Archives of Anesthesiology

ISSN 2638-4736

Volume 3, Issue 1, 2020, PP: 10-13

Airway Management in Patients with Ehlers-Danlos Syndrome

Eric Heinz, MD, PhD*[1], Everett Chu, MD[2], Raymond Pla, MD[3]

*[1]George Washington Medical Faculty Associates, Assistant Professor of Anesthesiology and Critical Care Medicine, 900 23rd St NW, Suite G-2092 Washington DC, 20037, USA.

[2]George Washington Medical Faculty Associates, Research Assistant for Anesthesiology and Critical Care Medicine, USA.

[3]George Washington Medical Faculty Associates, Assistant Professor of Anesthesiology and Critical Care Medicine, USA.

Heinz.md.phd@gmail.com

***Corressponding Author:** Eric Heinz, MD, PhD, George Washington Medical Faculty Associates, Assistant Professor of Anesthesiology and Critical Care Medicine, 900 23rd St NW, Suite G-2092, Washington DC, 20037, USA.*

Abstract

Ehlers Danlos Syndrome (EDS) is a group of collagen-related connective tissue disorders that is thought to affect 1 in 5000 individuals. EDS is divided into six main subtypes based on clinical picture, severity, pattern of inheritance, and specific genetic defect. The most common subtypes [type I, II (classical), and III (hypermobile)] make up about 90% of all cases of EDS while type IV (vascular) makes up about 3-10%. The remainder of subtypes [type VI (kyphoscoliosis), type VIIA/VIIB (arthrochalasis), type VIIC (dermatosparaxis)] are quite rare. Each subtype of EDS involves a specific mutation in genes coding for collagens or collagen-related proteins (collagen modifying enzymes, tenascin) that lead to connective tissue instability resulting in defects in cell attachment, platelet aggregation, organogenesis, and tensile strength in skin, bones, muscles, ligaments and tendons. These defects then lead to presentations that often go undetected with unknown clinical implications. (1) The purpose of this article is to review the current literature on the airway of EDS patients and discuss the challenges presented to the anesthesiologist. Although the manifestations of this disease are variable, there are several clinical features that are important for perioperative airway management.

Keywords: *Ehlers-Danlos Syndrome, Airway management, Hypermobility, Obstructive Sleep apnea*

Tongue, Dentition, and Oral Mucosa

Otolaryngologic symptoms of EDS include dysphonia and dysphagia. Patients with EDS are noted to have tongue hypermobility.(2) It is unclear the impact that this pathologic anomaly would have on airway management, however, it is reasonable to suspect that this would alter the routine placement of supraglottic airway or otherwise obscure direct laryngoscopy. In addition, EDS patients have a vaulted palate which may also hinder placement of oral or supraglottic airways.

Other symptoms of EDS include periodontal bone loss and gingival recession, which lead to exposed tooth roots and fragile dentition. All these dental manifestations lead to poor dentition and weakened tooth structure. The relevance of this lies in that it requires the anesthesiologist to use greater vigilance in protecting the patient's dentition and adds another variable that may make securing the airway more challenging. Utmost care must be provided to ensure the patient's dentition remains intact during any airway manipulation. With weakened dental stability, the increase in the likelihood of dislodging a loose tooth that may become lost in the airway should be on the forefront of the anesthesiologist mind.

Another clinical feature of EDS appears in the patient's oral cavity, with thin oral mucosa and fragile laryngeal

soft tissue. The oral mucosa of these patients is prone to excessive bleeding(3) which could be worsened with insertion of any type of airway. Airway instrumentation which occurs during laryngoscopy usually results in minimal to no trauma to the oral and laryngeal mucosa. However, repeated attempts at laryngoscopy can often lead to trauma and bleeding. In a patient that has fragile mucosa and oral bleeding, securing the airway via laryngoscopy or bronchoscopy becomes technically challenging. Multiple attempts can lead to excessive soft tissue damage and bleeding that can make intubation nearly impossible. Furthermore, laryngeal blood can be aspirated into the lungs leading to further harmful sequalae.

Temporomandibular Joint

EDS is characterized by increased extensibility, recurrent dislocations, and fragility of both joints and cartilaginous tissue. As a result, the temporomandibular joint (TMJ) can be involved, complicating airway management. Specifically, TMJ hyperextension, dislocation, and subluxation can occur. This may occur with any manual mouth opening but is even more likely during direct laryngoscopy when the laryngoscope is placed in the mouth and lifted with force to maneuver the tongue. Though the TMJ can relocate, the cartilaginous disc portion of the joint often remains dislocated resulting in pain, and limited TMJ mobility.

Initially, patients with the hypermobile variant of EDS exhibit increased maximal mouth opening beyond the normal range of 40-55 mm. However, once the patient dislocates the TMJ, damage to articular surfaces, and permanent dislocation of the disc portion of the joint contribute to chronic TMJ dysfunction over time resulting in sharply limited mouth opening, often less than 33 mm. Bruxing, clenching of the teeth, or dental malocclusion can also contribute to TMJ dysfunction with resultant limited mouth opening.(4)

An additional complicating airway management in patients with TMJ dysfunction appears to be the association of TMJ dysfunction and cervical spine disorders, with estimates as high as 70% of TMJ dysfunction patients exhibiting evidence of craniocervicalinstability.(4)

Cervical Range of Motion

Atlantoaxial instability is prevalent in patients with EDS.(5) (6) An unstable cervical spine poses serious challenges to the anesthesiologist who must secure the airway in either planned or urgent medical situations. These high-risk patients can suffer further spinal cord injury if not treated appropriately during airway management. Even still, patients with unstable c-spine are known to suffer neurological deterioration in the perioperative period.(7) Airway management without any cervical manipulation is challenging and intubation of a patient often causes cervical motion even in the presence of cervical stabilization. Video laryngoscopy has been shown to be superior to direct laryngoscopy in patients with cervical instability, however it does not completely eliminate cervical motion.(8)

Any patient known or suspected of having EDS should be carefully screened for signs or symptoms of atlantoaxial instability. In the event the anesthetic is elective a neurologic consult should be obtained and cervical imaging used to ensure any instability is identified. If the case is more urgent the anesthesiologist should use all precautions necessary to stabilize the cervical spine and use whatever airway technique he feels will cause the least motion of the cervical spine. The patient should be intubated by an experienced provider.

Surgical fixation in this population allows for corrections of these abnormalities(9), however raises other challenges for airway management. Often patients present with multi-level cervical fusion that significantly decreases range of motion. If the patient does not have other risk factors for a difficult airway, it is possible to secure the airway using direct laryngoscopy. Alternatively, fiberoptic intubation will likely minimize the range of motion necessary to secure the airway. Fiberoptic intubation in patients with fixed cervical spine can be achieved however requires great skill and has a high failure rate.(10)

Obstructive Sleep Apnea

EDS has been associated with sleep disordered breathing (SDB) in both the pediatric and adult population.(11-13) One study showed the incidence of obstructive sleep apnea (OSA) to be as high as 26% in the EDS population.(13) This association is not surprising given that SDB and OSA are multifactorial and can include anatomical factors such as floppy tissue, micrognathia, high arched palate, and abnormalities of the nasal and maxillary cartilage. These anatomical features are also common in EDSpatients(14, 15).

In both retrospective and prospective studies EDS patients experienced clinical symptoms of SBD including fragmented sleep, daytime fatigue, snoring, and mouth breathing(12) . In the retrospective study, they found that all patients met criteria for SDB on polysomnography including apneas, hypopneas, and flow limitations that resulted in clinical complaints that improved with nasal CPAP. Additionally, for 7 of the 34 patients undergoing rhinomanometry, they found a significantly higher mean nasal resistance when compared to age and sex matched control groups. Of significant mention, they found that both groups of EDS patients had variations in physical exam characteristics including a deviated nasal septum, high arched palatal vault, micrognathia, and crowded teeth with a history of wisdom tooth extraction. The authors suggest that defects in cartilage in EDS leads to the formation of facial structures that are known to affect the airway and cause SDB(11).

STOP-BANG questionnaire (SBQ) is a common perioperative screening tool used to identify patients who may have OSA. Recent studies have shown that the sensitivity of the SBQ for detecting moderate to severe OSA with an apnea-hypopnea index (AHI) >15 ranges from about 70-98% depending on the study (16-18). Additionally, the power of the SBQ to rule out moderate to severe OSA has also been studied with a probability of 95% to exclude an AHI > 15 [16]. While this questionnaire is predictive of OSA in the general population, it fails to fully encapsulate the EDS population given that the pathophysiology of apnea and hypopnea events differs in this population. For example, two of the eight questions required for the SBQ involves BMI and neck circumference which are not inherent qualities of the EDS patients and thus reduces the power of the questionnaire in this population.

Several reasons exist for identifying OSA in EDS patients in the perioperative period. For one, presence of OSA is associated with increased risk of both difficult mask ventilation and intubation(19, 20). Identifying and planning for potential difficult intubation is a necessity in this population.

Conclusion

Patients with EDS possess many anatomical variations that are important to their perioperative care and safe and effective airway management. Although the presentation may be variable with different manifestations within this patient population, it is important that the anesthesiologist review these risk factors to ensure proper airway management. Despite a well-established association with challenging intubation, no specific guidelines or recommendations for anesthetic management exist to date.(21) In order to improve EDS patient care, future research is necessary to elucidate safe and effective ways of managing these patients in the perioperative setting.

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Citation: **Eric Heinz, MD, PhD, Everett Chu, MD, Raymond Pla, MD.** *Airway Management in Patients with Ehlers-Danlos Syndrome. Archives of Anesthesiology. 2020; 3(1): 10-13*