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CASE REPORT

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Complication management in percutaneous dilatational tracheostomy: a case of tracheal needle sheath retrieval

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Abstract

Background Percutaneous dilatational tracheostomy (PDT) is a widely performed procedure in intensive care units (ICUs) for patients requiring prolonged mechanical ventilation. Although generally safe, PDT carries risks of complications, some of which may be life-threatening. Foreign body aspiration is a well-known concern, but the iatrogenic migration of procedural components, such as a tracheostomy needle sheath, has received little attention.

Case presentation We report the case of a male patient with intracerebral hemorrhage (ICH) who underwent a percutaneous dilatational tracheostomy. During the procedure, the sheath of the tracheostomy needle became dislodged and migrated into the tracheobronchial tree. Urgent intervention was required to prevent further complications. Bronchoscopy was promptly performed at the bedside, revealing the foreign body in the right main bronchus. Initial retrieval attempts using biopsy forceps were unsuccessful due to the sheath's positioning. The sheath was eventually maneuvered into the endotracheal tube (ETT) and extracted in a coordinated manner with the simultaneous removal of the ETT and forceps. The tracheostomy tube was then successfully placed under bronchoscopic guidance, and the patient remained stable without further complications.

Conclusion This case highlights a rare and potentially life-threatening complication of PDT, emphasizing the essential role of bronchoscopy in managing intraprocedural complications. It underscores the importance of procedural expertise and vigilance in ICU settings.

Keywords Bronchoscopy, Foreign body retrieval, Airway management and tracheostomy complications

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Introduction

Percutaneous dilatational tracheostomy is a critical procedure for patients requiring prolonged mechanical ventilation in ICU. While generally safe, complications can arise, necessitating prompt intervention and procedural expertise. This report presents a unique complication during PDT in a patient for whom the procedure was indicated due to impaired consciousness. During the procedure, the sheath of the tracheostomy needle became dislodged and entered the tracheobronchial tree. Bronchoscopy was used to locate and retrieve the sheath from the right main bronchus using biopsy forceps, enabling the successful placement of the tracheostomy tube.

This case highlights the vital role of bronchoscopy in managing complications during PDT and emphasizes the need for vigilance and expertise to ensure patient safety.

Case description

Preparation

A 55-year-old male patient presented with acute intracerebral hemorrhage was intubated due to a low Glasgow Coma Scale (GCS) score (E2V2M4). Given the anticipated requirement for prolonged mechanical ventilation, the patient was scheduled for PDT. Appropriate analgesia and sedation were administered, and a qualified operator and assistant were positioned to perform and manage the procedures, respectively.

Initial puncture

Using the landmark guidance technique, a preliminary dissection was performed after the skin incision to expose the trachea. The tracheostomy needle was then inserted into the trachea, and correct placement was confirmed by observing air egress from the needle. A guidewire was subsequently introduced through the needle, followed by the initial dilator. However, during the second serial dilation, resistance was encountered due to tight tissues, requiring the withdrawal of the dilator and restarting the procedure from the initial step.

Complication

During this subsequent attempt, the practitioner inserted a tracheostomy needle with its accompanying sheath. Because the tracheal stoma had already undergone partial

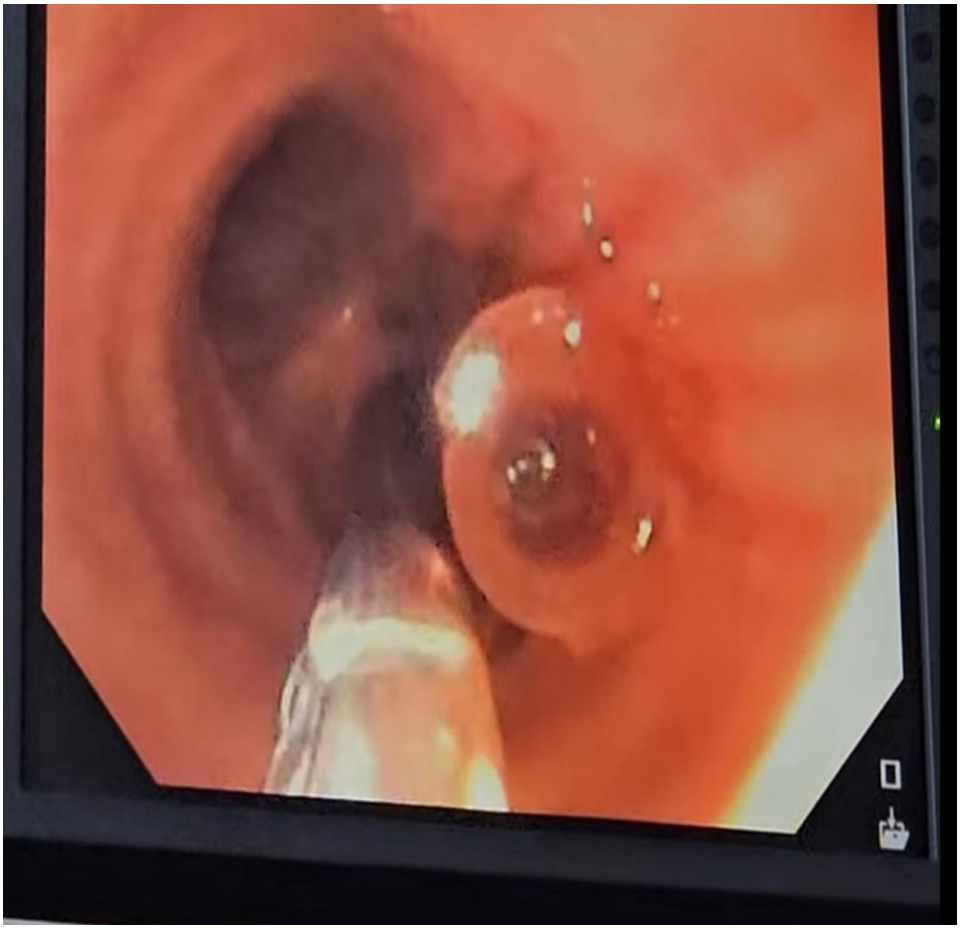

Fig. 1 Tracheostomy Needle Sheath at the Carina entering the Right Primary Bronchus

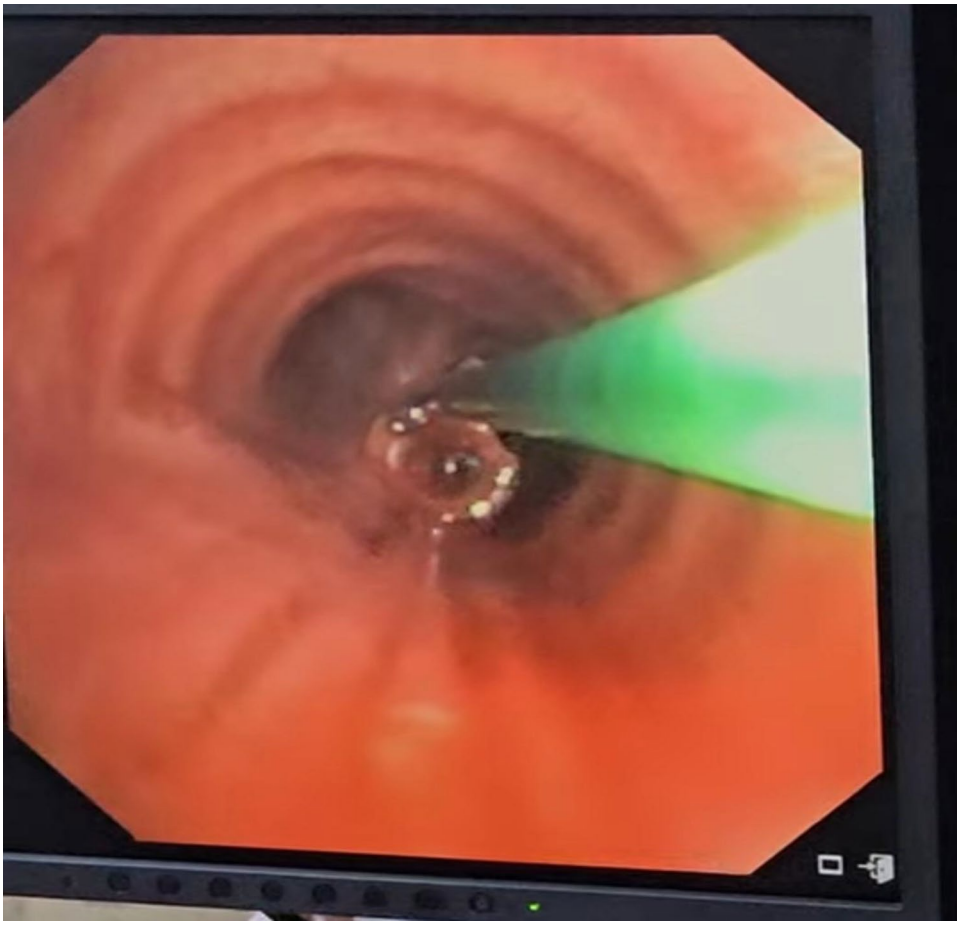

Fig. 2 Tracheostomy Needle Sheath at The Carina being extracted by aBiopsy Forceps

dilation, the plastic sheath was displaced and migrated into the trachea. **Urgent intervention was required, as the foreign body could move into the distal airways, potentially necessitating surgical resection to prevent severe complications such as empyema, fistula, or pneumonia.**

Retrieval attempts

Bronchoscopy (Olympus BF-1T150) with inner diameter of 2.8 mm and outer diameter of 6 mm and the working channel was 3 mm from distal end promptly performed at bedside by the **pulmonologist to** visualize and extract the foreign body. The bronchoscope was introduced through an oral **endotracheal tube of size 8.5 mm internal** diameter, revealing a dislodged PVC sheath in the right main bronchus. (Fig. 1) **Biopsy forcep with working channel of 2 mm was** advanced alongside the bronchoscope to grasp the sheath; however, the initial attempts were unsuccessful because of the sheath's position and difficulty in securing it. Subsequently, the sheath was carefully retracted into the endotracheal tube by using forceps. (Fig. 2) The endotracheal tube and the forceps (holding the sheath) were simultaneously and coordinatedly removed to prevent further dislodgement. (Fig. 3)

Final outcome

Following the confirmation of airway patency, a tracheostomy tube was inserted under direct bronchoscopic guidance to secure the airway. The patient was subsequently stabilized without further complications, illustrating the efficacy of prompt bronchoscopy and coordinated teamwork in managing a rare, potentially life-threatening complication of PDT. This case underscores the critical importance of procedural adaptability, multidisciplinary coordination, and the indispensable role of bronchoscopy in managing life-threatening complications during percutaneous tracheostomy.

Discussion

Percutaneous dilatational tracheostomy (PDT) has evolved significantly since its initial description in 1957, with substantial advancements introduced in 1985 by Ciaglia [1]. The Ciaglia Blue Rhino (CBR) method, widely considered the standard of care, employs a modified Seldinger technique. This procedure involves single-step

Fig. 3 Tracheostomy Needle Sheath extracted through the endotracheal tube by a Biopsy Forceps

dilation utilising a hydrophilic-coated dilator, frequently performed under bronchoscopic guidance [2]. The visualisation afforded by bronchoscopy has markedly enhanced the safety of PDT; however, complications remain a potential concern. In the United States, approximately 500 patients experience mortality or permanent disability annually as a consequence of tracheostomy-related complications [3]. A meta-analysis of 8,324 PDT cases reported a procedure-related mortality rate of 2.18%, with 31% of deaths occurring intra-procedurally and 49% within the initial seven days post-procedure [4]. Existing literature identifies several complications during PDT, ranging from minor issues like transient hypoxia to severe, life-threatening events such as tracheal injury or misplacement of the tracheostomy tube. Airway obstruction due to a fractured tracheostomy tube and its successful retrieval using rigid bronchoscopy is also reported in the literature [5, 6].

While foreign body aspiration is a well-documented concern, the iatrogenic introduction of procedural components, such as the inadvertent migration of a tracheostomy needle sheath into the trachea, has received less attention. This case underscores an overlooked risk associated with a commonly performed procedure, expanding the existing knowledge of PDT-related complications and emphasizing the need for prompt recognition and appropriate management.

The standard percutaneous dilatational tracheostomy (PDT) procedure commences with the insertion of an introducer needle perpendicular to the anterior tracheal wall, typically between the second and third cartilage rings. The needle was angled caudally, leaving a plastic catheter in situ when the needle was withdrawn. A guidewire was subsequently advanced through the catheter toward the carina. Utilizing the Seldinger technique, a small punch dilator is passed over the guidewire to create

an initial tract [7]. This was followed by the introduction of a single-stage progressive dilator to further expand the tract. Once the tract was adequately dilated, the tracheostomy tube was advanced over the guidewire into position, and the guidewire was subsequently removed. Bronchoscopic guidance is recommended to ensure correct placement and to mitigate potential complications.

In the present case, an error occurred during the PDT procedure when the operator inadvertently advanced the tracheostomy needle with its sheath instead of threading the first dilator. As the dilator had already partially increased the tract aperture, this error resulted in unintentional dislodgment of the needle sheath into the trachea. Such incidents can be potentially life-threatening because foreign bodies in the airway may compromise ventilation and lead to severe complications. To address this situation, immediate interventions have been implemented. A bronchoscope was procured at the bedside to locate and extract the dislodged sheaths. This case emphasizes the need for meticulous checks at each procedural step. The availability of bronchoscopic equipment at the bedside is invaluable. Bronchoscopy not only provides real-time visualization during PDT but also proves indispensable in managing unforeseen complications like foreign body retrieval. In this case, simultaneous management of ventilation and foreign body retrieval required close coordination between the bronchoscopist and airway management team, underscoring the importance of teamwork in critical care procedures.

Conclusion

This case highlights a rare and previously unreported complication of tracheostomy needle sheath migration into the tracheobronchial tree during PDT. It underscores the importance of thorough procedural checks, the availability of advanced tools like bronchoscopy, and seamless team coordination. By implementing preventive strategies such as protocols, checklists, and enhanced training, future incidents can be mitigated, ensuring safer patient outcomes. This case also reinforces the educational value of reporting unique complications to refine procedural techniques and inform clinical practice guidelines.

Abbreviations

CBR	Ciaglia Blue Rhino
GCS	Glasgow Coma Scale (GCS)
ICU	Intensive care units
ICH	Intracerebral haemorrhage
PDT	Percutaneous dilatational tracheostomy

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Author contributions

SM- acquisition and interpretation of data, manuscript writingBN- acquisition of data, manuscript writingSS- Conception of the work, acquisition of data, manuscript editingSP- design of the work, acquisition of data, manuscript editingSBM- Conception of the work, analysis of data and revising it critically SC- manuscript writing and editing.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient's next of kin to publish this case report and accompanying images.

Competing interests

The authors declare no competing interests.

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