Hemostasis in Airway Surgery

Adult and Pediatric

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KEYWORDS

• Tracheoinnominate fistula • Subglottic stenosis • Airway hemangiomas
• Recurrent respiratory papillomas • Airway lasers

KEY LEARNING POINTS

At the end of this article, the reader will:

- Know if bleeding is expected in the majority of laryngotracheal procedures.
- Be able to identify which injuries can result in potentially fatal bleeding during tracheal surgery.
- Know the factors that contribute to delayed hemorrhage risk after airway surgery.
- Be able to identify the surgical anatomy of the great vessels around the trachea, and the vascular supply to the larynx.
- Know which endoscopic instruments can be associated with bleeding risk during endoscopic airway surgery.
- Know which techniques can be used to mitigate bleeding in the airway.

INTRODUCTION

Bleeding during airway surgery

- Unlikely, but possibly devastating, early or late complication of tracheal surgery.[1–13]
- Potential trauma during thermal control to important adjacent structures (ie, recurrent laryngeal nerve).
- Medical morbidities include:
  - Potential for added morbidity owing to airway obstruction when bleeding into the airway;
  - Hypoxia; and
  - Transfusion of blood products.

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Otolaryngol Clin N Am 49 (2016) 691–703
http://dx.doi.org/10.1016/j.otc.2016.02.007 **oto.theclinics.com**
0030-6665/16/$ – see front matter

Surgical bleeding is an unlikely, but potentially devastating, event during the surgical management of pediatric and adult laryngotracheal disorders. As such, an intimate knowledge of the anatomy of the large vessels coursing in the vicinity of the airway is imperative. A frequently cited, albeit rare, complication while approaching the trachea either during resection techniques or tracheotomy tube placement is injury to the innominate artery. It is normal for the innominate artery to ride over the trachea in the region of the suprasternal notch, usually at the level of tracheal rings 7 to 9 (Fig. 1). However, in some cases, the innominate artery may be "high riding" and cross the anterior trachea as high as tracheal ring 2. In cases where neck extension is not possible or feasible during tracheotomy surgery there is an increased risk of innominate artery injury. For this reason, it is important to be cognizant of the position of the innominate artery when performing dissection of tissues over the anterior tracheal wall surface, lower in the neck. In most cases, however, injury to the innominate artery is delayed after tracheotomy tube placement, and does not occur during the surgical procedure itself. This situation is discussed elsewhere in this paper.

Bleeding when dissecting circumferentially around the trachea, lifting it off of the esophagus, frequently results in persistent slow oozing in the posterolateral aspects of the airway wall. The tracheoesophageal party wall is a hypervascular area with a plethora of small venocapillary vessels that contribute to slow bleeding in this location. Overzealous use of cautery techniques to control this bleeding can result in thermal injury to the recurrent laryngeal nerves, because they course just lateral to the trachea in the tracheoesophageal grooves. It is essential to be meticulous with hemostasis in this location, and to avoid random, continuous, and widespread use of electrocautery. Pledgets soaked in oxymetazoline can help tremendously in reducing the esophageal party wall ooze during pediatric tracheal surgery.

When making incisions into the laryngotracheal airway during a reconstructive procedure (see details in the later discussion), slow bleeding is invariably encountered from the incised airway mucosal edges. This bleeding can be an annoyance in completing the reconstructive maneuvers (either resection or insertion of free grafts), but more importantly can create a persistent bloody drip into the lower tracheobronchial tree. Use of gentle bipolar cautery on the mucosal edges can be helpful, but again, its indiscriminate use is discouraged. It is especially useful to inject the posterior

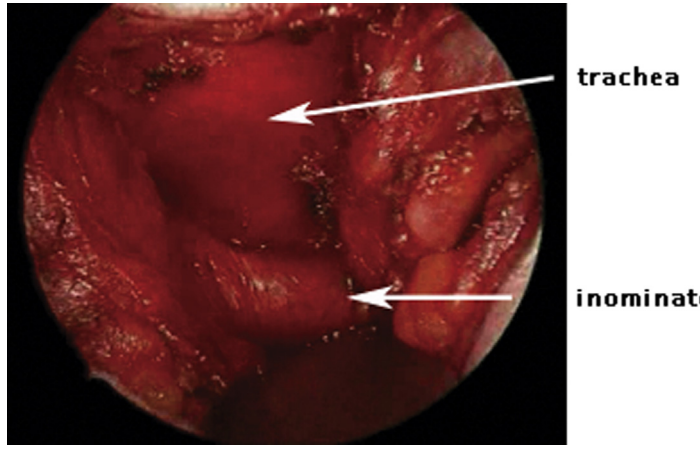

Fig. 1. Intraoperative photograph demonstrating course of innominate artery over the distal third of the cervicothoracic trachea.