Clinical Case Reports

Open Access

CASE REPORT

Safe tracheostomy: blunt puncture and dilation after minimal surgical exposure of the trachea (BPAD tracheostomy)

Hisatake Matsumoto[1], Mitsuo Ohnishi[1], Akinori Wakai[2], Tomoya Hirose[1], Nobuto Mori[1], Jotaro Tachino[1], Daikai Sadamitsu[2] & Takeshi Shimazu[1]

[1]Department of Traumatology and Acute Critical Medicine, Osaka University Graduate School of Medicine, Osaka, Japan
[2]Traumatology and Critical Care Medical Center, National Hospital Organization Osaka National Hospital, Osaka, Japan

Correspondence
Hisatake Matsumoto, Department of Traumatology and Acute Critical Medicine, Osaka University Graduate School of Medicine, 2-15 Yamadaoka Suita, Osaka 565-0871, Japan.
Tel: +81-6-6879-5707;
Fax: +81-6-6879-5720; E-mail: h-matsumoto@hp-emerg.med.osaka-u.ac.jp

Funding Information
No sources of funding were declared for this study.

Received: 11 March 2015; Revised: 27 May 2015; Accepted: 16 July 2015

Clinical Case Reports **2015; 3(10): 773–776**

doi: 10.1002/ccr3.340

Key Clinical Message

A number of complications can occur following both surgical tracheostomy (ST) and percutaneous tracheostomy (PT). A flexible new tracheostomy insertion technique with the advantages of both ST and PT is proposed to reduce these complications. Our blunt puncture and dilation technique (BPAD tracheostomy) appears to be technically safe and feasible to perform.

Keywords

Bronchoscopy, modified tracheostomy, procedures, technique.

Introduction

Tracheostomy is one of the most frequently performed surgical procedures in critically ill patients. Changing from an endotracheal tube to a tracheostomy tube is often considered when the need for prolonged use of an artificial airway is expected. Other indications include decreased level of consciousness, failure to wean from a ventilator, copious secretions, and upper airway obstruction associated with trauma and medical illness. As much as 10% of intubated patients receive a tracheostomy in intensive care [1, 2].

The traditional procedure is a surgical tracheostomy (ST), but percutaneous tracheostomy (PT) with bronchoscopic control has become an alternative to ST [3]. Both ST and PT carry risks of complications such as airway fire and posterior tracheal wall injury, and such complications can sometimes be life-threatening. We devised a safe technique for tracheostomy with the advantages of both ST and PT. We present seven cases of our safe procedure and explain the technique, which we call blunt puncture and dilation after minimal surgical exposure of the trachea (BPAD tracheostomy).

Case Report

The BPAD tracheostomies were performed after the procedure was explained and informed consent was obtained from each patient or the patient's relatives at the intensive care unit (ICU) bedside. Procedure time, practical feasibility, and possible complications were assessed. For the BPAD tracheostomy, an ST set and a Portex PT kit (Portex Ltd., Kent, U.K.) were required (Fig. 1). Tracheal tubes with an inner diameter of 7.0 to 9.0 mm were used: primarily 8.0 mm in the women and 9.0 mm in the men.

The existing endotracheal tube was left positioned as it was or advanced deeper than normal to prevent cuff damage during the BPAD tracheostomy. The second and

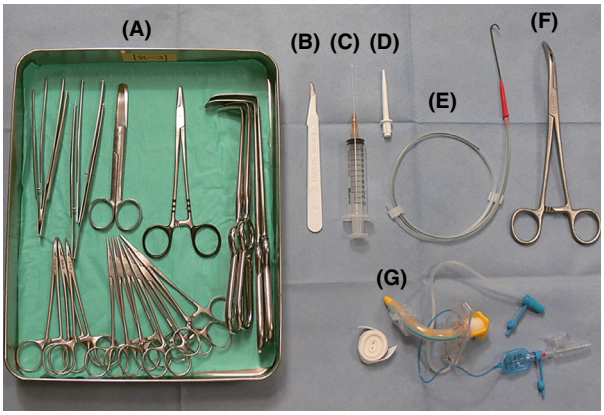

Figure 1. The surgical tracheostomy set: (A) general instruments (tissue tweezers, mosquito forceps, Cooper scissors, muscle retractors, and Mayo needle holder). The Portex percutaneous tracheostomy kit: (B) scalpel, (C) 14-gauge sheath, (D) dilator, (E) guidewire, (F) guidewire dilating forceps, and (G) tracheotomy tube.

third tracheal rings were minimally exposed as in ST (Fig. 2A). The canal was punctured bluntly with forceps against the endotracheal tube as a stopper (Fig. 2B). A 14-gauge sheath was inserted without a needle into the gap between the endotracheal tube and the anterior trachea (Fig. 2C). A guidewire was inserted beyond the cuff (Fig. 2D). The orifice was enlarged with a dilator inserted along the endotracheal tube (Fig. 3A). The guidewire dilating forceps were inserted between the endotracheal tube and anterior tracheal wall (Fig. 3B), and the tract was dilated with the forceps (Fig. 3C). The endotracheal tube was then withdrawn to facilitate tracheostomy tube insertion (Fig. 3D). In general, the BPAD tracheostomy can be completed similar to PT. To prevent accidental extubation, the tracheostomy tube flanges were sutured to the skin and attached with tape. We have performed BPAD tracheostomy on seven patients, including two patients in a halo vest with fixed neck extension. The average procedure time was 18 min. There was no need for bronchoscopic control. No complications were observed in any of the patients.

Discussion

Both ST and PT have their own unique complications. Asphyxia caused by tracheal flap obstruction is a potential complication of ST [4]. Airway fires are also a rare but potentially a fatal complication of ST. Heat such as that from an electrosurgical unit and oxygen are considered to have caused the airway fires. Although the risk of airway fires is reduced with a lower FIO_2, ST still requires scrupulous attention to prevent this complication [5]. Recent evidence has shown that PT can be performed safely even in high-risk patients [3, 6, 7]. Although they rarely occur, complications such as posterior tracheal wall injury, excessive bleeding, and premature extubation can

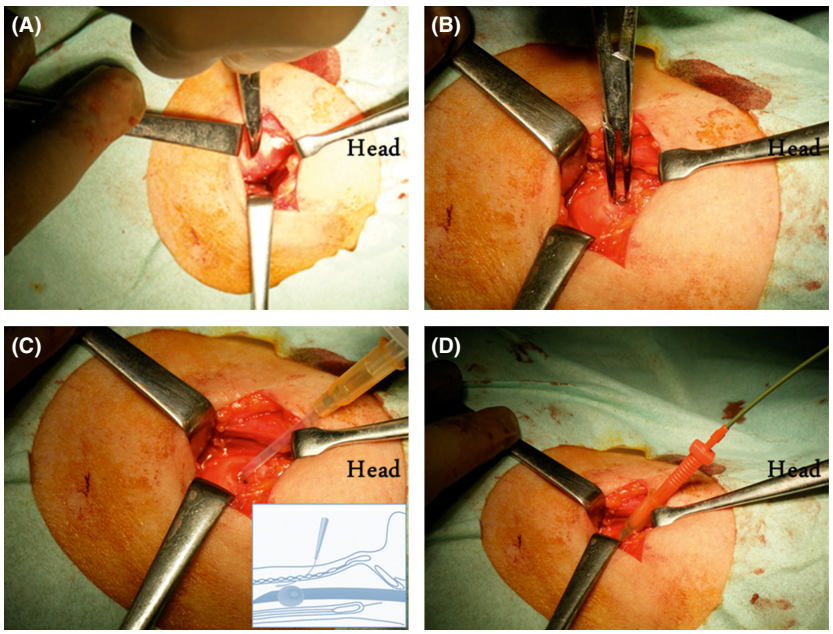

Figure 2. Surgical photographs of the blunt puncture and dilation technique. (A) Minimal exposure of the anterior trachea. (B) Blunt opening of the trachea with forceps. (C) Insertion of the sheath without a needle. Insert shows a schematic of the side view of the insertion. (D) Insertion of the guidewire and enlargement of the canal with a dilator.

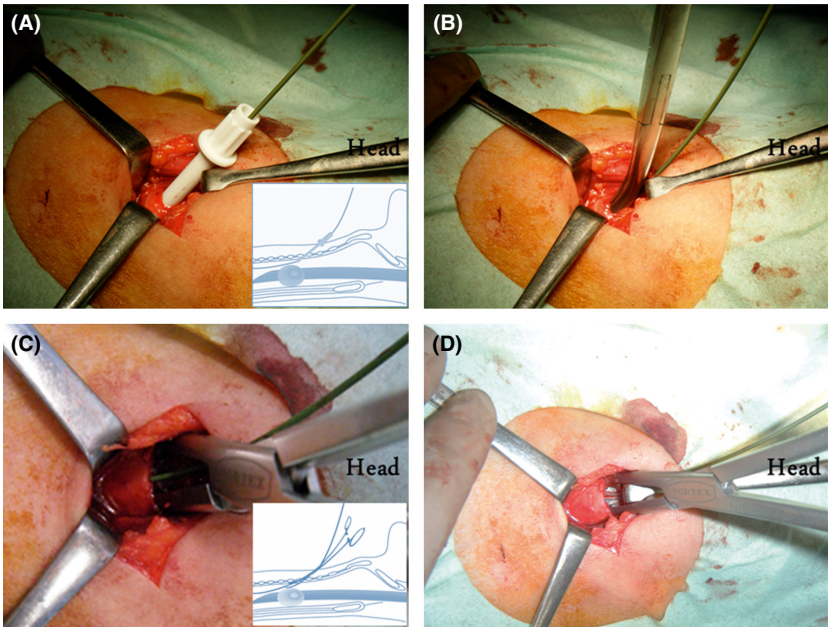

Figure 3. Surgical photographs of the blunt puncture and dilation technique, continued. (A) Enlargement of the orifice with a dilator inserted over the guidewire along the endotracheal tube. Insert shows a schematic of the side view of the insertion. (B) Insertion of the guidewire dilating forceps between the endotracheal tube and anterior tracheal wall. (C) Dilation of the tract with the guidewire dilating forceps. Insert shows a schematic from the side view. (D) Withdrawal of the endotracheal tube to facilitate tracheostomy tube insertion.

still happen, particularly in patients with anatomical difficulties of the neck and in those with coagulation disorders. Bronchoscopic control is likely to reduce the risk of these complications during the procedure [8, 9].

Several modified percutaneous puncture techniques with surgical assistance have been reported [10–12]. The BPAD tracheostomy differs from these techniques mainly in the following three points: (1) no needle puncture, (2) no need for partial withdrawal of the endotracheal tube, and (3) no requirement for bronchoscopic control (Fig. 4).

The potential benefits of the BPAD tracheostomy to reduce complications are summarized as follows: First, minimal exposure of the anterior tracheal wall similarly to that of ST provides several benefits. It allows the operator to confirm hemostasis before tracheal needle puncture. There is no requirement for partial withdrawal of the endotracheal tube, making it possible to prevent inadvertent premature extubation of the endotracheal tube. The hole is definitely made at the third tracheal ring. It prevents damage to major blood vessels by use of the needle, and it enables the performance of safe tracheostomy in patients with surgical wounds near the tracheostomy site or with conditions that compromised adequate visualization of normal anatomic landmarks. The BPAD tracheostomy appeared to be safe even in patients with fixed neck extension in a halo vest. Second, because the canal

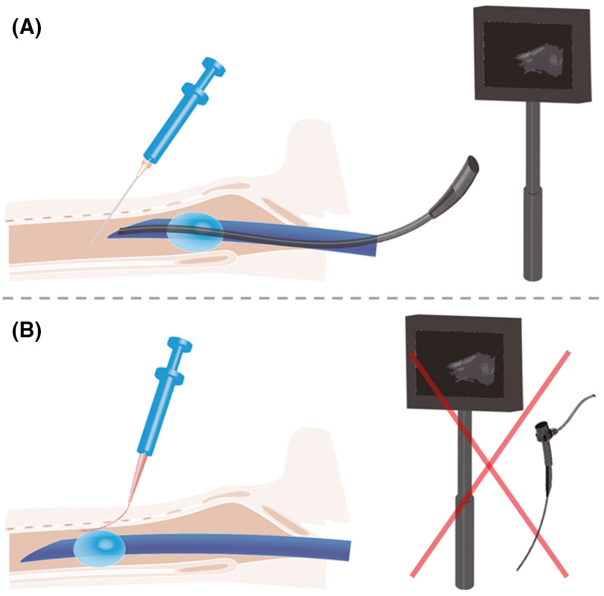

Figure 4. Comparison between the previous modified percutaneous puncture technique with surgical assistance (A) and the blunt puncture and dilation (BPAD) technique (B). The BPAD technique does not require needle puncture, withdrawal of the endotracheal tube, or bronchoscopic control.

is punctured bluntly using the endotracheal tube as a stopper, the BPAD tracheostomy prevents posterior tracheal wall injury without the necessity for broncho-

scopic control. Although ST is a well-established, routinely performed procedure, our novel technique negates the possibility of complications from surgical fire because no electrosurgical unit is required for BPAD tracheostomy.

Thus, the BPAD tracheostomy seems to be a safe procedure. However, special attention should be paid particularly to patients with anatomical difficulties of the neck and in those with coagulation disorders.

Conclusion

Our novel BPAD tracheostomy technique of blunt puncture and dilation after minimal surgical exposure of the trachea should theoretically be a safe procedure and might offer the advantages of both ST and PT while reducing complications of tracheal tube insertion.

Conflict of Interest

None declared.

References

1. De Leyn, P., L. Bedert, M. Delcroix, P. Depuydt, G. Lauwers, Y. Sokolov, et al. 2007. Tracheotomy: clinical review and guidelines. Eur. J. Cardiothorac. Surg. 32:412–421.
2. Durbin, C. G., Jr. 2010. Tracheostomy: why, when, and how?. Respir. Care 55:1056–1068.
3. Kornblith, L. Z., C. C. Burlew, E. E. Moore, J. B. Haenel, J. L. Kashuk, W. L. Biffl, et al. 2011. One thousand bedside percutaneous tracheostomies in the surgical intensive care unit: time to change the gold standard. J. Am. Coll. Surg. 212:163–170.
4. Goldenberg, D., E. G. Ari, A. Golz, J. Danino, A. Netzer, and H. Z. Joachims. 2000. Tracheotomy complications: a retrospective study of 1130 cases. Otolaryngol. Head Neck Surg. 123:495–500.
5. Rogers, M. L., R. W. Nickalls, E. T. Brackenbury, F. D. Salama, M. G. Beattie, and A. G. Perks. 2001. Airway fire during tracheostomy: prevention strategies for surgeons and anaesthetists. Ann. R. Coll. Surg. Engl. 83:376–380.
6. Huang, C. S., P. T. Chen, S. H. Cheng, C. K. Chen, P. K. Hsu, C. C. Hsieh, et al. 2014. Relative contraindications for percutaneous tracheostomy: from the surgeons' perspective. Surg. Today 44:107–114.
7. Dennis, B. M., M. J. Eckert, O. L. Gunter, J. A. Morris Jr., and A. K. May. 2013. Safety of bedside percutaneous tracheostomy in the critically ill: evaluation of more than 3,000 procedures. J. Am. Coll. Surg. 216:858–865.
8. Simon, M., M. Metschke, S. A. Braune, K. Püschel, and S. Kluge. 2013. Death after percutaneous dilatational tracheostomy: a systematic review and analysis of risk factor. Crit. Care 17:R258.
9. Cools-Lartigue, J., A. Aboalsaud, H. Gill, and L. Ferri. 2013. Evolution of percutaneous dilatational tracheostomy–a review of current techniques and their pitfalls. World J. Surg. 37:1633–1646.
10. Atweh, N. A., P. P. Possenti, P. F. Caushaj, G. Burns, M. J. Pineau, and M. Ivy. 1999. Dilatational percutaneous tracheostomy: modification of technique. J. Trauma 47:142–144.
11. Paran, H., G. Butnaru, I. Hass, A. Afanasyv, and M. Gutman. 2004. Evaluation of a modified percutaneous tracheostomy technique without bronchoscopic guidance. Chest 126:868–871.
12. Feldman, M. J., S. M. Milner, K. M. Dhanjani, Z. Stjepanovic, and K. Gerold. 2011. Semi-open percutaneous tracheostomy in burn patients. Burns 37:1072–1078.