



Case report

Argon plasma coagulation in the management of uncovered tracheal stent fracture



Yiu-Hei Ching^{a,*}, Robert D. Geck^b, Arthur D. Andrews^b, Mark J. Rumbak^b, Enrico M. Camporesi^c

^a Department of Surgery, University of South Florida Morsani College of Medicine, 1 Tampa General Circle, Tampa, FL 33606, USA

^b Department of Medicine, Division of Pulmonary Critical Care and Sleep Medicine, Section of Interventional Pulmonary, James A Haley Veterans Hospital and University of South Florida Morsani College of Medicine, 2 Tampa General Circle, Tampa, FL 33606, USA

^c Florida Gulf-to-Bay Anesthesiology Associates, 1 Tampa General Circle, Tampa, FL 33606, USA

A B S T R A C T

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Endotracheal and endobronchial stenting, particularly with uncovered stents, can be complicated by stent fracture, granulation tissue formation, direct airway injury, and airway obstruction. While stent removal is possible, it can result in significant complications and long-term benefit is not guaranteed. Argon plasma coagulation can be employed to trim fractured stent fragments and remove granulation tissue simultaneously. In this manuscript, we report a case and describe our experience with using this technique.

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Introduction

Endotracheal stents are used in the management of airway malacia or cancers when other measures fail [1]. Tracheal stents, especially those that are uncovered, can be complicated by stent fracture and migration and airway obstruction secondary to irritation, inflammation, and granulation tissue formation [1,2].

Argon plasma coagulation (APC) (ERBE™, Tübingen, Germany) is an interventional bronchoscopy technique that is beneficial in treating tracheal stenosis resulting from stent-related granulation tissue formation. While successful APC trimming of biliary and gastrointestinal metallic stents has been previously reported in the literature [3,4], its use in managing airway stents has not been described to our knowledge. In this manuscript, we present the case of a patient with severe tracheomalacia treated with endotracheal stenting (Ultraflex™, Boston Scientific, Boston, MA) complicated by stent fracture and significant, symptomatic granulation tissue formation and discuss the utility of APC in managing fractured tracheal stents.

Case report

A 43-year-old male sustained cutaneous flame burns and severe inhalation injury after being involved in a house fire. His history was significant for chronic obstructive pulmonary disease, morbid obesity, and obstructive sleep apnea. The patient's cutaneous burns were treated conservatively without need for excision and grafting. However, due to the nature of his inhalation injury and underlying pulmonary disease, he required chronic tracheostomy placement. His course was further complicated by development of tracheomalacia which ultimately necessitated placement of an uncovered nitinol endotracheal stent (Ultraflex™, Boston Scientific, Boston, MA). From that time, the patient underwent serial bronchoscopies with APC treatments to manage progressive tracheal stenosis secondary to granulation tissue formation in and around the stent. Additionally, the stent since fractured with displacement of metallic fragments into the trachea. In order to manage this problem, we utilized APC to evaporate exposed metal without causing injury to any underlying or surrounding structures (Fig. 1). The patient tolerated these procedures well and consistently experienced immediate relief of his obstructive symptoms without any significant complications to date.

* Corresponding author. Tel.: +1 (813) 844 4122; fax: +1 (813) 844 1906.

E-mail addresses: yching@outlook.com (Y.-H. Ching), rgeck@health.usf.edu (R.D. Geck), aandrew1@health.usf.edu (A.D. Andrews), mrumbak@health.usf.edu (M.J. Rumbak), ecamporesi@fgtba.com (E.M. Camporesi).

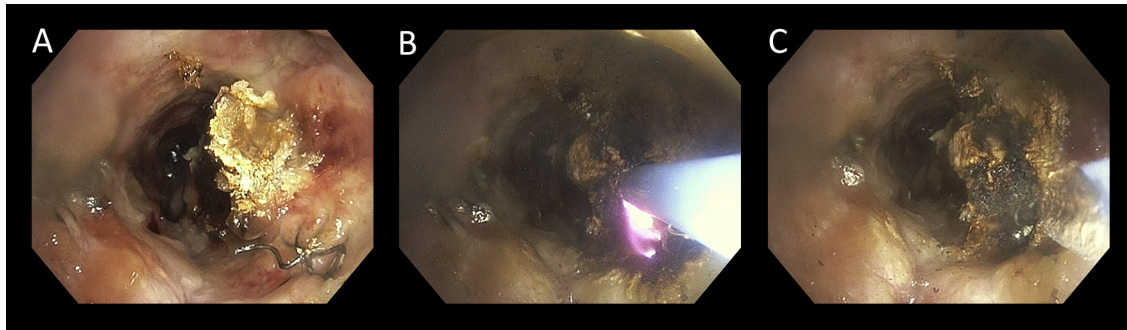


Fig. 1. Bronchoscopic view during argon plasma coagulation. A, Prior to argon plasma coagulation, fractured stent fragments and granulation tissue are present in the tracheal lumen. B, The stent fragment is seen to be illuminated with activation of argon plasma coagulation. C, After argon plasma coagulation, the evaporated stent fragments are no longer visualized. The remaining granulation tissue was removed after capturing the image.

Discussion

While complications of long-term tracheal and bronchial stenting and fracture can be addressed with stent removal, this procedure is fraught with risks such as stent fragment retention, mucosal tearing and hemorrhage, repeat obstruction, need for mechanical ventilation, and pneumothorax [5,6]. The ability to use APC to simultaneously trim stent fragments and remove granulation tissue presents a novel but proven approach to managing the fractured stent. We hypothesized that APC could be used safely with minimal collateral damage to the airway secondary to the increased resistance of the mucosa compared to metal stent fragments. In our patient with severe tracheomalacia and confounding pulmonary disease, stent removal would be treacherous and unlikely to provide long-term benefit. APC stent trimming allows for continued management while retaining the stent in place.

We perform APC endotracheal stent trimming under general anesthesia while maintaining the fraction of inspired oxygen at less than 0.4 with argon flow at 1–2 L per minute and power set at 70–80 W. This increased power setting for APC is significantly stronger than that routinely used for granulation tissue removal. Activation of APC occurs over intervals of less than 3 s with the probe positioned parallel or perpendicular to the free end of the stent fragment to minimize collateral damage. Upon initial contact with the argon flow, the stent illuminates brightly. After this flash dissipates, APC is stopped. Cessation of APC treatment is determined after the treating pulmonologist is satisfied with the degree of improvement in stenosis and clearance of stent fragments.

In our institution's experience with APC granulation tissue removal and metal stent trimming, we have observed positive results with effective relief of airway obstruction and avoidance of any significant complications. Recurrence of granulation tissue is significantly less in areas where the stent has been trimmed. We believe that this technique is valuable in patients with fractured

stents at risk for airway obstruction and perforation who are poor candidates for stent removal or in patients in whom stent removal is inadequate. However, we are concerned about the potential negative effects of metal evaporation in the airway, especially in the presence of positive pressure ventilation. Metallic precipitation or absorption may lead to unforeseen pulmonary and other systemic complications. To minimize this potential, we routinely perform airway suctioning with bronchoscopy. In conclusion, in addition to following their airway status, we recommend close observation and long-term monitoring of these patients *in toto*.

Disclosures

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