

## CASE REPORT

# Innovative Use of Cook's Pediatric Airway Exchange Catheter in Difficult Tracheostomies

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## ABSTRACT

Tracheostomy is a routine airway procedure performed by surgeons and anesthesiologists. However, it is a life-saving procedure in cases of severe tracheal stenosis secondary to traumatic airway injuries, or prior tracheal surgeries. Tracheostomy is challenging in these situations even in experienced hands, especially in an emergency setting, and there can be a fatal loss of airway. Cook's pediatric airway exchange catheter can be successfully used in such cases to safely achieve an appropriately sized tracheostomy even in adults. Initial transtracheal airway access is achieved with a smaller (internal diameter 3.5–4.5 mm) uncuffed endotracheal tube (ETT) to relieve obstruction and improve oxygenation. Railroaded of bigger tubes over a Cook's pediatric airway exchange catheter inserted into the smaller ETT is then sequentially done to achieve a desired size of tracheostomy without loss of airway or compromised oxygenation. We describe five cases of difficult tracheostomy with the use of this technique.

**Keywords:** Cook's pediatric airway exchange catheter, Tracheal stenosis, Tracheostomies.

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## INTRODUCTION

The incidence of iatrogenic tracheal stenosis following intubation and/or tracheostomy is increasing due to improved patient survival following prolonged ventilatory support in the intensive care unit (ICU) setting.<sup>1,2</sup> Other causes of tracheal stenosis include trauma,<sup>1,3</sup> idiopathic stenosis,<sup>2</sup> autoimmune disorders,<sup>2</sup> and restenosis posttracheal surgeries.<sup>4</sup> Patients with restenosis can have severe and long segment tracheal stenosis.

Such patients present with respiratory distress and noisy breathing. Emergency tracheostomy may be needed but is difficult to perform due to distorted anatomy that may worsen with apprehension and positioning. Sedation may not be possible in these cases due to the impending threat of loss of airway. At times, flexible laryngoscope is introduced nasotracheally after prior local anesthetic nebulization to visualize the best site for tracheostomy. This may result in increased discomfort due to temporary narrowing of the tracheal lumen. We present a technique to improve the success of tracheostomy in these cases.

We report a series of five patients with respiratory distress secondary to tracheal stenosis, presenting to our institute from February 2013 to February 2016. The clinical details are summarized in Table 1. All these difficult tracheostomies were successfully managed using a technique involving the use of Cook's<sup>®</sup> pediatric airway exchange catheter.

Our two-staged technique is performed using the following steps. Initial transtracheal airway access is achieved with a smaller (internal diameter 3.5–4.5 mm) uncuffed ETT, with a sterile red rubber suction catheter acting as a stylet, if required, to stiffen the tube catheter assembly set. After initial oxygenation and relief of obstruction through this smaller lumen tube, Cook's pediatric airway exchange catheter (Cook<sup>®</sup> Medical product number G07833, 8 French, 45 cm length, internal diameter 1.6 mm, Cook Medical Headquarters, P.O. Box 489, 750 Daniels Way, Bloomington, IN 47402–0489, USA) is introduced into the smaller ETT. Oxygenation is then continued through the Cook's pediatric airway exchange catheter with the appropriate connector. Final tracheostomy with a 5 to 6 mm internal diameter uncuffed ETT is achieved using the Cook's pediatric airway exchange catheter (Fig. 1). The railroaded of bigger tubes is thus sequentially done and the desired size of tracheostomy is achieved without loss of airway or compromised oxygenation. Final tracheostomy is achieved with a 5 to 6 mm internal diameter uncuffed ETT rather than the readily available tracheostomy tubes as the tracheostomy tubes are not long enough to traverse the long stenotic tracheal segment.

Case number one was a tracheostomized male who presented with increasing respiratory distress and noisy breathing. He had history of unsuccessful tracheotracheal resection and anastomosis. The patient had required a T-tube and later smaller-sized tracheostomy due to

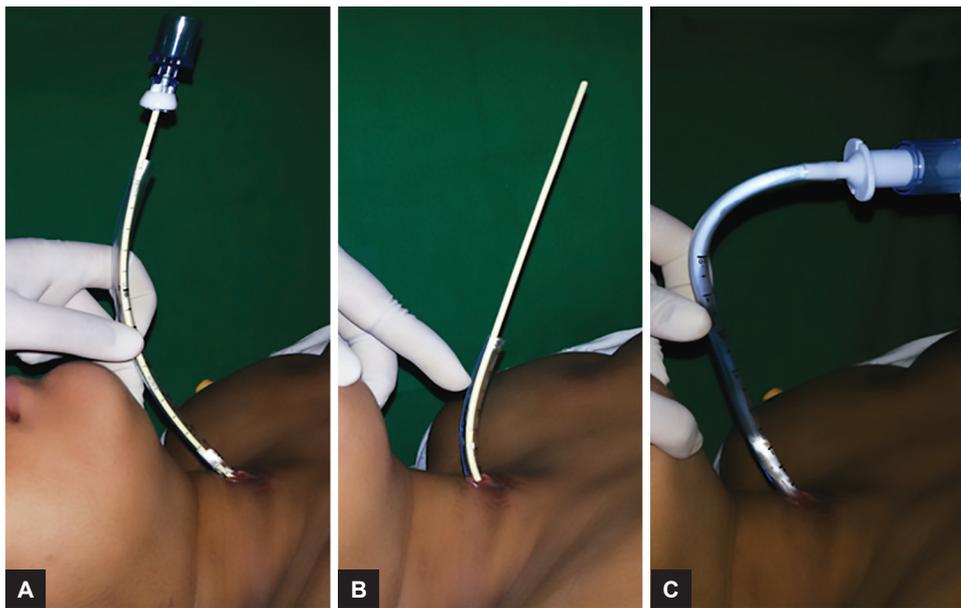
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**Table 1:** Clinical details of cases

Age/sex	Reason for first intubation and ventilatory support	Time from first intubation	Present indication for tracheostomy	Laryngeal/tracheal lesion
23/male	Dengue	2 years	Severe respiratory distress	Long segment stenosis distal to tip of tracheostomy
20/male	Viral encephalitis	1 month	Stridor	Vocal cord palsy and grade IV subglottic stenosis with associated long segment severe tracheal stenosis
45/male	Phorate poisoning	1 month 15 days	Respiratory distress	Subglottic and tracheal stenosis
11/female	Head injury	3 months	Difficult weaning of tracheostomy	Granulations distal to tracheostomy tip
23/female	Organophosphorus poisoning	15 days	Severe respiratory distress	Long segment cricotracheal stenosis

**Figs 1A to C:** Cook's pediatric airway exchange catheter for changeover from size 3.5 to size 5 ETT.

tracheal leak and restenosis. Endoscopic follow-up over a period of 1 year showed gradually increasing stenosis distal to the tracheostomy tube tip. The patient finally presented with respiratory distress and almost no air blast through tracheostomy tube. He needed a change of tracheostomy tube or a fresh tracheostomy to relieve his distress. However, the scarred trachea and long and distal tracheal stenosis made tracheal access and tracheostomy tube insertion extremely difficult. Finally, airway could be established with a size 3 uncuffed ETT. This helped in oxygenation; however, patient continued to experience difficulty in breathing. This tube needed to be changed to at least 5 to 6 mm internal diameter for him to breathe comfortably. In view of the extremely difficult tracheal access and precarious oxygenation status of the patient, tube exchange was essential but risky without an exchange device. The smaller size led us to the use of Cook's airway exchange catheter for the first time in adult tracheostomy. We have found the tube exchange to be smoother with the innovative use of this technique.

The second patient presented with stridor, hoarse voice, and dropping oxygen saturation 10 days after discharge from medical ICU. Flexible nasotracheal endoscopic evaluation suggested vocal cord palsy and grade IV subglottic stenosis. The length of stenotic segment could not be visualized due to inability to pass scope beyond cricoid cartilage. Tracheal access was easily obtained; however, passage of tube proved to be difficult due to long segment severe tracheal stenosis. Staged tracheal tube placement with size 3.5 uncuffed ETT to relieve hypoxia followed by changeover to size 5.5 uncuffed ETT over the exchange catheter as described above was done.

The third patient who had developed severe subglottic stenosis required emergency tracheostomy in view of respiratory distress. Tracheostomy with a size 5.5 uncuffed ETT was performed using the two-stage technique described earlier.

The pediatric patient presented with difficulty in weaning from tracheostomy and mild respiratory distress due to granulations distal to the lower end of the

tracheostomy tube. The technique of using the Cook's pediatric airway exchange catheter for change of tube in this case of difficult reinsertion of tracheostomy tube proved to be a useful and relatively stress-free intervention.

The fifth patient presented with severe respiratory distress and noisy breathing within a week of discharge from the ICU. In this case, a quick tracheal assessment was done using nasal flexible fiberoptic laryngoscope after prior local anesthetic nebulization. It showed long-segment severe cricotracheal stenosis. Obstruction was temporarily relieved with size 4 ETT. Patient complained of choking sensation in spite of improvement in oxygen saturation. A change to size 5.5 uncuffed tube was achieved over the Cook's pediatric airway exchange catheter.

## DISCUSSION

There is an increasing incidence of laryngotracheal stenosis due to improved survival rates following prolonged intubations, and/or tracheostomies in critical care units in India.<sup>5-7</sup> Such patients can require emergency tracheostomy for severe respiratory distress.

If the tracheal stenosis is due to traumatic airway injuries or there is restenosis in previously decannulated tracheostomies or posttracheal reconstruction, tracheostomy can be extremely difficult to perform and there can be a fatal loss of airway. The limiting feature in these cases is a characteristically severe long segment tracheal stenosis. Patients present with worsening dyspnea and difficult and noisy breathing accompanied by hypoxia and hypercapnia. Airway access needs to be restored on an emergency basis. Though airway difficulty can worsen with apprehension and positioning, sedation may not be possible in these cases due to the impending threat of loss of airway. Thus, these tracheostomies become difficult to perform even in skilled hands.

Airway exchange catheters have been used for the performance of difficult tracheostomies in orotracheally intubated patients in the ICU setting.<sup>8</sup> A solid ETT exchanger has been used as a guidewire for difficult tracheostomy tube placement in an intubated obese patient with a short neck as reported by Hwang et al.<sup>9</sup> However, use of hollow airway exchange catheter as described by us in previously unintubated patients has not been reported yet.

We found increased safety and comfort for patients, surgeons, and anesthesiologists alike with our technique.

The Cook pediatric airway exchange catheter has become a mandatory equipment on our checklist for all difficult tracheostomies, especially in adults.

## CONCLUSION

Our experience with the innovative use of Cook's pediatric airway exchange catheter for difficult tracheostomies in adults, and other difficult tracheostomies is easily reproducible. We hope to familiarize anesthesiologists with this technique to achieve safe airway in difficult tracheostomies in otolaryngological set-ups all over the world.

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