

Iatrogenic Tracheal Posterior Wall Perforation Repaired with Bronchoscope-Guided Knotless Sutures Through Tracheostomy

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A 68-year-old man presented with a posterior tracheal wall injury caused by percutaneous dilatational tracheostomy. The wound was immediately covered with an absorbable polyglycolic acid sheet. Ten days after the injury, the perforation was closed with knotless sutures using a Castroviejo needle-holder through the tracheostomy. The successful repair in this case indicates the feasibility of the knotless suture technique for perforations. The technique is described in detail in this report. The patient was weaned from the mechanical ventilator on postoperative day 25. In cases of posterior tracheal posterior wall perforation, every effort should be made to repair the perforation through an existing opening.

Key words: 1. Tracheal injury
2. Sutures
3. Bronchoscopy
4. Percutaneous dilatational tracheostomy
5. Knotless suture

Case report

A 68-year-old man was diagnosed with a thoracoabdominal aortic aneurysm and underwent graft repair. On postoperative day 7, the need for prolonged airway access became apparent, and a tracheostomy was therefore planned. During tracheostomy tube insertion using a percutaneous dilatational technique with bronchoscopic guidance at the bedside, a posterior tracheal wall injury occurred when the guiding catheter and dilator were not properly stabilized. When the patient was ventilated through a pre-existing orotracheal tube, air bubbles were observed at the injury site, suggesting perforation of the posterior tracheal wall. A 2-cm mucosal defect

was identified (Fig. 1). An absorbable polyglycolic acid (PGA) sheet (Neoveil, 10×5 cm; Gunze Ltd., Kyoto, Japan) was applied through the tracheostomy visualized by the bronchoscope that had been used for percutaneous dilatational tracheostomy (PDT). A tracheal tube was inserted and placed over the PGA sheet. At 6 days after the injury, follow-up bronchoscopy revealed granulation tissue around the perforation, but no specific signs of healing. The patient developed fever while receiving vancomycin and meropenem as antibiotic therapy, and developed paraplegia as a postoperative complication.

At 10 days after the injury, the perforation was closed in a distal-to-proximal direction with unidirectional absorbable Stratafix sutures (Ethicon, Somerville,

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NJ, USA) using a Castroviejo needle-holder through the tracheostomy. Instead of tying the knot, the tip of the needle entered through the fixation loop and was tightened (Fig. 2A, B). The field was visualized via flexible bronchoscopy (Fig. 3). The patient was sedated and ventilated through the orotracheal tube using intermittent positive pressure by an Ambu self-inflating bag. There was no sign of desaturation or hypercapnia on arterial blood gas analysis after the procedure. Postoperative serial chest radiographs showed no evidence of pneumothorax or pneumo-mediastinum.

On postoperative day 22, 15 days after the injury, follow-up bronchoscopy showed a healed posterior

tracheal wall, with no sign of inflammation, stenosis, or tracheal narrowing (Fig. 4). The patient was weaned from the ventilator on postoperative day 25, 18 days after the injury. The patient was discharged without any respiratory problems after 8 months.

Discussion

Tracheal wall injury is an uncommon, although well-recognized, and potentially fatal injury. Even if the membranous part of the trachea is very friable and susceptible to tearing, which is especially likely in elderly patients, iatrogenic laceration is a relatively infrequent event [1]. Most of the reports pub-

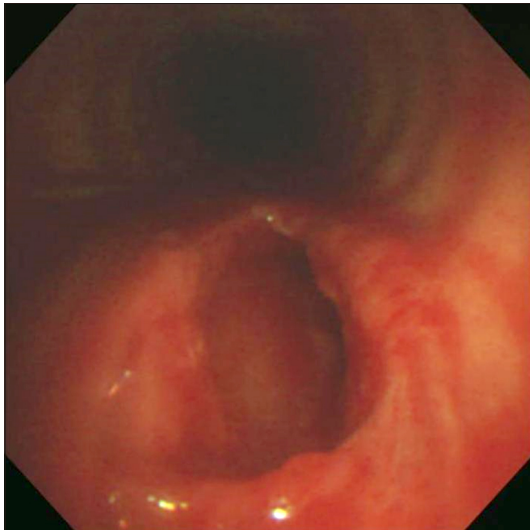


Fig. 1. A 2-cm mucosal defect was identified during percutaneous dilatational tracheostomy.

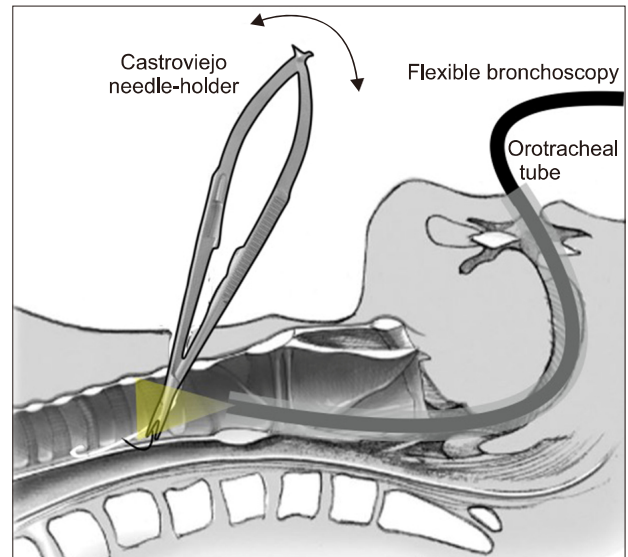


Fig. 3. Schematic view of the repair.

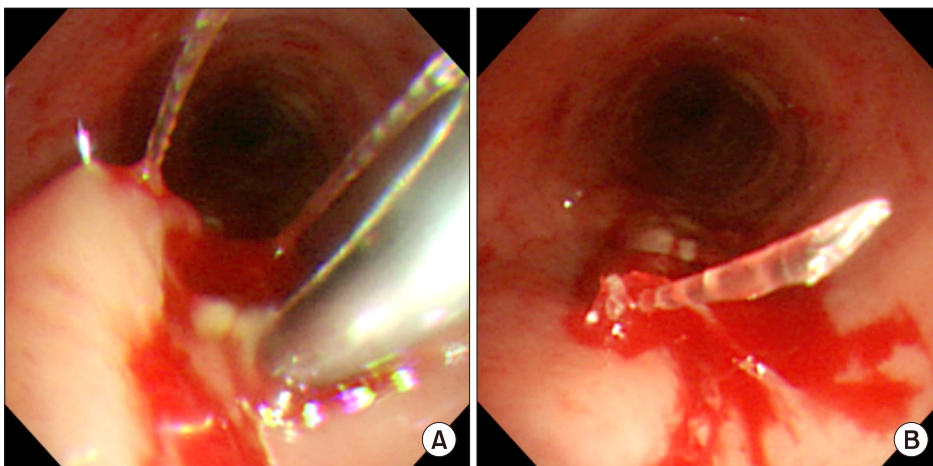


Fig. 2. (A) The unidirectional absorbable Stratafix sutures made using a Castroviejo needle-holder through the tracheostomy visualized with bronchoscopy. (B) Knotless suturing was performed.

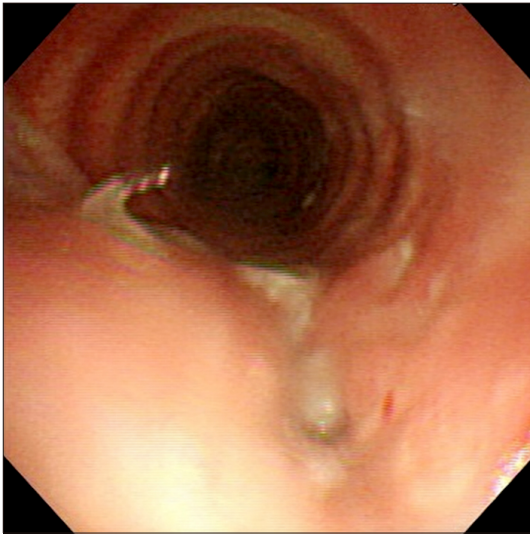


Fig. 4. At 15 days after the injury, follow-up bronchoscopy showed a healed posterior tracheal wall.

lished in the literature describe only a few cases in which the injury occurred after intubation or PDT [2].

Various methods have been described for the repair of tracheal wall injuries, and most require neck surgery [3]. Although surgical intervention is the mainstay of treatment, endobronchial maneuvers to seal defects have received increasing attention, particularly for patients with comorbidities that may contraindicate formal surgery or transfer, or in cases where local surgical expertise is not available [4]. For tears less than 5 mm in diameter, it may be possible to seal the defect by directly applying BioGlue (CryoLife Europa, Guildford, UK) using pledgets as an endobronchial technique [5]. However, our case had a larger injury that failed to heal with the application of a PGA sheet.

We needed a new method that was both minimally invasive and simple. A tracheostomy can provide access for small instruments such as a Castroviejo needle-holder. However, 2 or more instruments cannot pass through the tracheostomy simultaneously because of the risk of further injuries to the airway and widening of the tracheostomy. The other obstacle is that the tracheostomy may not appear in

the field of vision. We overcame these obstacles using knotless sutures, which only require a Castroviejo needle-holder and can be visualized by bronchoscopy; this fact also means that irrigation and suction are possible. The entire procedure took less than 10 minutes. The problems associated with this procedure included difficulty measuring the depth when the needle penetrated the tissue and a slightly limited range of motion when handling the needle-holder. These problems can be resolved with surgical expertise.

After repair, routine studies should include chest radiography, thoracic computed tomography (including the trachea), and bronchoscopy [3]. In patients with a tracheal injury, injuries of the esophagus and vocal cords may also be present. All injuries should be diagnosed and prioritized, and several teams may be involved in patient management.

In tracheostomy-related tracheal wall injuries, the presence of a stoma and the ability to visualize the injury via bronchoscopy should prompt the surgeon to make every effort to repair the injury through the preexisting opening.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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