Managing Tracheal Perforations Following Percutaneous Dilation Tracheostomy

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Citation

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Abstract

In the overall management of patients requiring prolonged mechanical ventilatory support, Percutaneous Dilation Tracheostomy (PDT) has replaced open tracheostomy in many centers. While infrequent, one of the most devastating morbidities associated with PDT is tacheal wall injury. We have successfully managed two such injuries with endotracheal tube advancement beyond the anatomical site of laceration thereby cresting a temporary, but functional, endoluminal stent.

INTRODUCTION

Ciaglia first described the technique of Percutaneous Dilation Tracheostomy (PDT) in 1985.[1] Subsequent reports revealed a complication rate from two to thirty-nine percent.[2,3] In our review of the literature, the most common complications included hemorrhage, loss of airway, hypoxia, pneumothorax, peristomal leak, and tracheal wall injuries.3,[4] Prior reports have documented successful repair of posterior tracheal lacerations occurring during PDT with either local exploration or thoracotomy (primary closure and drainage).[5] However, managing this injury with a thoracotomy adds considerable morbidity. An alternative to traditional management, endoluminal stenting (i.e., endotracheal tube advancement beyond the tracheal laceration), has been described for injuries associated with open tracheostomy.[6,7] To our knowledge this theory has not been applied for injuries occurring during PDT. Presented are two cases of tracheal wall injury occurring during PDT, which were both managed with endoluminal stenting.

CASE 1

A twenty-year-old male, ejected during a high-speed motor vehicle crash, was admitted to the intensive care unit for a closed head injury (GCS 3T). The patient had been orally intubated prior to his arrival. He was extubated on the fourth hospital day, subsequently aspirated and required re-intubation. He developed ARDS requiring pressure controlled inverse ratio ventilation. On his tenth intensive care day, a percutaneous bedside dilation tracheostomy was performed. The patient developed subcutaneous emphysema and a tension pneumothorax with a continuous air leak after tube thoracostomy. Subsequent bronchoscopy revealed a small linear posterior tracheal wall laceration just distal to the insertion site. An oral endotracheal tube was placed under bronchoscopic guidance with the cuff inflated beyond the site of perforation and the tracheostomy tube was removed. Esophagoscopy was unremarkable. Repeat endoscopy two weeks later revealed mucosal healing. The mechanical ventilatory support was subsequently weaned and the patient extubated. He continues to do well at six months follow-up.

CASE 2

A twenty year old male was admitted to the intensive care unit after sustaining a severe closed head injury (GCS 3T) and femur fracture in a motor vehicle collision. He had been orotracheally intubated in the field for unresponsiveness. He received PDT on hospital day three. The patient developed massive subcutaneous emphysema and a pneumothorax requiring chest tube thoracostomy. Bronchoscopy demonstrated a linear disruption of the posterior trachea, distal to the tracheostomy site. Esophogoscopy did not reveal an esophageal injury. An endotracheal tube was advanced under bronchosopy to a point beyond the tracheal laceration, and the tracheostomy tube was removed. Repeat bronchoscopy one week later revealed healing of the tracheal

perforation and a percutaneous tracheostomy was placed. The patient eventually was weaned from mechanical support.

DISCUSSION

Bedside PDT has several advantages when compared to oral endotracheal intubation: improved pulmonary hygiene and patient comfort, as well as facilitating mechanical weaning.[8] In addition, PDT is less expensive than open tracheostomy and avoids the risks associated with transportation to the operative suite.[9,10] At our institution, an open tracheostomy performed in the operating room will cost $2,463 (surgeon's fee excluded) compared to $523 for a PDT done without bronchoscopy.[11] At the University of Arizona, we routinely perform PDT without bronchoscopy as described in the literature.1 Of one hundred twenty-four PDTs performed over the last two years, there have been two posterior tracheal wall injuries (1.6%). When the PDT is performed without endoscopy, the development of subcutaneous emphysema and pneumothorax with a persistent air leak may be the first clinical signs indicative of pars membranacea rupture.5,[12] Bronchoscopic evaluation is indicated for any patient developing subcutaneous emphysema or pneumothorax with continued air leak following PDT. If endoscopy reveals evidence of posterior tracheal wall injury, esophagoscopy, computerized tomography, or a contrast swallow are utilized to evaluate esophageal integrity.[13] If there is any evidence of esophageal injury, the patient is formally explored in the operating theatre and the trachea is repaired at that time. However, if the esophagus appears intact, an oral endotracheal tube is gently inserted under bronchoscopic guidance with the cuff inflated beyond the site of disruption – creating a temporary but functional endoluminal stent. The tracheostomy tube is then removed and the injured site is allowed to heal; the trachea is formally re-evaluated in one to two weeks to confirm mucosal healing. If the patient's clinical condition deteriorates during this time of observation, the tracheal disruption should be suspected and operative debridement considered. Standard management of a tracheal disruption includes exploration and debridement of devitalized tissue with approximation of mucosal surfaces and drainage as necessary.

Oral endotracheal tube advancement beyond the site of tracheal perforation is an option for the management of small iatrogenic tracheal lacerations occurring in clinically stable patients after PDT. However, further experience with this technique of tracheal stenting is necessary to evaluate its overall efficacy and long-term results.

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References

1. Ciaglia P, Firsching R, Syniec C. Elective Percutaneous Dilation Tracheostomy. Chest 1985;87(6):715-719.
2. Fernandaz L, Norwood S, Roettger R, Gass D, Wilkins H. Bedside Percutaneous Tracheostomy With Bronchoscopic guidance in Critically Ill Patients. Arch Surg 1996;131:129-132.
3. Graham J, Mulloy R, Sutherland F, Rose S. Percutaneous versus Open Tracheostomy: A retrospective cohort outcome study. J Trauma 1996;42(2):245-50.
4. Toursarkissian B, Zweng T, Kearney P, Pofahl W, Johnson S, Barker D. Percutaneous Dilation Tracheostomy: A Report of 141 Cases. Ann Thorac Surg 1994;57:862-867.
5. Berrouschot J, Oeken J, Steiniger L, Schneider D. Perioperative Complications of Percutaneous Dilation Tracheostomy. Laryng. 1997;107:1538-44.
6. Flege J. Tracheosesophageal fistula caused by a cuffed tracheostomy tube. Ann Surg. 1967;130:996-999.
7. Chew J, Cantrell R. Tracheostomy; Complications and their Management. Arch Otolaryng. 1972;96:538.
8. Smith I, Flemming S, Cernaianu A. Mishaps During Transport from the Intensive Care Unit. Crit Care Med 1990;18:879.
9. Porter J, Ivatury R. Perferred Route of Tracheostomy-Percutaneous versus Open at the Bedside: A randomized, Prospective Study in the Surgical Intensive Care Unit. Amer Surg 1999;65:142-6.
10. Griggs W, Myburgh J, Worthley L. A Prospective Comparison of Percutaneous Tracheostomy Technique with Standard Surgical Tracheostomy. Intensive Care Med 1991;261-3.
11. J. Gerdes and B. Hess. Percutaneous Dilation Tracheostomy Surgical Study 1997. Quality Improvement Department, The University of Arizona Medical Center 1997.
12. Paul A, Marelli D, Chiu RCJ, Vestweber K, Mulder D. Percutaneous Endoscopic Tracheostomy. Ann Thorac Surg. 1989;47:314-315.
13. Duranceau A: Perforation of the esophagus. In Sabiston DC, editors: Textbook of Surgery, ed 15, Philadelphia, 1997, W B Saunders Company; pp 759-767.

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