

**Arytenoid Injury and Subluxation**

**in**

**Anesthetic Practice**

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**Key Words:**

Arytenoid injury

Arytenoid subluxation

Arytenoid dislocation

Postoperative hoarseness

## **I. Introduction**

Anesthesiologists visualize the bulge in the mucosal surface overlying the arytenoids during laryngoscopy and often do so without full appreciation of the importance of the arytenoids to anesthetic care. This is especially significant because the arytenoids and cricoarytenoid joint are relatively fragile and are vulnerable to injury during laryngoscopy. Undo stress upon the arytenoids is a cause of hoarseness and bilateral subluxation of the cricoarytenoid joint can result in airway compromise. The former complication constitutes one of the most frequent post-anesthetic complaints and the later can lead to potentially serious post-extubation airway difficulty. The arytenoids are far more important to the anesthesiologist than their small size predicts.

## **II. Anatomy**

The arytenoids are small, pyramidal cartilages perched atop the cricoid cartilage and are best visualized posteriorly and in the context of the other laryngeal cartilages (Figure 1). They are joined to the cricoid by a symmetrical, synovial joint--the cricoarytenoid joint. (1) Bridging the cricoarytenoid joint is the cricoarytenoid ligament. It arises from the cricoid lamina and attaches to the medial surface of the arytenoid cartilage. (2)

Two processes extend from the base of each cartilage: a vocal process and a muscular process. The vocal process extends anteriorly and provides attachment to the vocal ligament and the muscular process extends posterolaterally and provides a point of insertion for the lateral and posterior cricoarytenoid muscles. (3) These muscles open and close the glottis by creating lateral and medial movements of the attached vocal ligaments. The cricoarytenoid joint is involved in two types of motion: a sliding motion of the arytenoid along the longitudinal axis of the joint and a rocking of the arytenoid during adduction and abduction of the vocal cords. (2)

### III. Arytenoid injury and subluxation

Subluxation is joint dislocation with some remaining contact of joint surface. Despite some suggestion to the contrary (4), the cricoarytenoid joint may be relatively vulnerable to anterior-medial pressure. (2) Kambric states, "It is possible that only slight pressure on the free medial part of the arytenoid is sufficient to dislocate the cartilage." (5)

Cricorytenoid subluxation is associated with a number of factors, namely the degree of experience of the laryngoscopist; (6) pressure from the convex aspect of the endotracheal tube upon the arytenoid; (7) protrusion of the endotracheal tube stylet; (8) prolonged or traumatic intubation; (9) several systemic diseases; (10) external blunt trauma; (11, 12) dental malocclusion, retrognathia, and a large tongue. (6)

Of the documented cases of arytenoid subluxation more than half involved the left arytenoid. This may be secondary to insertion of the endotracheal tube from the right side of the mouth and oropharynx with consequent force upon the left arytenoid by the convex curvature of the endotracheal tube. (5, 6) Blind intubation techniques, such as those utilizing the lighted stylet or "light wand" have also resulted in arytenoid subluxation but the incidence of this complication is unknown. (13)

Cricorytenoid subluxation may occur much more frequently than commonly realized. Overall, the incidence of significant injury after short-term intubation is about 6% with laryngeal hematoma, mucosal laceration, and vocal cord dysfunction or paralysis, in this order, being most frequent. (5, 14) While the incidence of documented arytenoid subluxation is only about 1 in 1,000 with only a handful of reported cases in the English language literature, (1, 4, 5, 14) there is evidence that the true incidence may be much higher. In the Kambric et al study of 1,000 patients evaluated following intubation for general anesthesia and surgery, 52 had evidence of hematoma (45 of these involving the vocal cords), 8 had vocal cord mucosa laceration, 1 had laceration of the vocal cord muscle, and 1 had subluxation of the arytenoid. (5) In a study by Peppard et al involving 475 patients following intubation for general anesthesia, 6.3% (30 patients) were found to have traumatic lesions of the larynx or hypopharynx. Twenty-two had hematoma of the vocal cord, 2 of the epiglottis, and 1 of the false cord; Three patients had lacerations of the larynx or hypopharynx, and 2 had vocal cord paralysis. Arytenoid subluxation was not detected. (14)

This information suggests that the incidence of arytenoid subluxation is rare but the true incidence may be much higher. For example, Rudert, reported an incidence of 30% arytenoid subluxation (6 of 19 cases) in patients referred to him with prolonged hoarseness following instrumentation of the larynx. (3, 15) Further, with the known occurrence of spontaneous repositioning of subluxed arytenoids (16, 17) and with the incidence of hoarseness

following short term endotracheal intubation about 4% the true incidence of arytenoid dislocation may be much higher than suspected.

Arytenoid subluxation occurs most frequently in adults but it has been described in children and neonates(3) . There seems to be some association with juvenile diabetes mellitus, acromegaly, laryngomalacia, and chronic steroid use but any association between arytenoid subluxation and systemic disease is inconsistent. In some patients and by means not clearly understood, these conditions are thought to weaken the posterior cricoarytenoid ligament and make the joint more vulnerable to subluxation from anterior forces. (4, 9, 18)

Another type of injury involving the arytenoids is neuropraxia of the recurrent laryngeal nerve secondary to compression. (19) In the setting of (especially prolonged) inflation and/or over-inflation of an endotracheal tube cuff, the recurrent laryngeal nerve can be compressed against the thyroid cartilage. This occurs between the arytenoid cartilage and the membranous true vocal cord. The incidence of vocal cord paralysis or partial paralysis from this etiology is unknown. (19)

#### **IV. Diagnosis**

A spectrum of physical signs and symptoms have been associated with arytenoid subluxation and injury and should raise suspicion: hoarseness, sore throat, painful swallowing (10) inspiratory stridor, hypoxemia, and cyanosis (1) (20) . (Table 1)

Undoubtably, the most threatening manifestation of arytenoid subluxation is airway obstruction, occurring post-operatively following extubation of the trachea. Castella et al reported a case of a 77 year-old female who underwent general endotracheal anesthesia for a retrosigmoid resection. She was intubated with an 8 mm ID low pressure cuff orotracheal tube. A stylet was not used and intubation was easily achieved with a Macintosh 3 blade. The cuff was slowly inflated until a seal was achieved. At the conclusion of an uneventful 3 hour surgery and anesthetic, the patient was extubated, again uneventfully. Four hours postoperatively the patient developed signs and symptoms of progressive upper airway obstruction, manifested principally by hoarseness, dysphagia, and stridor. Despite steroids, theophyllin, and racemic epinephrine her respirations became progressively more labored and she was reintubated, again with an 8 mm ID endotracheal tube. She was transferred to the intensive care unit and after 24 hours of medical therapy was extubated. Within several minutes, she again developed signs and symptoms of upper airway obstruction. Fiberoptic laryngoscopy revealed bilateral arytenoid dislocation with severe glottic edema. A tracheostomy was performed. Subsequent examination revealed resolution of the left arytenoid dislocation. The right arytenoid was still somewhat subluxed after three months but near normal glottic opening was present and the trachea was decannulated without complication. (20)

The diagnosis of arytenoid subluxation is made by indirect and fiberoptic laryngoscopy, computerized tomography (CT) (1, 21, 22) or magnetic resonance imaging (MRI) (4) .(Figure 2) Subluxation can be anterior, medial or posterior. Characteristically, the involved vocal cord is bowed and in an intermediate position. (1) (Figure 3)

Laryngoscopy is the most common first step in diagnosis. When findings are obscured by edema or hematoma or when the patient is intubated, CT is a valuable diagnostic tool. (4) If the CT is equivocal, laryngeal EMG is useful to confirm vocal cord dysfunction. A normal laryngeal EMG is strong evidence against the diagnosis of arytenoid subluxation. (1)

Since most hoarseness is secondary to laryngeal edema only persistent hoarseness or hoarseness with associated symptoms probably demands evaluation. Diagnostic laryngoscopy has been recommended but there are no widely accepted guidelines in terms of its timing. Much depends upon associated symptoms. For hoarseness associated with dysphagia, airway obstructive symptoms, hemoptysis, or severe pain diagnostic laryngoscopy should probably be performed as soon as possible. For minor hoarseness with no associated symptoms a two week period of observation is reasonable. (1)

## **V. Treatment**

As noted above, resolution of arytenoid subluxation may be spontaneous and treatment not required. (16, 17) Definitive treatment consists of either endoscopic reduction under local anesthesia within 24-48 hours of injury (1) or surgical reduction under general anesthesia (7, 23) . Local anesthesia offers the advantage of earlier assessment of phonation. (7, 10) Delays of up to five weeks have been reported with no long term complications (1) but soft tissue injury in conjunction with arytenoid subluxation in the setting of blunt trauma is often more problematic in regaining normal vocalization. (24)

If reduction is undertaken, the following techniques and procedures are common: Utilizing 4% topical lidocaine, bilateral superior laryngeal nerve block, and sedation, (21) microlaryngoscopy is undertaken. The tip of a 3 mm laryngeal suction catheter is then used to apply lateral and posterior pressure to the vocal cord. Gentle pressure is usually sufficient to anatomically realign the cricoarytenoid joint. Following reduction, improvement can be immediate, with the cords able to meet in the midline and vocal quality greatly improved. (1) If improvement does not occur or a considerable amount of time has elapsed since subluxation, other therapies are instituted: Teflon injection into the involved vocal cord, cricoarytenoid arthodesis, and vocal cord medialization procedures. (4)

## **VI. Summary**

The importance of the arytenoids is often not fully recognized. Arytenoid injury can result in one of the most frequent post-anesthetic complaints, hoarseness, and also one of the most serious, airway compromise. The true incidence of arytenoid subluxation is unknown. Identification of the problem, especially if acute, is key. In the acute setting, laryngoscopy and intubation may be necessary.



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**Table 1**

**Signs and Symptoms of Arytenoid Injury**

Hoarseness

Sore throat

Painful swallowing

Inspiratory stridor

Cyanosis

Displaced arytenoid and/or bowed vocal cord

**Figure 1**

(not shown here)

Cartilages of the larynx: Posterior View. There are nine laryngeal cartilages, three singles and three pairs. The arytenoids are located at the upper, posterior border of the cricoid cartilage. These two pyramidal structures articulate with the cricoid in the triangular areas marked.

**Figure 2**

(not shown here)

Magnetic images of the larynx in a case of arytenoid subluxation. A) The arrow points to the cricoid lamina, just below the vocal cord. B) At the level of the arytenoids, the arrow points to an anterior-medial and inferiorly displaced arytenoid cartilage protruding into the airway.

(From Hoffman, et. al.; Used with permission of the author and publisher.)

**Figure 3**

(not shown here)

Arytenoid subluxation is most commonly diagnosed by indirect or fiberoptic laryngoscopy. The drawing on the left shows a normal appearing vocal cord and arytenoid. On the right, there is evidence for arytenoid injury or subluxation. The arytenoid appears to be displaced and the vocal cord is bowed and in an intermediate position.

