
How I Do It

The Tracheotomy Punch for Urgent Tracheotomy

Ryan M. Mitchell, PhD; David W. Eisele, MD, FACS; Ron Mitzner, MD; David Goldenberg, MD, FACS

Key Words: Urgent, punch, tracheotomy, tracheostomy, emerging airway.
Laryngoscope, 120:745–748, 2010

INTRODUCTION

Tracheotomy is a commonly performed surgical procedure for access to the airway. The overwhelming majority of tracheotomies are performed as elective procedures.^{1,2} In general, there are four categories of indications for tracheotomy: long-term mechanical ventilation, upper airway obstruction, need for pulmonary toilet, and as an adjunct to surgery where mechanical ventilation or obstruction is anticipated.^{1,3,4}

A variable step in the operative tracheotomy is the method of creating an opening into the tracheal lumen. Several reports have assessed the use of single vertical or horizontal tracheal incisions and larger tracheal windows.^{5–8} Evidence suggests that the method of creating the tracheal window contributes to the degree of epithelialization, fibrosis, lymphocytic infiltration, and foreign body reaction at the stomal site, which may impact long-term complications.^{5,9} Regardless of the method of initial tracheal opening, eventually a circular tracheal defect may result due to circumferential pressure on the tracheal cartilage from the tracheotomy tube.⁷

In our institutions, the tracheotomy punch is included in all operative tracheotomy sets. It is used in all adult tracheotomies performed by the senior authors (D.G., D.W.E.). We describe five cases of urgent tracheotomy in which the tracheal punch was used to

successfully create a uniformly sized tracheal window (Table I).

MATERIALS AND METHODS

The Eisele tracheotomy punch (Pilling, Teleflex Medical, Research Triangle Park, NC) (Fig. 1 and Fig. 2) was designed to create a circular opening conforming to the diameter of a tracheotomy tube. This device easily and quickly creates a precise and standardized circular opening (Fig. 3). The instrument locks after deployment to entrap tracheal fragments, thus reducing the potential for airway foreign bodies (Fig. 4). The Eisele tracheotomy punch was modeled after the Rubio aortic punch¹⁰ used by cardiothoracic surgeons to create a hole in the wall of the ascending aorta for the purpose of coronary artery bypass.¹⁰ Such a punch device creates a precise and standardized circular opening with minimal difficulty and manipulation. The same concept applies to the use of a punch for tracheotomy. Following a horizontal tracheal incision, the tracheotomy punch is inserted into the trachea and is deployed to create a round anterior tracheal window (approximately 1.22 cm in diameter). This device has the advantage that it is easily deployed by the surgeon with one hand, leaving the other hand free to suction or retract the larynx cephalad with a hook. The punch allows the operator to rapidly enlarge the initial horizontal tracheal incision to a consistently sized opening facilitating quick tracheal cannulation.

DISCUSSION

In urgent situations, surgical means of securing an airway are the last resort after failed intubation techniques, laryngeal mask ventilation, and jet ventilation.¹¹ When feasible, emergency cricothyroidotomy is the preferred method of obtaining an emergency surgical airway due to simplicity and speed.^{12,13} Urgent awake tracheotomy may be indicated in preference to cricothyroidotomy after failure to ventilate by either mask or intubation during an elective tracheotomy.¹² Additionally, an urgent tracheotomy may be indicated at times when a cricothyroidotomy is contraindicated, such as with distorted anatomy, obstructing tumor, and laryngeal trauma.² With urgent operative tracheotomy local anesthesia may be used, and the patient may be awake.² Pulse rate, blood pressure, and oxygen saturation are monitored.⁴ A vertical skin incision is typically used for

From the Division of Otolaryngology–Head and Neck Surgery, Penn State University, Hershey, Pennsylvania (R.M.M., R.M., D.G.); and Department of Otolaryngology–Head and Neck Surgery, University of California, San Francisco, California (D.W.E.), U.S.A.

Editor's Note: This Manuscript was accepted for publication December 3, 2009.

The authors have no funding, financial relationships, or conflicts of interest to disclose.

Send correspondence to David Goldenberg, MD, FACS, Division of Otolaryngology–Head & Neck Surgery, Penn State University, 500 University Drive, PO Box 850 H091, Hershey, PA 17033-0850.
E-mail: dgoldenberghmc.psu.edu

DOI: 10.1002/lary.20836

TABLE I.
Five Illustrative Cases of Urgent Tracheotomy in Which the Tracheal Punch Was Utilized Effectively for Rapidly Creating a Uniformly Sized Tracheal Window.

Case	Age (Yr)	Sex	Pathology	Setting	Outcome
1	53	F	Nasopharyngeal carcinoma s/p chemoRT; cancer invasion of the tongue base; trismus	Planned tracheotomy for progressive dyspnea; while attempting fiberoptic transnasal intubation, the patient's oxygen saturations dropped precipitously	Successful; patient recovered without incident; remained with tracheotomy and no complications as of 2-month follow-up visit
2	49	M	Supraglottic cancer s/p chemoRT	Tumor obstruction and post-radiation changes; patient's oxygen saturations dropped precipitously necessitating urgent tracheotomy	Successful; patient recovered without incident; no complications at tracheotomy site as of 2-month follow-up visit
3	51	M	Ludwig's angina	Airway lost during intubation and attempts at reintubation unsuccessful	Successful; patient recovered without incident and was decannulated on POD 3; no complications as of 1-month follow-up visit
4	47	M	Infected hardware removal and mandible deformity ; s/p anterior mandibulectomy for oral cavity carcinoma	On extubation tongue prolapsed and airway was lost; attempts at reintubation unsuccessful	Successful; patient recovered without incident and was decannulated on POD 40; no complications at tracheotomy site as of 9-month follow-up, but received revision tracheotomy for airway protection
5	67	F	Subarachnoid hemorrhage necessitating placement of a ventriculoperitoneal shunt	Intubation unsuccessful, likely due to subglottic stenosis	Successful; patient recovered without incident; no complications at tracheotomy site as of 2-month follow-up visit; patient remains with a tracheotomy due to continuing neurologic impairment

All cases were considered urgent awake tracheotomies in which other methods of obtaining airway access were not possible or were contraindicated. There were no complications in any of these cases.

F = female; s/p = status post; chemoRT = chemoradiotherapy; M = male; POD: postoperative day.

an urgent tracheotomy, as opposed to the alternative horizontal skin incision.^{3,12} Advantages of a vertical skin incision in this setting include reduced bleeding and easier access to the midline.¹² A vertical trachea incision through the second and third tracheal rings and extending 2 to 3 mm into each ring may be made with an 11 or 15 blade.¹⁴ The vertical incision in the trachea, however, may be difficult in some adults as the tracheal rings are often calcified. Alternatively, a horizontal incision



Fig. 1. (A) The Eisele tracheal punch is easily manipulated with one hand and placed through a horizontal tracheal incision. (B) Punch creates 1.2 cm window. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

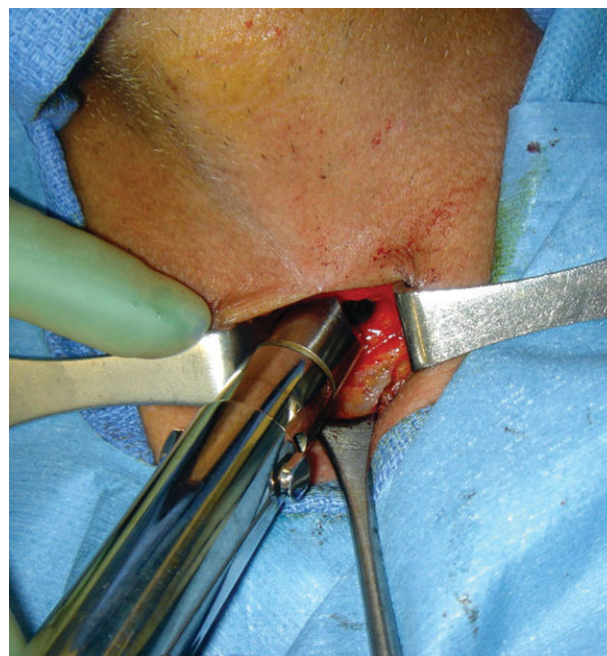


Fig. 2. The Eisele tracheotomy punch being deployed via a horizontal tracheal incision. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

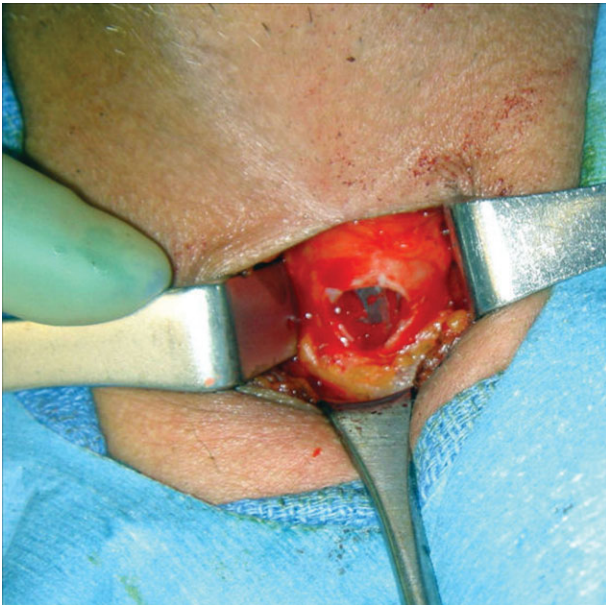


Fig. 3. A uniformly sized, round, tracheal window is quickly created. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

between the rings of the trachea may be used, but the resultant opening is usually not of sufficient size to allow successful cannulation without enlargement of the tracheal incision. One study of elective tracheotomies compared an initial 10-mm horizontal incision extended further with scissors versus a window-type tracheal incision.¹⁵ The only significant difference they found between these techniques was a faster operation time in the horizontal incision group; however, the method of

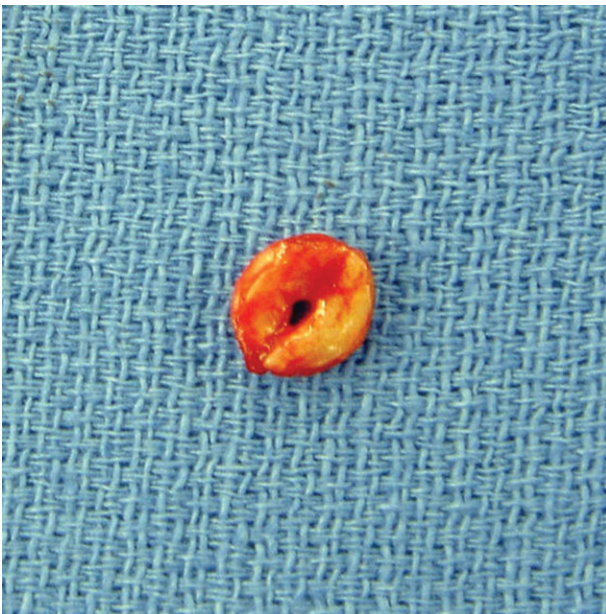


Fig. 4. Tracheal fragment after being released from the tracheal punch. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

creating the tracheal window was not described in detail.

Several methods exist for creating a tracheal window. The inferiorly based Bjork flap, or a superiorly based tracheal flap, may be used to maintain a tracheal window.^{16–18} A starplasty incision, consisting of multiple tracheal incisions and interdigitation with skin flaps, may also provide a long-term tracheal window.¹⁹ Incision of calcified tracheal rings may necessitate use of scissors. Although these methods may be successful, they can be time consuming and, thus, may be less appropriate in an urgent setting.

In a single study from 1965, Hale and Hale described a punch device for use in tracheotomy for the purpose of easily creating a tracheal opening.²⁰ This instrument was designed to create a uniformly sized circular tracheal window as an alternative to other, more technically difficult, methods. Its use in the urgent setting, however, has not been described, and the device does not appear to be in current production or usage. A tracheal fenestrator capable of producing a uniform tracheal window is currently in production (Montgomery Tracheal Cannula System; Boston Medical Products, Westborough, MA), although this device requires the attachment of external suction to prevent aspiration of the excised tracheal core.

As illustrated by the cases described, the ease of function is beneficial for the performance of an urgent tracheotomy. The cutting function of the device is sturdy, thus allowing effective resection of calcified tracheal rings.

CONCLUSION

The indications for urgent awake tracheotomy imply the necessity of fast and simple techniques that may be easily learned and performed with minimal assistance. Use of the tracheotomy punch for the performance of adult tracheotomy allows quick and effective tracheal opening and facilitates rapid airway access. These features are valuable during all adult tracheotomies, and particularly in the setting of urgent tracheotomy.

BIBLIOGRAPHY

1. Goldenberg D, Golz A, Netzer A, et al. Tracheotomy: changing indications and a review of 1,130 cases. *J Otolaryngol* 2002;31:211–215.
2. Yuen HW, Loy AH, Johari S. Urgent awake tracheotomy for impending airway obstruction. *Otolaryngol Head Neck Surg* 2007;136:838–842.
3. Scurry WC, McGinn JD. Operative tracheotomy. *Oper Tech Otolaryngol Head Neck Surg* 2007;18:85–89.
4. De Leyn P, Bedert L, Delcroix M, et al. Tracheotomy: clinical review and guidelines. *Eur J Cardiothorac Surg* 2007;32:412–421.
5. Whitley R, Castillo N, Hassett JM, et al. Early tracheostomal healing in rabbits with use of various tracheal incisions. *Wound Repair Regen* 1997;5:323–328.
6. Smith MM, Saunders GK, Leib MS, et al. Evaluation of horizontal and vertical tracheotomy healing after short-duration tracheostomy in dogs. *J Oral Maxillofac Surg* 1995;53:289–294.
7. Bryant LR, Mujia D, Greenberg S, et al. Evaluation of tracheal incisions for tracheostomy. *Am J Surg* 1978;135:675–679.

8. Fry TL, Jones RO, Fischer ND, et al. Comparisons of tracheostomy incisions in a pediatric model. *Ann Otol Rhinol Laryngol* 1985;94:450–453.
9. Natvig K, Olving JH. Tracheal changes in relation to different tracheostomy techniques. (An experimental study on rabbits). *J Laryngol Otol* 1981;95:61–68.
10. Rubio PA, Farrell EM. Aortic punch: an adjunct for cannulation of the ascending aorta during extracorporeal circulation. *Cardiovasc Dis* 1979;6:346–349.
11. Price T. Surgical tracheostomy. In: Russell C, Matta B, eds. *Tracheostomy: A Multiprofessional Handbook*. New York, NY: Cambridge University Press; 2004:35–58.
12. Dierks EJ. Tracheotomy: elective and emergent. *Oral Maxillofac Surg Clin North Am* 2008;20:513–520.
13. Goldstein B, Goldenberg D. The difficult airway: implications for the otolaryngologist-head and neck surgeon. *Oper Tech Otolaryngol Head Neck Surg* 2007;18: 72–76.
14. Bonanno FG. Techniques for emergency tracheostomy. *Injury* 2008;39:375–378.
15. Lin ZM, Chen PR, Chou AS, et al. Tracheal incision for elective tracheotomy in oral cavity cancer. *Oral Oncol* 2007;43:15–19.
16. McGregor IA, Neill RS. Tracheostomy and the Bjork flap. *Lancet* 1983;2:1259.
17. Malata CM, Foo IT, Simpson KH, et al. An audit of Bjork flap tracheostomies in head and neck plastic surgery. *Br J Oral Maxillofac Surg* 1996;34:42–46.
18. Miller FR, Eliachar I, Tucker HM. Technique, management, and complications of the long-term flap tracheostomy. *Laryngoscope* 1995;105:543–547.
19. Solares CA, Krakovitz P, Hirose K, et al. Starplasty: revisiting a pediatric tracheostomy technique. *Otolaryngol Head Neck Surg* 2004;131:717–22.
20. Hale NS, Hale MT. A new tracheotomy instrument: the Hale tracheotomy punch. *Surgery*. 1965;57:823–825.