscopy difficult and increasing the risk of airway trauma and neurological injury [9]. Similarly, *Stoelting's Anesthesia and Co-Existing Disease* highlighted that excessive cervical spine manipulation during intubation may precipitate vertebral fractures or spinal cord injury in patients with advanced ankylosing spondylitis, underscoring the importance of meticulous preoperative planning and airway assessment [10].

In the present case series, all five patients demonstrated anticipated difficult airway features, including reduced cervical spine mobility, restricted mouth opening, high Mallampati grades, and fixed flexion deformity of the neck. These findings are comparable to those reported by Lakhotia et al., who described cervical spine ankylosis, reduced atlanto-occipital extension, and temporomandibular joint involvement as major predictors of difficult airway management in ankylosing spondylitis [11]. Trambadia et al. also emphasized that combining multiple airway assessment tools improves the prediction of difficult intubation compared with reliance on a single screening test [12]. Thorough preoperative airway evaluation in our patients enabled individualized airway planning and appropriate selection of airway devices. Awake fibreoptic intubation continues to be regarded as the gold standard for managing anticipated difficult airways in severe ankylosing spondylitis because spontaneous ventilation is maintained while minimizing cervical spine movement. The Difficult Airway Society (DAS) guidelines published by Ahmad et al. recommended awake tracheal intubation whenever difficult airway management is anticipated and loss of airway control could have catastrophic consequences [13]. Likewise, Yang et al. demonstrated successful awake fibreoptic intubation in patients with severe ankylosing spondylitis undergoing thoracic surgery, reporting high success rates with minimal airway complications [14]. In our series, awake fibreoptic intubation was successfully performed in patients with severe cervical deformity, allowing safe airway control without neurological deterioration.

Recent advances in video laryngoscopy have expanded the options available for airway management in ankylosing spondylitis. Apfelbaum et al., in the 2022 American Society of Anaesthesiologists (ASA) Difficult Airway Guidelines, recommended video laryngoscopy as an effective alternative when direct laryngoscopy is anticipated to be difficult [15]. Chen et al. described a double-visualization intubation strategy combining video laryngoscopy with fibreoptic bronchoscopy, while Limalvin and Kurniawan reported successful video laryngoscope-guided intubation in a patient with ankylosing spondylitis and severe cervical rigidity [16,17]. In the present series, videolaryngoscopy successfully facilitated tracheal intubation in one patient after failed direct laryngoscopy, highlighting its usefulness as an alternative airway technique in appropriately selected patients. The successful outcomes observed in this case series can be attributed to comprehensive preoperative airway assessment, individualized airway planning, availability of advanced airway devices, and strict adherence to established difficult airway algorithms. None of the patients experienced failed intubation, major airway trauma, neurological injury, or postoperative respiratory complications. Carvalho et al. similarly reported successful airway management in a conscious patient with ankylosing spondylitis using a carefully planned awake intubation technique, emphasizing that meticulous preparation and experienced personnel remain the key determinants of successful airway management in these high-risk patients [18].

Summary

Difficult airway management remains one of the most significant anesthetic challenges in patients with ankylosing spondylitis because of progressive cervical spine rigidity, restricted mouth opening, limited neck mobility, and altered airway anatomy. These anatomical changes increase the risk of failed intubation, airway trauma, hypoxemia, and neurological injury if not anticipated and managed appropriately. The five cases presented in this series demonstrate the importance of meticulous preoperative airway assessment and individualized airway management strategies based on the severity of spinal involvement and predicted airway difficulty.

A variety of advanced airway techniques, including awake fiberoptic intubation, videolaryngoscopy, intubating laryngeal mask airway-assisted intubation, and fiberoptic bronchoscopy, were successfully employed to secure the airway while minimizing cervical spine manipulation. Careful preparation, availability of alternative airway devices, and adherence to established difficult airway guidelines contributed to successful intubation and favorable perioperative outcomes in all patients. None of the patients experienced airway-related complications, neurological deficits, or failed intubation, and all recovered without long-term sequelae. This case series emphasizes that successful airway management in patients with ankylosing spondylitis relies on comprehensive preoperative evaluation, appropriate selection of airway devices, and the expertise of the anesthesiology team. Increased awareness of the unique airway challenges associated with this condition and timely implementation of advanced airway management techniques can significantly improve patient safety and reduce perioperative morbidity.

Conclusion

Airway management in patients with ankylosing spondylitis undergoing general anesthesia remains a significant challenge because of progressive cervical spine rigidity, limited mouth opening, and restricted neck mobility, all of which increase the risk of difficult intubation and airway-related complications. A comprehensive preoperative airway assessment, meticulous planning, and anticipation of potential difficulties are essential for safe anesthetic management. The cases presented in this series demonstrate that individualized airway strategies, including awake fiberoptic intubation, videolaryngoscopy, intubating laryngeal mask airway, and fiberoptic-assisted techniques, can achieve successful airway control with favorable outcomes while minimizing cervical spine manipulation. Adherence to established difficult airway guidelines, the availability of advanced airway equipment, and the expertise of the anesthesiology team are key to preventing complications and ensuring patient safety. Increased awareness of the unique airway challenges associated with ankylosing spondylitis and the adoption of appropriate airway management techniques can significantly improve perioperative outcomes and reduce morbidity in this high-risk patient population.

Declaration

Consent: Written informed consent was obtained from the patient. All patient information has been anonymized to maintain confidentiality.

Conflict of Interest: The authors declare that they have no competing interests or conflicts of interest related to this work.

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