Aberrant Innominate Artery: A Possible Hazard During Total Laryngectomy

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Background: Surgical management in laryngeal carcinoma remains a challenge with countless unexpected complications. Great vessel anomalies such as anomaly of the innominate artery carry high risk of morbidity and mortality if not managed properly.

Methods: We present our first experience with an aberrant innominate artery during total laryngectomy which complicated the whole surgical procedure and tracheostoma placement.

Results: We decided to place a pectoralis major muscle flap to separate and cover up the aberrant vessel from the trachea and end-stoma which ultimately did not lead to major complications postoperatively and postradiation therapy.

Conclusion: Aberrant innominate artery is an extremely rare entity and failure of recognizance can lead to hazardous complications. Preoperative angio-graphy needs to be done if there are high suspicions of aberrant vessels in the operative field. Careful dissection of the head and neck region, and prompt decision making are mandatory to manage such cases.

Key Words: Aberrant innominate artery, total laryngectomy, laryngeal carcinoma.

Levels of Evidence: Case Report

INTRODUCTION

In laryngeal carcinoma, where the principle of “organ preservation” therapy has failed and salvage surgery is indicated, or in advanced laryngeal carcinoma, total laryngectomy is indicated. Total laryngectomy addresses whole larynx as well as jugular chain lymph nodes removal and this operative procedure poses a great challenge for head and neck surgeons. Especially, intraoperative end-stoma placement and neopharynx reconstruction can be challenging. Any abnormality of the great vessels in this narrow-field operative region, especially of the innominate or carotid arteries, will complicate the surgical procedure and therefore increases the risk of morbidity and mortality. As a routine, preoperative imaging must be performed and meticulously reviewed to assess the tumor extension and to identify abnormalities that may contribute to any catastrophic event or unexpected intraoperative finding.

We report a case of total laryngectomy for advanced laryngeal carcinoma in which we discovered an aberrant innominate artery which led to complicated surgery and eventually to the placement of the tracheostoma. This case report will emphasize the importance of knowledge and awareness of vascular anomalies and impetuous decision making for future cases. This is perhaps the first case describing aberrant innominate artery course found during total laryngectomy in English literature thus far.

CASE REPORT

An 80-year-old woman with underlying Wegener’s disease, asthma, and hypothyroidism who was a heavy smoker for 60 years presented to our clinic with a few years existing progressive hoarseness. She also complained of intermittent dysphagia, odynophagia, or any constitutional symptoms. She had no dysphagia, odynophagia, or any constitutional symptoms.

The patient underwent multiple microlaryngeal endoscopy and biopsy procedures which consistently revealed features of laryngitis or local flare of her Wegener’s disease. Histopathological examination of the biopsies revealed reactive leukoplakia with no evidence of malignancy. At this point, she was treated with oral steroids for 17 days; however, her complaints persisted even after a few weeks of oral steroids treatment.

Persevering hoarseness and nonconclusive biopsies warranted further investigation. We performed a dual-energy contrast-enhanced Computed Tomography (CT) scan which showed soft tissue expanding in the laryngeal region over a course of 15 mm unto the paralaryngeal fat (see Fig. 1a, 1b). The CT revealed a cT4N0M0 transglottal laryngeal carcinoma, with involvement of the paraglottal fat tissue and...
extralaryngeal extension at the subglottic level. Prior to the surgery, the case was discussed in a routine tumor board meeting. Only surgery and/or radiation therapy were the possible options in this case, with the patient preferring surgery. At that point of time, further investigations were not indicated as there were no suspicions of aberrant vessels.

During the procedure, an aberrant innominate artery was encountered, positioned anterior and horizontally over the third and fourth tracheal ring, therefore obstructing normal end-stoma placement (see Figs. 1 and 2). This complicated the surgery and thus increased the perioperative and postoperative risks tremendously. The aberrant innominate artery required quick intervention and procedural switching, because normal end-stoma placement would be directly on the innominate artery and would therefore be hazardous over time. To separate and to cover up the aberrant vessel from the trachea and end-stoma, placement of a muscle-only pectoralis major flap was the best surgical intervention available. The surgical team preferred to use the pectoralis major flap compared to the choice for other flaps. The pectoralis major muscle flap is a one-stage procedure and the
most reliable flap in this kind of surgery. The length of the flap can be modified to cover the vessel in either direction.

DISCUSSION

Although in approximately 1.2% of the cases anomalies of the carotid arteries were found and reported, the incidence of aberrant innominate arteries is still scarce and yet to be discovered.3,4 The innominate artery, or brachiocephalic trunk, is the first largest branch arising from the aorta, normally ascending posterolateral on the right side of the trachea and dividing into the right common carotid artery and right subclavian artery, posterior to the sternoclavicular joint. Normally the innominate artery has a straight course. Nevertheless, it has been reported to have congenital anomalies such as left brachiocephalic or retroesophageal origin, or the innominate artery can have an aberrant course such as high brachiocephalic bifurcation or tortuosity, as seen in our case.3,4

For a practicing head and neck surgeon, an aberrant innominate artery may jeopardize the surgical procedure, specifically in thyroidectomy, parathyroidectomy, or tracheostomy as reported.5 Choi et al have reported a similar case concerning the tortuous carotid artery, whereby it was encountered during laryngectomy and routine neck dissection which was not detected preoperatively. Intraoperative intervention required only repositioning of the carotid to its usual position.7 However, in our case, it was impossible to reposition the innominate artery, because it crossed anterior and horizontally over the third and fourth tracheal ring, therefore obstructing normal end-stoma placement.

Temporary tracheostomy placement would involve a significant risk of erosion or injury of the adjacent vessel postoperatively, secondary to the patient’s neck movements. Being aware of these risks, we knew intervention was required to cover and to separate the tortuous innominate artery from the end-stoma.8 Recognition of the aberrant artery was important and necessary to avoid catastrophic hemorrhage or unexpected complications postoperatively.8–10 The decision to place a muscle-only pectoralis major flap to separate and to cover up the aberrant vessel from the trachea and end-stoma was impetuous. The vascular surgeon as well as the plastic surgeon helped with the reconstruction. This was the best outcome at that point during surgery, because we possibly needed to radiate the neck as well.

It is neither cost-effective nor significant to have a Computed Tomography Angiogram (CTA) angiogram for all patients undergoing head and neck surgery with the aforementioned incidence of aberrant innominate arteries. However, all patients with an unusual pulsatile neck mass during preoperative clinical examination need to undergo Computed Tomography Angiography (CTA) evaluation.11 Some authors suggested preoperative color-coded duplex sonography evaluation of the vessels in addition to CT imaging.5,12 In addition to that, 3-Dimensional Computed Tomography (3D-CT) imaging was preferred if no abnormalities were detected on 2-Dimensional Computed Tomography (2D-CT) imaging. With 3D-CT imaging being superior to 2D, vital information about the size, length, location, and course of the carotid and innominate arteries can be obtained. This can guide head and neck surgeons to the optimal surgical approach and prevent unnecessary, unplanned intervention of the procedure (see Figs. 3 and 4, and the Supporting Video 1 fragments).3

Surgeon’s awareness, experience, and knowledge of aberrant innominate arteries can avoid significant potential hazards during head and neck surgery. This is particularly important in total laryngectomy with end-stoma placement procedures. Although the incidence of aberrant innominate arteries is scarce and rare, encountering one brings additional risks with possible disastrous consequences, requiring knowledge of its course and careful approach and assessment by the surgeon.12 Fortunately in this case, intraoperative utmost wise decision making and experience led to quick intervention preventing major postoperative or postradiation therapy complications.

CONCLUSION

Aberrant innominate artery is an extremely rare entity and failure of recognition can lead to hazardous complications. Preoperative angiography with 3D-CT reconstruction needs to be done if there are high suspicions of aberrant vessels in the operative field. Careful dissection of the head and neck region, and prompt decision making with the vascular and reconstructive team to standby are mandatory to manage such cases.

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