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# Successful percutaneous tracheostomy via puncture through the thyroid isthmus

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## Abstract

Tracheostomy is one of the most frequently performed procedures in intensive care units. Bedside percutaneous tracheostomy has become an increasingly popular option to standard open tracheostomy. Several contraindications for percutaneous tracheostomy, including an enlarged thyroid isthmus, have been described. However, as experience with this technique has increased, most of the described contraindications appear to be relative rather than absolute, provided the procedure is performed by an experienced practitioner. Herein we present a case of an unavoidable direct puncture of the thyroid isthmus during a percutaneous tracheostomy. The procedure was performed smoothly, and no complications occurred.

## Introduction

Tracheostomy is a commonly performed procedure in patients with prolonged ventilator use. Bedside percutaneous tracheostomy has become an increasingly popular option to standard open tracheostomy. Compared with standard open tracheostomy, percutaneous tracheostomy has the benefits of a smaller incision, shorter operative time, lesser intraoperative bleeding, and reduced risk of postoperative infection [1]. However, it is more difficult to avoid injury to the thyroid gland when performing a percutaneous tracheostomy, especially in patients with an enlarged thyroid gland and those with a short neck [2].

When performing a tracheostomy, the thyroid isthmus overlying the anterior trachea should be retracted cranially or caudally, even divided by electrocautery or suture ligation, to avoid postoperative bleeding [3]. We present a case of direct puncture of the thyroid isthmus during a percutaneous tracheostomy. The procedure was performed smoothly, and no complications occurred.

## Case Report

The patient was a 33-year-old female with a history of cerebral abscess and recurrent olfactory meningioma; she had undergone a posterior fossa craniectomy and C1–C3 laminectomy for a posterior olfactory meningioma and suboccipital pseudomeningocele at another hospital 8 years prior to the current admission at our hospital. She was ventilator-dependent and had repeated episodes of pneumonia, and our department was consulted for tracheostomy creation for long-term respiratory care. Preoperative physical examination and neck computed tomography (CT) revealed an enlarged thyroid gland overlying the trachea, as well as prominent vessels (Fig. 1A, B). In addition, the patient was of short stature (140 cm in height), and had a short neck with limited extent of hyperextension. The surgical risks and benefits of a percutaneous versus open tracheostomy were explained to the patient and her family, as were her unique features making her at high risk for a percutaneous tracheostomy. We also discussed

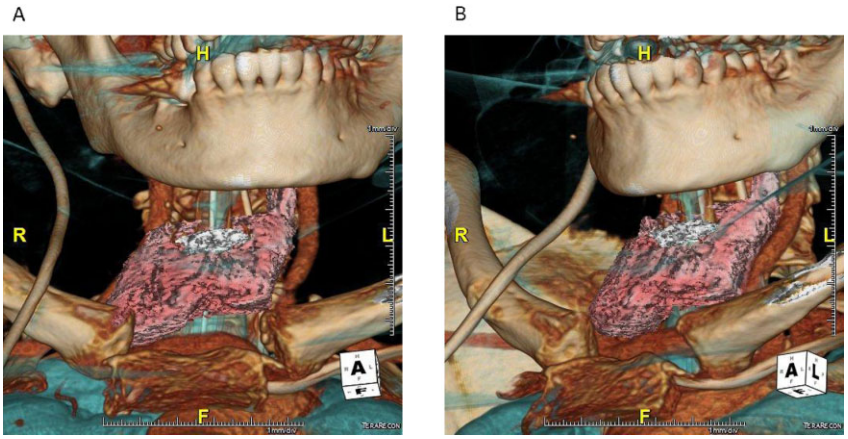


**Figure 1.** (A, B) Preoperative neck computed tomography reconstruction showing an enlarged thyroid gland overlying the trachea. white: cricoid cartilage; pink: thyroid gland.

our prior experience in performing percutaneous tracheostomies in high risk cases [4]. After a detailed discussion, she decided to have the percutaneous procedure performed.

For the procedure, the patient was placed under heavy sedation, and was put in supine position without neck hyperextension due to the previous C1–C3 laminectomy and fusion. As we are experienced thoracic surgeons, the technical experience and equipment were available if bleeding or other emergencies should occur. Preoperatively, bedside neck sonography was performed for identifying the thyroid, vessels, and appropriate location of the trachea to perform the tracheostomy. Percutaneous tracheostomy was then performed as previously described [4]. Briefly, a xylocaine injection was administered for local pain control and tracheal depth localization. Then, a 1.5-cm transverse incision through the subcutaneous layer was made about 2 cm above the sternal notch. The endotracheal tube was withdrawn under bronchoscopic guidance to just below the vocal cords so as to illuminate the anterior trachea. External compression using the tip of a mosquito forceps, held in the operator's right hand, was used to confirm the puncture location without any deeper dissection. The trachea was then punctured on the midline between the 2nd and 3rd tracheal rings under bronchoscopic surveillance.

Following bronchoscopic visualization of the puncture site, a guidewire was introduced over the cannula and advanced down the bronchial tree. The cannula was then removed and the percutaneous tracheostomy was performed with the Ciaglia method (Blue Rhino Advanced Percutaneous Tracheostomy Introducer Sets and Trays; Cook Medical Inc., Bloomington, IN). Immediately after tracheostomy tube insertion, a fibrobronchoscope was introduced into the tracheostomy lumen to confirm the position, and for sputum and blood clot aspiration. The operative time was 10 minutes and the blood loss was minimal. The patient tolerated the procedure well. Postoperative CT showed the tracheostomy tube passing through the thyroid gland (Fig. 2A, B). The postoperative course was uneventful, and the wound healed well.

## Discussion

Tracheostomy is a commonly performed procedure in intensive care units, and both traditional open and percutaneous tracheostomies are performed. During the past 20 years, percutaneous tracheostomy has become increasingly popular [1]. Compared with standard open tracheostomy, percutaneous tracheostomy has several established benefits including smaller incision, shorter operative time, lesser intraoperative bleeding, lesser incidence of postoperative infection, and improved outcomes for patients who require prolonged mechanical ventilation after cardiac surgery [5, 6]. Many of the benefits are related to the smaller incision, which allows the wound to be confined to a small area, thus allowing a minimal amount of sputum and secretions to pass. A smaller incision also reduces the dead space, and thus reduces the chances of hematoma formation [7]. However, the risk of injury to the thyroid is greater with percutaneous tracheostomy, especially in patients with short necks and large thyroid glands. Normally, the thyroid isthmus overlies the first few rings of the trachea. During conventional open tracheostomy, due to a larger operative field, the isthmus can be easily mobilized by blunt dissection and then retracted cranially or caudally with the aid of a retraction hook to avoid damage and bleeding. If the isthmus is too large to be retracted, it can be divided using electrocautery or suture ligation [8]. During a percutaneous tracheostomy, only the landmark, the cricoid cartilage, can be retracted cranially and inferiorly using the operator's fingers, which leads to thinning of the thyroid isthmus (Fig. 3). However, complete retraction and avoidance of the

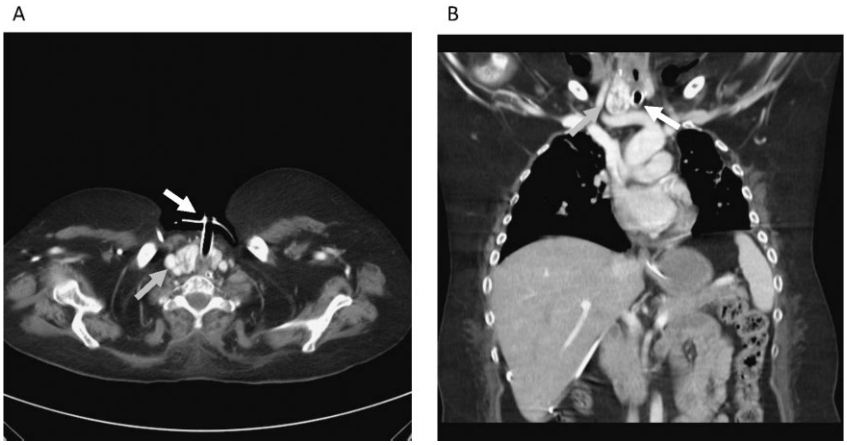


**Figure 2.** (A) Cross-section and (B) sagittal neck computed tomography showing the tracheostomy tube in place. White arrow: tracheostomy tube; grey arrow: thyroid gland.

**Figure 3.** Diagram of the thyroid isthmus retracted by operator's left index and middle fingers. Retracting the cricoid cartilage cranially and inferiorly results in thinning of the thyroid isthmus.

thyroid isthmus cannot be achieved. In the case presented, the isthmus of the thyroid gland was punctured, as shown by the postoperative CT scan, but there was no massive bleeding during or after the procedure. We speculate that the minimal bleeding was due to the small incision and single tract used for dilation.

Puncture through the thyroid isthmus during a percutaneous tracheostomy is probably a more common occurrence than reported in the literature. The location of the isthmus, particularly in obese patients and those with short necks, can be difficult to verify. A criticism may be made that we did not perform a standard open tracheostomy for this high risk patient. However, an open tracheostomy in our patient would not be without risk. For an open tracheostomy, the wound needs to be big enough to divide the thyroid isthmus and identify the trachea, which is difficult to perform in a narrow operative field, and an extended wound is associated with a higher incidence of infection, especially in a patient with an absent cough reflux. A backup expert at surgical airway management should be immediately available when performing a high risk percutaneous tracheostomy [9].

One case report cannot prove that puncturing the thyroid isthmus during a percutaneous tracheostomy puncture is safe. However, Ben Nun et al. [2] reported five cases of percutaneous tracheostomy performed though an enlarged thyroid isthmus without complications, and we previously reported 17 cases performed without complications [4]. We believe this is the first report to provide clear postoperative radiographic images of a percutaneous tracheostomy in which the thyroid isthmus was punctured.

In conclusion, thyroid isthmus puncture during a percutaneous tracheostomy did not result in any complications in the case presented herein. As experience with percutaneous tracheostomy increases, most of the perceived contraindications appear to be relative rather than absolute. Patient safety should always be first priority when considering a percutaneous tracheostomy.

## Disclosure Statements

No conflict of interest declared.

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

 

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