Subcutaneous Emphysema following Emergent Surgical Conventional Tracheostomy

Leon Ardekian, DMD¹ Michal Barak, MD² Adi Rachmiel, DMD, PhD¹

¹Department of Oral and Maxillofacial Surgery, Rambam Health Care Campus, Haifa, Israel

²Department of Anesthesiology, Rambam Health Care Campus, Haifa, Israel

Address for correspondence: Adi Rachmiel, DMD, PhD, Department of Oral and Maxillofacial Surgery, Rambam Health Care Campus, POB 9602, Haifa 31096, Israel (e-mail: adi_rach@netvision.net.il).

Craniomaxillofac Trauma Reconstruction 2014;7:290–293

Abstract

Keywords

- tracheostomy
- subcutaneous emphysema
- acute airway obstruction
- postoperative complications
- hemorrhage
- treatment outcome

In maxillofacial surgery, tracheostomy is indicated in congenital, inflammatory, oncologic, or traumatic respiratory obstruction. In traumatic cases, however, it is sometimes hard to implement. We describe subcutaneous emphysema following emergent surgical conventional tracheostomy performed after stab injury to the floor of the mouth. We analyze the course that led to this complication and discuss suggestions on how to avoid it. In addition, we review the literature to improve our knowledge and practice regarding this entity. Massive subcutaneous neck emphysema occurred because ventilation started at the time when the hemorrhage was not completely managed and the tracheal tube was not fully secured. In traumatic cases with profound bleeding, hemorrhage management must be performed carefully. The recommendation not to ventilate until the hemorrhage is completely managed should be observed.

Tracheotomy has been used for centuries in the severely ill patient with acute respiratory obstruction. As the incidence of the 19th century threats such as diphtheria, croup, and laryngitis declined, the operation came to be performed only occasionally, particularly as the high mortality and complication rates associated with the use of tracheotomy/tracheostomy in diphtheria were still vivid. After a short while, however, it again became a routine procedure at intensive care units as well as a common procedure performed by a variety of surgical specialties. The use of tracheostomy has undoubtedly prevented many deaths from diseases which formerly were inevitably fatal. However, the former high complication rate may well have been overlooked as enthusiasm for the operation increased, and little information is now available on the incidence and types of complications of tracheostomy.

Patients with injuries of the maxillofacial area may need tracheostomy as well, in cases where their status of respiration is severely impaired.¹ Such trauma patients usually have tracheostomy for continued airway support. Traumatic

wounding to the upper aerodigestive tract and stab injury to the mouth, in particular, can cause acute airway compromise.² Taicher et al³ concluded that in maxillofacial injuries surgically securing the airway by tracheostomy should be revised and other available methods should be considered. In the era of rigid fixation of fractures and the possibility of leaving the patient with an open mouth, it is unnecessary to carry out tracheostomy for securing the airway as frequently as in the past. The decision to place a tracheostomy should be made by considering the balance between benefits versus risks of the procedure. Indeed, tracheotomy/tracheostomy is associated with several complications such as tracheitis, shallow necrotic ulcers, structural deformity of the trachea, dilatation of the lumen of the trachea, emphysema, pneumothorax, and more.^{4,5} Displaced or obstructed tubes can be added to the list of complications which can be immediate or late.

The current case describes subcutaneous emphysema following emergent surgical conventional tracheostomy performed in a patient with a stab injury to the floor of the

received

September 22, 2013

accepted after revision

December 10, 2013

published online

June 17, 2014

Copyright © 2014 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0034-1378186>.
ISSN 1943-3875.

mouth. In this article, we analyze the course that led to this complication and discuss recommendations on how to avoid it. In addition, we review the literature regarding this rare complication.

Case Presentation

A 35-year-old healthy male was brought to the emergency room of our institution with a stab wound at the floor of the mouth. Upon arrival, massive arterial and venous bleeding from the floor of the mouth was present. Because of a significant risk of loss of airway patency, the risk of vomiting with subsequent aspiration, and the need for surgical treatment, a secure airway was necessary. Initial signs of respiratory distress were observed and endotracheal intubation was suggested. Although oxygen saturation was monitored, an attempt to intubate the patient and to secure the airway failed because of the mouth elevation and edema of the tongue (►Fig. 1).

After initial reduction of the bleeding, the patient was brought to the operating room and surgical tracheostomy was performed (►Fig. 2). The incision was made between the third and the fourth tracheal rings. The operation was performed following the standard protocol and a cuffed tracheal cannula was inserted. The patient was then sedated. The bleeding in the floor of the mouth was eventually managed after exploration and ligation of the bleeding vessels. One day after the surgery, however, the patient started to bleed

Figure 2 The patient after tracheostomy.

Figure 1 Elevation of floor of mouth after hemostatic suturing.

around the cannula. This hemorrhage did not cause obstruction either by clot formation within the lumen of the trachea or tracheostomy tube, or by flooding of the lower respiratory tract. During examination, subcutaneous emphysema was diagnosed (►Fig. 3). Head, neck, and mediastinum computed tomography (CT) was performed and revealed massive air collection in the neck soft tissue structures (►Fig. 4A, B). No pneumothorax was identified on subsequent chest X-ray and CT. The patient was transferred again to the operating room and the sutures around the tracheostomy site were released. The emphysema decreased and disappeared 3 days after tracheostomy and release of the sutures. The patient was decannulated after 4 days. Stomal closure occurred within 7 days with a minimal residual scar (►Fig. 5A, B). At 6-month follow-up, no tracheitis, pulmonary infections, structural deformity of the trachea, or other complications were noted.

Discussion

“When emphysema occurs after the opening of the trachea - and this is the stage at which it commonly occurs - it is usually because the wound in that organ does not correspond in situation with the wound in the skin and fat, and the obvious treatment is to enlarge the latter, either upwards or downwards, or in both directions.”

This was written in 1877⁶!

Figure 3 Neck swelling and emphysema 1 day after hemostasis.

While not exactly the case, the presented case is less about the achieved success in treatment of the complication and more about the medical error that led to this complication. Complications of tracheostomy are generally preventable and can be avoided by careful operative technique and by meticulous attention to correct postoperative management. Emphysema, subcutaneous and mediastinal, is usually a consequence of incorrect suturing of the wound. Indeed, as it was said in 1877, it is induced by incorrect positioning of the tissues to be sutured.

In this particular case, the emphysema occurred because ventilation started at the time when the hemorrhage was not completely managed and the tracheal tube was not fully secured. The closure of the soft tissues did not allow air to escape and would also explain an increased incidence of emphysema after tracheostomy. The recommendation not to ventilate until the hemorrhage is completely managed is clear and self-evident. In traumatic cases, however, this is sometimes hard to observe. In general maxillofacial surgery, tracheostomy is indicated in congenital, inflammatory, oncologic, or traumatic respiratory obstruction. In traumatic cases with profound bleeding, hemorrhage management might take significantly more time in comparison with, for example, inflammatory or oncologic cases. Meanwhile, as the recent (2011) report on tracheostomy in maxillofacial surgery shows approximately 36% of patients who required tracheostomy had suffered trauma.⁷ In this report, subcutaneous emphysema occurred in 13% of cases and bleeding in 16.2% of cases. This indicates that the problem is not solved yet and perhaps further improvement of the surgical technique is needed. If the surgical technique is adequate, the rate of complications can be insignificant. Another recent (2012) research on tracheostomy indications and perioperative complications in oral and maxillofacial surgery service indicated overall complication rate of 2.7%.⁸ The authors of this research concluded that conventional open tracheostomy in an operating room is associated with a low complication rate. A management plan that was recently suggested for posttracheotomy subcutaneous emphysema can hardly be implemented in all cases because cases vary significantly.^{9,10}

The last topic we would like to address is the ongoing discussion on conventional open tracheostomy versus percutaneous tracheostomy. It was recently reported that percutaneous tracheostomy is easier to perform, with less blood loss, and lower incidence of subcutaneous and mediastinal emphysema than conventional surgical tracheostomy.¹¹ While in the presented case conventional tracheostomy was complicated by emphysema, our general experience discourages us from supporting this point of view. Regarding emphysema, in particular, there are numerous reports in the literature on surgical

Figure 4 Head and neck computed tomography shows air infiltrating the neck soft tissue structures. (A) Axial view. (B) Three-dimensional reconstruction of anterior view.

Figure 5 Decrease in swelling and stomal closure, 1 week after decannulation. (A) Mouth open and (B) mouth closed.

emphysema following percutaneous tracheostomy.^{12–15} These reports suggest frequent posterior tracheal wall laceration. This has never been our experience with conventional open tracheostomy. Some reports describe massive subcutaneous emphysema following percutaneous tracheostomy^{16,17}; however, this can hardly be the case when open tracheostomy is used. Although percutaneous dilatational tracheostomy has become a routine procedure for airway management in critically ill patients, this operation is associated with serious complications no less than conventional tracheostomy.^{18,19} We believe that both techniques require further improvement.

References

- 1 Tanner D. Emergency care of maxillo-facial injuries. *Can Med Assoc J* 1967;96(4):219–220
- 2 Mepani VN, Antscherl J. A tricky tracheotomy: airway management dilemma following unusual stab injury to the mouth. *Ann R Coll Surg Engl* 2012;94(1):e28–e29
- 3 Taicher S, Givol N, Peleg M, Ardekian L. Changing indications for tracheostomy in maxillofacial trauma. *J Oral Maxillofac Surg* 1996; 54(3):292–295, discussion 295–296
- 4 Miller JD, Kapp JP. Complications of tracheostomies in neurosurgical patients. *Surg Neurol* 1984;22(2):186–188
- 5 Stock MC, Woodward CG, Shapiro BA, Cane RD, Lewis V, Pecaro B. Perioperative complications of elective tracheostomy in critically ill patients. *Crit Care Med* 1986;14(10):861–863
- 6 Cameron HC. Clinical observations on cases of tracheotomy. *BMJ* 1877;1(838):63–65
- 7 Salgarelli AC, Collini M, Bellini P, Cappare P. Tracheostomy in maxillofacial surgery: a simple and safe technique for residents in training. *J Craniofac Surg* 2011;22(1):243–246
- 8 Haspel AC, Coviello VF, Stevens M. Retrospective study of tracheostomy indications and perioperative complications on oral and maxillofacial surgery service. *J Oral Maxillofac Surg* 2012;70(4): 890–895
- 9 Pal N, Makhija N, Kiran U, Pal S. Posttracheostomy subcutaneous emphysema: a management plan. *Paediatr Anaesth* 2007;17(3): 298–300
- 10 Showmaker JA, Page MP. Life-threatening tension subcutaneous emphysema as a complication of open tracheostomy. *Otolaryngol Head Neck Surg* 2010;142(4):628–629
- 11 Ning H, Zhao L. [Comparison between percutaneous dilatational tracheostomy and surgical conventional tracheostomy in clinical practice]. *Zhongguo Wei Zhong Bing Ji Jiu Yi Xue* 2009;21(10): 621–623
- 12 Douglas WE, Flabouris A. Surgical emphysema following percutaneous tracheostomy. *Anaesth Intensive Care* 1999;27(1):69–72
- 13 Kaylie DM, Wax MK. Massive subcutaneous emphysema following percutaneous tracheostomy. *Am J Otolaryngol* 2002;23(5): 300–302
- 14 See JJ, Wong DT. Unilateral subcutaneous emphysema after percutaneous tracheostomy. *Can J Anaesth* 2005;52(10):1099–1102
- 15 Orme RM, Welham KL. Subcutaneous emphysema after percutaneous tracheostomy—time to dispense with fenestrated tubes? *Anaesthesia* 2006;61(9):911–912, reply 912
- 16 Lin TY, Huang CJ, Lin HC. Massive subcutaneous emphysema following bronchoscopy-guided percutaneous dilatational tracheostomy. *J Formos Med Assoc* 2005;104(12):942–945
- 17 Matsuura K, Nakanisi T, Nagakawa T, Katou S, Honda Y. [Massive subcutaneous emphysema following percutaneous tracheostomy]. *Masui* 2008;57(4):474–478
- 18 Gilbey P. Fatal complications of percutaneous dilatational tracheostomy. *Am J Otolaryngol* 2012;33(6):770–773
- 19 Pandian V, Gilstrap DL, Mirski MA, et al. Predictors of short-term mortality in patients undergoing percutaneous dilatational tracheostomy. *J Crit Care* 2012;27(4):e9–e15