

Endobronchial removal of uncovered stent using argon plasma coagulation via fiberoptic bronchoscopy

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Abstract

Bronchial stenosis is a complication of lung transplantation that often requires repeated balloon dilation, endobronchial treatments, and possibly stent placement. Endobronchial stents, particularly uncovered ones, may have several complications including excessive granulation tissue that cause airways obstruction and impaired mucociliary clearance, which may lead to inflammation and infections. Removal of epithelialized endobronchial stents is usually done in the operating room using rigid bronchoscopy. Argon plasma coagulation (APC) has been used for removal of biliary stents. One case report described an endotracheal uncovered stent removal using this technique. APC can be used via flexible bronchoscopy, which may carry less risk of complications and can be done in an outpatient setting. In this case, we report using APC, at a low energy level, for complete removal of a totally epithelialized endobronchial uncovered stent in a patient experiencing stent-related complications.

Introduction

Bronchial stenosis is a complication of lung transplant with an incidence that ranges between 7% and 33%. It often requires repeated balloon dilations or endobronchial treatments, including laser ablation, cryotherapy, and possibly endobronchial stent placement [1]. Endobronchial stents, particularly uncovered ones, may have several complications, including excessive granulation tissue that may cause airways obstruction and impaired mucociliary clearance that may lead to further inflammation and subsequent infections [2].

In some patients, complications that arise from excessive granulation tissue formation following uncovered stent placement requires stent removal. Removal of epithelialized endobronchial stents is usually done in the operating room, under general anaesthesia using rigid bronchoscopy. Argon plasma coagulation (APC) has been successfully used to remove metallic stents from the biliary tree in patients with pancreatobiliary obstructions [3].

Herein we report fiberoptic removal of an embedded uncovered endobronchial stent from a patient experiencing stent-related complications in an outpatient setting.

Case Report

The patient is a 71-year-old male who received right lung transplantation for idiopathic pulmonary fibrosis. The transplant was complicated by severe right mainstem bronchial stenosis requiring frequent balloon dilation, endobronchial cryotherapy, and APC ablation of the stenotic area.

Following a large laceration with haemorrhage of the posterior wall of the right mainstem bronchus following airway dilation, an uncovered 12 × 30-mm ultraflex stent (Boston Scientific, USA) was placed by interventional radiology.

Several months following stent placement, the patient started experiencing worsening symptoms of dyspnoea and productive cough. These were attributed to several severe airway complications, including formation of granulation tissue over the uncovered stent causing airway stenosis and obstruction of the right upper and middle lobes and the superior segment of the right lower lobe, impaired mucous clearance, and recurrent pneumonia.

The patient required repeated endobronchial treatments including APC and cryotherapy for granulation tissue removal.

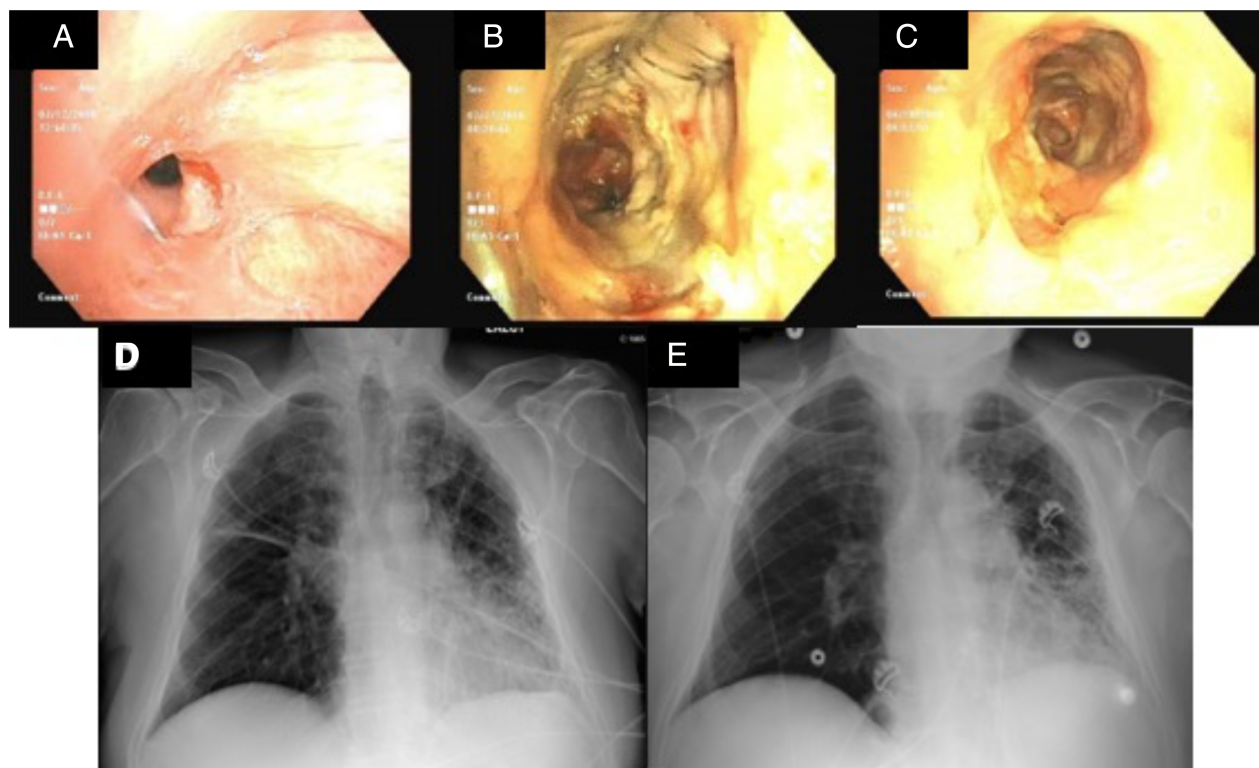


Figure 1. (A) Granulation tissue covering the embedded uncovered wire stent with significant narrowing of the right mainstem bronchus. (B) Right mainstem bronchus after partial removal of the stent wires using argon plasma coagulation (APC). (C) Right mainstem bronchus after complete removal of the uncovered stent using APC. (D) Pre-stent removal chest X-ray showing the uncovered stent in the right mainstem bronchus with some partial atelectasis of the right upper lobe and hyperinflation of the right lung. (E) Chest X-ray after complete stent removal showing resolution of the right upper lobe atelectasis and less air trapping of the right lung.

A decision was then made to remove the embedded stent via fiberoptic bronchoscopy to attenuate further complications and granulation tissue development.

We first treated the granulation tissue with a circumferential APC probe—pulse effect 2, flow of 0.5 L/min, and power of 25 W. We started distal to the stent, activating the APC in the centre of the airway, and worked towards the proximal end. This technique allowed the stent struts to be exposed. We then used a small, 2-mm straight fire APC probe pulsatile-1 with a flow of 0.5 L/min and power set at 50–60 W with filter 1500 A (Erbe elektromedizin GmbH, Germany), allowing for more direct energy application targeted to the stent wires. Stent wires were pulled from the airway wall by an alligator forceps to allow APC probe energy to be directed parallel not perpendicular to the airway wall. Using this technique, the stent conducted and absorbed the energy. The FiO_2 was turned down to $\leq 30\%$ when APC was applied; negligible airway injury occurred. The patient required five sequential procedures to completely remove the stent during scheduled bronchoscopy appointments for debridement of granulation tissue and airway dilatation.

Total removal of the uncovered stent resulted in reduction of inflammation, infection, and improvement of overall symptoms. The stent was fully removed with no significant mucosal burns, trauma, or bleeding. This was achieved 19 months after initial stent placement (Fig. 1).

Discussion

Bronchial stenosis carries significant morbidity in lung transplant patients. It often requires frequent endobronchial balloon dilations [1]. Airway stents have become an important part of bronchial stenosis management due to their feasibility and cost effectiveness. Complications of endobronchial stents largely depend on the type of stent and individual patient response that is amplified by the presence of airway bacterial colonization, infection, and poor bronchial neovascularization post implantation [2].

Endobronchial stent removal carries several risks, including bleeding, mucosal tears, re-obstruction requiring new stent placement, pneumothorax, post-operative mechanical ventilation, retained stent fragments, and death. Risk factors for

these complications include type of the stent, duration of indwelling stent, and initial indication for the placement [4].

Uncovered endobronchial stent removal can be challenging, especially if it has been in place for a prolonged period of time as granulation tissue forms and the stent becomes embedded into the airway wall due to epithelialization. Embedded metallic stents are usually removed in the operating room, using rigid bronchoscopy and following repeated treatment of granulation tissue and exposing the stent [2].

APC is a thermal ablation technique that uses argon gas to achieve tissue cauterization, debridement, debulking, and achieving haemostasis.

Metallic stents can be cut by means of APC, as their melting point is reached by the temperature generated by argon plasma (1000–1300°C).

Case reports for biliary stents have used APC at a flow rate ranging from 0.8 to 2 L/min and a power ranging between 60 and 80 W [3]. In one case report describing removal of an endotracheal uncovered stent, the energy used was 70–80 W [5]. This is significantly higher than the energy required for granulation tissue removal (20–30 W).

The energy that we used to melt the stent wires was 50–60 W, which is lower than the only one reported in the literature. This reduces the risk of mucosal injury. We pulled portions of the stent by forceps into the middle of the airway lumen and used a small straight fire APC probe to ablate the stent wires to aid stent removal in progressive fashion over a planned course of five sequential treatments.

The energy that we used to melt the stent wires is lower than the only one reported in the literature, which reduces the risk of mucosal injury.

APC can be used via flexible bronchoscopy, which may carry less risk of complications compared to rigid bronchoscopy. In addition, flexible bronchoscopy is more cost effective as it utilizes less resources and can be done in the outpatient setting.

To our knowledge, our case is the first to report using APC technique for complete removal of a totally epithelialized endobronchial uncovered stent 19 months after placement for a severe right mainstem bronchial laceration following repeated balloon dilation for stenosis following right lung transplantation.

Disclosure Statement

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

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