

CASE REPORT

CARDIAC ANESTHESIA

Laryngeal granuloma formation following endotracheal intubation for coronary artery bypass grafting surgery

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Abstract

Laryngeal granuloma formation is an uncommon complication following endotracheal intubation. We describe a case wherein a pedunculated laryngeal granuloma developed following endotracheal intubation for coronary artery bypass grafting (CABG) surgery. The intubation was atraumatic, and extubation in the ICU was without complication. Following an initial uneventful recovery, the patient developed laryngopharyngeal reflux and contracted an upper respiratory infection (URI), at which point she progressively developed hoarseness of voice and foreign body sensation over a period of three months. We present her case discussing the management of a massive pedunculated laryngeal granuloma.

Key words: Laryngeal Granuloma; Vocal Cord Granuloma; Endotracheal Intubation; Laryngopharyngeal Reflux.

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1. Introduction

Laryngeal granulomas are benign lesions that can occur following endotracheal intubation.¹ Though more commonly occurring as a complication of long-term endotracheal intubation; laryngeal granulomas have been reported developing following 3.5 h of endotracheal intubation time.² The granulomas usually manifest as lesions that may be unilateral or bilateral; spherical; sessile; or pedunculated; they may also overlie the cartilaginous portion of the vocal cords or arytenoids.^{1,2} These lesions stem from reactive inflammatory process to local injury or irritation.¹ Patients with laryngeal granulomas exhibit hoarseness of voice; foreign body sensation; sore throat; dysphonia; and dyspnea.³ We present a case of laryngeal granuloma following endotracheal intubation and CABG surgery.

2. Case Report

A 40-year-old female with past medical history significant for diabetes; hypertension; obesity (BMI: 32 kg/m²) and CABG presented for laryngeal granuloma resection. Six months prior to her scheduled granuloma resection; she underwent a double vessel CABG. The patient was noted to be easily ventilated; and intubation was uneventful and atraumatic. A grade 1 view was obtained using a McGRATH™ MAC video laryngoscope (Medtronic; Northridge California); a 7.0 endotracheal tube (ETT) was placed on the first attempt and taped to the right side of the mouth. The CABG operation lasted for 4.5 h; with a cardiopulmonary bypass (CPB) time of 75 min. The patient was extubated 4.5 h after the case was completed. Her post-operative transthoracic echocardiogram noted normal left

ventricular systolic function; ejection fraction of 60–65%; and mild mitral valve regurgitation.

Three months after the CABG; the patient contracted an upper respiratory tract infection of unknown etiology. At that time; she began experiencing a chronic cough; mild hoarseness of voice; and foreign body sensation. She was subsequently evaluated by an otolaryngologist; who performed a fiberoptic evaluation in the clinic and noted "a cystic lesion attached to the right posterior cord which 'ball valved' on phonation. Bilateral true cords normal and mobile; no arytenoid erythema or edema noted" (Figure 1).



Figure 1 (A & B): Pedunculated laryngeal granuloma attached to the right posterior vocal cord via a thin stalk

The patient was diagnosed with laryngopharyngeal reflux and started on omeprazole—a proton pump inhibitor. Following two weeks of omeprazole treatment; the patient's hoarseness of voice mildly improved. However; the granuloma remained unchanged on repeat fiberoptic examination; and the patient was scheduled for surgical resection.

The anesthesiology and otolaryngology teams formulated an anesthetic and surgical management plan prior to the scheduled date of surgery. Due to the location and size of the granuloma; as well as the extremely thin stalk attaching it to the right vocal cord there were serious concerns regarding both ventilation and intubation. Specifically; dislodging the granuloma into the trachea with airway instrumentation; potential bleeding; and adequate space to place an ETT. The plan included: holding dual antiplatelet therapy in concert with cardiology; preinduction arterial catheter and awake intubation; and immediate availability of percutaneous transtracheal jet ventilation and tracheostomy equipment.

On the day of surgery; a preinduction arterial catheter was placed and the patient was prepped for an awake fiberoptic intubation. A MADgic® atomizer (Teleflex; Morrisville; NC; USA) was used to topicalize the airway by serially applying 8 ml of 4% lidocaine to the tonsillar pillars and oropharynx. The patient was then brought to

the operating room and placed in the sniffing position with otolaryngologist at bedside. The neck was marked; and the surgeon was available for emergency cricothyroidotomy.

Glycopyrrolate 0.1 mg was administered intravenously (iv) and dexmedetomidine infusion was initiated at 0.5 µg/kg/h. A Glidescope® (Verathon; Bothwell; WA USA) was inserted while the patient was breathing spontaneously. However; this provided a partial view of the glottis as the airway was anterior and mobile. The decision was made to increase the depth of anesthesia using sevoflurane while maintaining spontaneous ventilation. The subsequent Glidescope® view demonstrated the granuloma stalk located on right posterior vocal cord; which moved into the glottic opening then to a subglottic position during spontaneous ventilation. The position of granuloma did not change location with rotation of the patient's head or neck to the right or left side.

After establishing that the patient could be ventilated by hand; the team then opted to relax the vocal cords using a remifentanyl iv bolus (0.5 µg/kg). When the vocal cords relaxed; the granuloma resided centrally and encompassed the majority of glottic opening. The patient could still be ventilated by hand; although there was a more resistance to air flow now. Due to its size and location; there was inadequate space to place a 5.0 MLT® (microlaryngoscopy tube) or Cook® Airway Exchange Catheter (Cook Medical; Bloomington; IN; USA) without risk of bleeding or dislodging the granuloma.

At this point; the teams agreed that the otolaryngologist would surgically remove the laryngeal granuloma from its stalk; followed by endotracheal intubation. A laryngoscope was then inserted into the oral cavity to the level of the cords and placed in suspension. The granuloma was grasped with alligator forceps and resected. The patient was then intubated with a 5.0 MLT® (Medtronic; Inc.; Minneapolis; MN) The base of the granuloma stalk along the posterior right vocal cord

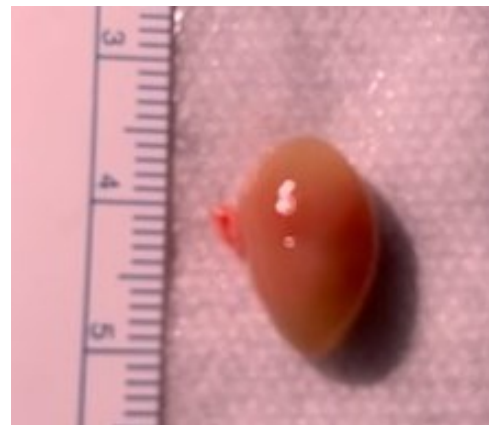


Figure 2: Laryngeal granuloma following resection

bled slightly. This was treated with oxymetazoline and adrenaline pledgets application to the vocal cord. Once hemostasis was obtained; the endotracheal tube was removed; and the larynx inspected. The patient tolerated the procedure well and was then transported to the post-anesthesia care unit (PACU) in stable condition. Figure 2 shows the resected granuloma.

3. Discussion

Laryngeal granulomas can develop following airway manipulation and lead to significant morbidity. Laryngeal granulomas typically form on the posterior aspect of the vocal cords; vocal process of the arytenoids; or posterior cricoid plate in the subglottic larynx. These patients typically present with hoarseness; and may also report dysphonia; dyspnea; pharyngodynia; and foreign body sensation after surgery.^{3;14}

The development of laryngeal granulomas is associated with obesity; short neck; hereditary airway anomalies; laryngopharyngeal reflux; fragile laryngotracheal mucosa; and female sex.^{2;4} Women account for 70–90% of all laryngeal granulomas; potentially due to a narrower glottis and lower glottic proportion.^{3;5;6} Laryngeal granuloma formation is also linked to traumatic intubation or extubation; oversized ETT; excessive cuff pressure; improper cuff location; extensive head and neck positioning; positioning of the ETT; and duration of endotracheal intubation.² Laryngeal granulomas are generally associated with prolonged intubation (greater than 3 days) but can also occur after short-term intubation.

Both URI and laryngopharyngeal reflux can magnify the risk of laryngeal granulomas following extubation.^{15;16;18} Infection and persistent reflux can lead to inflammation and disruption of normal tissue healing; exacerbating the effects of trauma to the larynx.^{15;17} This physiology could explain the delayed and progressive presentation of laryngeal granulomas.

Preventative strategies may reduce the incidence of laryngeal granuloma. This includes use of smaller ETT size; minimizing duration of intubation; attention to cuff pressure (less than 20 to 30 cmH₂O); judicious use of nitrous oxide; use of muscle relaxants and maintenance of adequate depth of anesthesia to avoid reflex movements of the cords around the tube; prevention of excessive flexion or extension of the neck; and avoidance of traumatic intubation and extubation. These strategies may reduce the risk of injury and tissue ischemia.^{12;13;14}

Though most laryngeal granulomas result from traumatic intubation; they can occur even after routine intubation.¹³ Endotracheal intubation utilizes a right-sided approach; with the ETT secured to the patient's

right oral commissure. In turn; the right-sided laryngeal mucosa is more frequently injured during this process. Moreover; taping the ETT to the right side may unevenly place pressure on the right vocal cord and provide a nidus for inflammation and subsequent granulation.¹³

Events during CABG surgery may have played a role; as well. Cardiopulmonary bypass (CPB) is associated with non-pulsatile blood flow; ischemia-reperfusion injury; cytokine release; and poor tracheal and esophageal perfusion.^{19;21;22} Hypothesized mechanisms include lateral traction on the subclavian arteries during median sternotomy; direct trauma; thrombosis; or hematoma formation due to central venous thrombosis; hypothermic injury related to ice slush placed in the pericardial and pleural cavities during CABG; undue pressure from nasogastric tubes or Transesophageal Echo (TEE) probe.¹⁴ TEE probe insertion can elevate ETT cuff pressure while on-pump during CPB and may place the tracheal mucosa at risk of hypoperfusion.²⁴ Physical pressure on the ETT from the TEE probe may have been transmitted to the right vocal cord during the operative case. TEE use and physiologic changes during cardiopulmonary bypass may have magnified the patient's risk; however; this may represent an association and not a direct causal event.

Referral to an otolaryngologist should occur in any patient reporting hoarseness lasting greater than one week.¹⁴ A fiberoptic laryngoscopic evaluation can be performed by the otolaryngologist in clinic and provide a diagnosis. Treatment for laryngeal granulomas include simple observation; steroidal inhalation; proton pump inhibitor (PPI); voice therapy; botulinum toxin injection; and surgical resection.^{1;7} Involvement of a speech-pathologist may aid in diagnosis and enhance recovery. When conservative management fails or when respiratory distress is imminent; surgical intervention is warranted.²⁵ In patients who require surgical excision; the risk of recurrence can approach 92%.⁹ The use of radiotherapy may reduce the rate of recurrence following granuloma resection.¹⁰

4. Conclusion

Laryngeal granuloma formation is a known; but uncommon complication following endotracheal intubation. Increased healthcare provider awareness of laryngeal granulomas may result in timely recognition and reduce the risk of its sequelae; including airway compromise. Clinicians should maintain a high level of suspicion when a patient presents with hoarseness; dysphonia; dyspnea; pharyngodynia; and/or foreign body sensation following airway manipulation. In any patient reporting these symptoms lasting greater than one week following endotracheal intubation; referral to an otolaryngologist is warranted.

5. Conflict of interest

The authors declare no conflict of interests and no external or industry funding was involved.

6. Authors' contribution

TQD: literature search; manuscript editing.

AR: literature search; manuscript editing

CL; HSW; AHC: manuscript editing

7. References

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