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An approach to tracheostomy in a patient with an expandable metallic tracheal stent

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Abstract
With increasing use of expandable metallic stents to manage patients with a variety of endobronchial pathologies, some will have a subsequent need for tracheostomy insertion. We describe a successful technique to insert a tracheostomy using rigid and fibre-optic bronchoscopy in a patient who had an 8 cm expandable metallic tracheal stent deployed previously on account of tracheomalacia.

Key words: Trachea; Stent; Tracheostomy; Surgical Procedure

Introduction

Endobronchial stenting has been successfully employed to treat a variety of patients with diverse benign and malignant endobronchial pathologies.[1,2] More recently, improvements in the stents themselves, together with the development of covered and uncovered expandable metallic stents designed for long-term insertion, have led to encouraging experience. There are particular complications which can accompany stent deployment; the majority of these can usually be successfully treated.[3–6]

Usually, covered stents are deployed to prevent tumour or granulation-tissue proliferation through the stent or to seal defects e.g. tracheoesophageal fistula or iatrogenic tracheal tear complicating percutaneous tracheostomy. However, the covering can impede sputum expectoration and therefore facilitate sputum retention and infection. Uncovered stents are used to support the airway in conditions which produce extrinsic airway compression e.g. tumour, aneurysm or thyroid enlargement. Being uncovered, these stents are less likely to produce respiratory infection. Once inserted, expandable metallic stents are very difficult to remove and are therefore considered to be permanent. The newer expandable metallic stents have a fine nickel titanium mesh and with uniform expansion do not usually cause local ischaemia. As such, airway rupture and stent migration are uncommon. The earlier metallic stents had wide struts and often did not expand in a uniform fashion. Local mucosal ischaemia could lead to airway dehiscence and stent migration. Other complications which can occur with expandable metallic stents include proliferating granulation tissue formation above, within or below the stent, which, if the stent is uncovered, can compromise the airway lumen or bleed. Halitosis can occur in some patients.

For some patients it may be subsequently necessary to fashion a tracheostomy. Given the fact that the expandable metallic stents are made of finely woven titanium mesh which cannot be easily cut, together with the fact that once deployed the stents are usually difficult to remove, tracheostomy formation may be challenging in these patients. However, for those patients with distal tracheal disease requiring stenting it is possible to deploy a tracheostomy tube above the stent and to carefully guide the tube into the lumen of the stent. We describe a successful approach for tracheostomy deployment in a patient who previously had an 8 cm expandable metallic stent deployed to treat distal tracheomalacia.

Case report

A 65-year-old woman was referred to our unit for management of a type-A aortic dissection which extended distally beyond the left subclavian artery with some involvement to the spinal arteries. She had a background of hypertension, which we believe was the causative factor in the development of her aortic dissection. She also had a background of asthma, although this had not been properly clarified pre-operatively by formal lung function testing locally and she did not demonstrate a clinical response to bronchomodulatory therapy.

Following surgery, the patient developed multiple organ dysfunction which necessitated prolonged intensive-care treatment for sepsis control and haemodia filtration. She was difficult to wean from mechanical ventilatory support, and rigid bronchoscopy confirmed the presence of tracheomalacia extending for a distance of 6 cm proximal to the carina. There was no airway malacia elsewhere. It is possible that this had been longstanding and indeed was the cause of her airflow obstruction, which had been incorrectly labelled as asthma. Additionally, the tracheomalacia could have resulted from additional prolonged mechanical ventilatory support post-operatively or from ischaemia as a consequence of her aortic dissection. Given the fact that it was our impression that her airway malacia was long-standing and needed to be addressed prior to successful weaning from mechanical ventilatory support, an 8 cm uncovered Ultraflex© expandable metallic stent (Boston Scientific, Waterson, MA) was deployed via rigid bronchoscopy and the patient was successfully extubated the following day.

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As the patient's other co-morbidities improved, she was discharged from intensive care to the surgical ward and subsequently was referred back to her local hospital. Eight weeks post-operatively, she developed a respiratory infection and was admitted to intensive care where she was treated with broad-spectrum antibiotics. Her condition deteriorated and she required mechanical ventilatory support. A size-8 endotracheal tube was inserted. On account of poor respiratory effort as a consequence of respiratory muscle weakness, she became difficult to wean from mechanical ventilatory support and a tracheostomy was indicated.

The procedure was performed in the intensive care unit at the patient's bedside. The endotracheal tube was removed and a rigid bronchoscope was inserted. The patient was ventilated via a venturi system using a Sanders injector. The anatomy of the airway and the stent were defined and, using the rigid bronchoscope, the trachea was displaced anteriorly. The light source highlighted the optimal position for tracheostomy insertion. Under a strict aseptic technique, local anaesthetic was inserted into the neck in the midline. A midline incision was made and blunt dissection was performed onto the anterior trachea. A guide wire was then inserted into the trachea. A fibre-optic bronchoscope was inserted through the rigid bronchoscope and, using forceps, the guide wire was snared and guided through the stent to lie in the right main bronchus. Interestingly, when the guide wire was initially placed in the trachea it was found to insinuate between the posterior wall of the stent and the membranous trachea. Obviously, had this not been identified, significant damage to the stent and airway could have occurred. Under direct vision through the rigid bronchoscope, it was possible to ensure adequate placement of the tracheostomy, and this was confirmed after deployment using the fibre-optic bronchoscope inserted through a size-8 tracheostomy tube. The tracheostomy tube was guided using the fibre-optic bronchoscope to lie in the proximal 1.5 cm of the stent and the cuff was inflated. The patient tolerated the procedure without complication.

Discussion

With increasing use of expandable metallic stents in the management of endobronchial pathology, more and more long-term patients with endobronchial stents are being encountered who may require subsequent airway manipulation. We appreciate that our patient had a stent in the lower 8 cm of the trachea and that there was space above to successfully insert a tracheostomy tube and also that stents deployed in more proximal positions may render tracheostomy deployment much more difficult. The use of rigid bronchoscopy at the bedside enabled us to safely perform percutaneous tracheostomy insertion in such patients. Throughout the procedure, the airway was preserved and the rigid bronchoscope splinted the airway open and permitted its anterior displacement. Furthermore, direct visualization of the airway at all times ensured correct positioning of the guide wire. If necessary, a fibre-optic bronchoscope can be used to direct the guide wire through the stent lumen into the main bronchus distally. When the tracheostomy was inserted into the trachea the fibre-optic bronchoscope could be passed through it to ensure that the tracheostomy lay in a suitable position within the stent mechanism. Furthermore, one could also inspect the distal stent to ensure that there was no stent migration.

We suggest that for those patients who have had previous expandable metallic stents deployed in the trachea, rigid and fibre-optic bronchoscopy should be used if percutaneous tracheostomy is indicated to ensure optimal positioning of the tracheostomy tube in the airway and to minimize stent damage.

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