Innominate Artery Resection to Prevent an Impending Tracheoinnominate Fistula and to Permit Tracheotomy in a Patient with Subglottic Stenosis and High Riding Innominatc artery

Joshua Tokita, MD1; Raymond Kung, BS1; Kalpaj Parekh, MD2; Henry Hoffman, MD1
1Department of Otolaryngology – Head and Neck Surgery, University of Iowa Hospitals and Clinics; 2Department of Cardiothoracic Surgery, University of Iowa Hospitals and Clinics

ABSTRACT

Objectives: Tracheoinnominate fistula (TIF) is a rare but fatal complication for tracheostomy-dependent patients. Resection of the innominate artery may be a viable option for patients with warning signs of an impending TIF. This study seeks to determine the long-term viability of innominate artery resection and tracheotomy for a patient at high risk of developing a TIF in the setting of subglottic stenosis and a high riding innominate artery.

Study Design: Retrospective review of patient chart.

Methods: Analysis of a case with two year follow-up.

Results: A 45 year old diabetic male with untreated obstructive sleep apnea and multiple admissions for coma and delirium tremens associated with alcohol abuse developed subglottic stenosis presumed to result from multiple intubations coupled with untreated gastroesophageal reflux. He was found to have a palpable supravacular pulse during preoperative examination for a tracheotomy. A CT scan revealed a high riding innominate artery at the level of stenosis along with granulation tissue and disruption of the cartilaginous trachea suggesting a high risk of impending TIF. The patient underwent a mini sternotomy approach resection of the innominate artery with closure of the distal stump with a sternohyoid muscle flap. Intraoperatively, a plane of dense adhesions between the posterior innominate artery and the trachea was dissected sharply. The anterior tracheal wall appeared calcified, however, there was no evidence of erosion of either the trachea or the artery. Six weeks later an epithelial lined tracheotomy was performed. Follow-up twenty-seven months after the innominate artery resection identified the absence of complication from the innominate artery resection.

Conclusions: Resection of the innominate artery is an option for some patients to address either the warning signs of TIF or to permit a tracheotomy to be performed in the presence of a high innominate artery.

INTRODUCTION

Tracheoinnominate fistula (TIF) is a rare but fatal complication for tracheostomy-dependent patients. Even with surgical intervention, the survival rate remains an absurd 25%. Previous cases of prophylactic innominate artery ligation prior to tracheostomy have been reported however it is not a routine procedure. This study seeks to determine the long-term viability of innominate artery resection as a prophylactic measure in a patient at high risk of developing a TIF as well as to permit the safe placement of a tracheotomy as definitive treatment for the patient’s subglottic stenosis.

CASE REPORT

A 45-year-old diabetic male with a history of subglottic stenosis resulting from a combination of multiple previous intubations and untreated gastroesophageal reflux, untreated obstructive sleep apnea and multiple admissions for aspiration pneumonia and delirium tremens associated with alcohol abuse presented with alcohol intoxication and stridor at a regional medical center. Within twenty-four hours, he required intubation due to respiratory fatigue and was noted to be a difficult intubation by the operator. He was then transferred to a tertiary care center for a tracheotomy and further management.

He arrived intubated with a 5.5 cuffed endotracheal tube and was noted to have a palpable supraclavicular pulse. Chest computed tomography (CT) confirmed the presence of a 2cm long x 1cm diameter stenotic airway just superior to the thoracic inlet and a high-riding innominate artery at the level of the stenosis with disruption of the adjacent cartilaginous trachea and formation of granulation tissue.

Bronchoscopy revealed granulomatous tissue encroaching from the anterior cartilaginous membrane with a 6 mm opening in the proximal trachea (Figure 2). Due to the high risk of TIF, the patient underwent resection of the innominate artery via a mini sternotomy approach and closure of the distal stump with a sternohyoid muscle flap. Intraoperatively, a plane of dense adhesions between the posterior innominate artery and the trachea was dissected sharply. The anterior tracheal wall appeared calcified, however, there was no evidence of erosion of either the trachea or the artery. Six weeks later, an epithelialized tracheotomy was performed. Though he did not have any symptoms related to it, postoperative follow up at twenty seven months was remarkable for an inability to obtain blood pressure in the right upper extremity using sphygmomanometer. There were otherwise no complications resulting from the innominate artery ligation.

DISCUSSION

Several approaches were considered in treating the patient’s tracheal stenosis. He was initially considered a candidate for tracheostomy due to his recurrent tracheal stenosis and untreated obstructive sleep apnea. However, his history of diabetes, and the location of his high-riding innominate artery increased his risk of developing a TIF following a standard tracheotomy. A second option was to treat his stenosis using microdirect laryngoscopy followed by local ketanest, injection and possible use of the microcuvad or balloon dilatation. However, the chest CT demonstrated disruption of the cartilaginous trachea abutting the innominate artery along with granulation tissue. Thus, the second option was abandoned. Placement of a long term croithotomy was also considered, but was deemed suboptimal in light of possible complications including subglottic stenosis, tracheomalacia, dysphonia or aphonia[9]. Mediastinal tracheostomy was also considered as a possible approach, however, this procedure has a high mortality rate and is usually reserved for 1) carcinoma invading the subglottic larynx; 2) sternal resection, after laryngectomy, or 3) well-differentiated thyroid carcinoma invading the trachea[11]. To address both the tracheal stenosis and to avoid a TIF, a staged approach involving prophylactic ligation of the innominate artery followed by a tracheotomy was decided upon. This approach would move the innominate artery out of the field of the tracheotomy.

Though surgical management of TIF has been extensively discussed in the literature, innominate artery ligation as TIF prophylaxis has not been as frequently described. Iodice et al. reports prophylactic innominate artery ligation in seven patients who had previously received a tracheotomy[10]. Obatake et al. describes prophylactic innominate artery ligation in neurologically impaired children requiring a tracheostomy[2] and Hisamatsu et al. suggests it as a viable prophylactic measure in patients with severe chest deformities resulting in tracheal compression by the artery[3]. The present case illustrates a scenario where optimal treatment of the primary pathology (tracheal stenosis) is complicated by the high risk of developing a TIF. Ligation of the innominate artery carries a 5% risk of stroke, the procedure is generally well tolerated, particularly when carried out electively rather than in an emergency situation[8]. In this case, innominate artery resection not only significantly decreased the risk of TIF, but also allowed for successful creation of an optimally placed epithelial lined tracheotomy six weeks later.

REFERENCES

11) Hoffman HT (ed), Iowa Head and Neck Protocols “Mediastinal tracheostomy for total laryngectomy with sternal resectionhttps://wiki.uiowa.edu/display/protocols/Mediastinal+tracheostomy+for+total+laryngectomy+with+resection+of+manubrium

CONCLUSIONS

The success rate of innominate artery ligation as prophylaxis for TIF is far higher when performed as an elective procedure rather than as an emergency intervention. While prophylactic innominate artery resection is not a routine procedure for patients at risk of developing a TIF, it may be a viable option for some patients to address either the warning signs of TIF or to permit a tracheotomy in the presence of a high-riding innominate artery.

Contact
Joshua Tokita MD
University of Iowa Hospitals and Clinics
Dept of Otolaryngology – Head and Neck Surgery
206 Hawkins Dr
Iowa City, IA, 52242
jtokita@uihealthcare.com