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Case Report

Airway management of patients with tracheobronchial stents

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The use of tracheobronchial stents for compromised large airways is increasing. We provide a case series highlighting some of the complications of airway management in patients with tracheobronchial stents *in situ* and propose an approach for dealing with this potentially complicated situation.

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As advances in technology and treatment strategies are made in thoracic medicine, along with improvements in stent design and manufacture, an increasing number of patients are being treated using airway stenting. Anaesthetists, in both specialist and non-specialist centres, should be aware of, and be able to successfully manage such patients for elective and emergency operations, without compromising the integrity of the airway stent.

Large airway stenting has been traditionally considered a palliative treatment for malignant disease, but there are a number of other reasons for stent insertion.[1–5] Current practice demonstrates the increasing use of tracheobronchial stents for a number of non-malignant conditions and, at times, can be curative (Table 1). Many of the patients with non-malignant disease may have a normal lifespan and may present for elective or emergency surgery unrelated to their airway problem. It will not be unusual for the non-specialist anaesthetist to come across such patients in their day-to-day practice.

The complications of airway stenting can be divided into those of the procedure itself and those occurring in the immediate and long-term after stent deployment[1 6–8] (Table 2). It should, however, be noted that tracheobronchial stent insertion carries a low risk for complications occurring during the procedure.

Our experience of anaesthesia for stent insertion

Our anaesthetic technique is similar to that described recently,[9] so it will not be described further. We currently perform 20 rigid bronchoscopies per month for endobronchial intervention (Nd:YAG laser, dilatation, stent deployment, foreign body retrieval). Since 1997 we have deployed 150 Ultraflex (Boston Scientific, Waterson, MA) expandable metallic stents in patients with a variety of endobronchial pathologies. We have had no mortality directly related to the procedures, but two patients developed a pneumothorax, requiring intercostal tube insertion, and one had significant bleeding that was successfully controlled using bronchoscopic manoeuvres. With this experience of stent deployment in our unit comes the inevitable learning curve of dealing with airway management and problems occurring in patients with tracheobronchial stents *in situ*. In order to illustrate this point, four such cases and their subsequent management are described.

Case report 1

'*In situ* stent complicating emergency tracheostomy insertion, followed by successful management of tracheostomy tube changes, using the bronchoscopy and bougie technique'.

A 58-year old female underwent expandable metallic stent deployment for treatment of subglottic tracheal compression caused by myeloma. Unfortunately, continuing airway compromise led to a respiratory arrest on the ward. Failed intubation was followed by emergency surgical tracheostomy. During attempts at tracheostomy the original stent was damaged (Fig. 1) and had to be removed before a tracheostomy tube could be inserted. After 6 days in the intensive care unit (ICU) she was discharged to the ward with a fenestrated tracheostomy tube. Further large airway obstruction led to another respiratory arrest requiring redeployment of an expandable metallic stent. The technique for reinsertion of the tracheostomy tube was as

Table 1 Indications for stent insertion. NHL, non-Hodgkin's lymphoma; CLL, chronic lymphatic leukaemia

Malignant	Internal airway	Carcinoma of the lung
	External compressing	Pulmonary metastases Neuroendocrine carcinomas Thymomas Haematological cancer – NHL, myeloma, CLL Carcinoma of the lung ('Mass Effect')
Benign	Iatrogenic	Post-surgical strictures – transplant, resection Prolonged intubation – tracheomalacia, tracheal tears, stenoses, granulation tissue formation
	Fistulae	Bronchopleural and tracheoesophageal
	Inflammatory stenoses	Amyloidosis, tuberculosis, Wegener's
	Vascular anomalies	Inoperable aortic aneurysms, subclavian artery aneurysm
	Neuroendocrine Tracheal web	Benign tumours, multinodular goitre

Table 2 Complications of stent insertion

Procedural complications	Complete or partial airway obstruction due to breakage or malposition of the stent Perforation of the tracheobronchial wall Surgical emphysema Tension pneumothorax Pneumoperitoneum
Immediate complications	Migration—leading to anything from mild ventilatory abnormality to total airway obstruction Retention of secretions with airway obstruction Obstruction of bronchial orifices Cough Infection
Long term complications	Sputum retention Granulation tissue at proximal or distal end of stent Halitosis Metal fatigue Respiratory infections

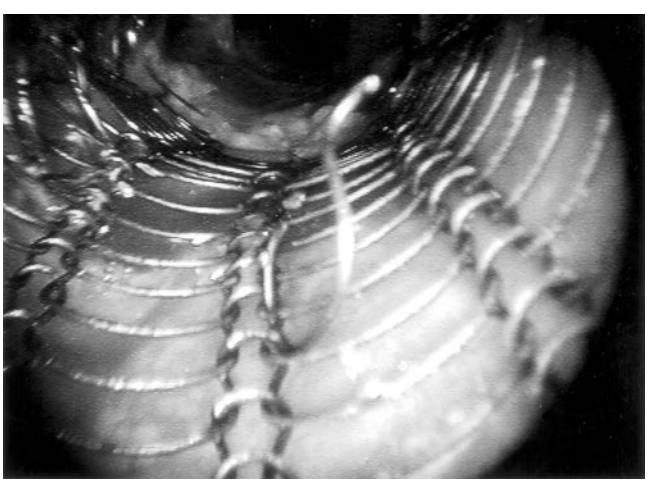

Fig 1 Complication of stent fracture during attempted tracheostomy, with a sharp metal fragment in the tracheal lumen.

follows: a rigid bronchoscope was inserted through the existing tracheal stoma, a gum elastic bougie was placed within the stent lumen under direct vision via the bronchoscope and a tracheostomy tube railroaded over the bougie. Successful positioning of the tracheostomy tube and the stent was then confirmed with the fibreoptic bronchoscope. A further tracheostomy tube change was performed 6 days later under direct vision using the rigid bronchoscopy and bougie technique. The tracheostomy tube was eventually removed 7 weeks later and the patient discharged home. She has since undergone three further rigid and fibreoptic bronchoscopies to clear granulation tissue overgrowth with tracheal dilatation and laser therapy. She has received a successful stem cell transplant for her myeloma.

Case report 2

'Complication of stent migration and successful management of multiple tracheostomy tube changes using bronchoscopy'.

A 57-year old male with multiple serious co-morbidities, including C7 tetraplegia, multi-infarct cerebrovascular accidents and previous tracheostomy, presented to the emergency department with respiratory failure and respiratory arrest. Bronchoscopy demonstrated significant tracheomalacia in the lower half of the trachea and he underwent early surgical tracheostomy to facilitate ventilatory weaning. At repeat rigid bronchoscopy, there was marked vocal cord oedema with reduced right vocal cord movement, granulation tissue at and below the tracheostomy insertion site and significant tracheomalacia. An expandable metallic tracheal stent was deployed below the tracheostomy with the aid of a rigid bronchoscope. An endotracheal tube (ETT) was inserted using the rigid bronchoscopy and bougie technique—the bougie to be visualized within the lumen of the stent before introduction of the ETT. The ETT was later replaced with a tracheostomy tube using the same technique.

Over the following 3 weeks, ventilatory weaning was complicated by stent migration on five occasions. Each time the stent was successfully repositioned using the rigid bronchoscope and the tracheostomy tube was guided into the lumen of the stent under direct vision with the fibreoptic bronchoscope. Unfortunately, the patient died due to continuing sepsis.

Case report 3

'Complications of stent migration and creation of an extraluminal tracheal track due to non-bronchoscopic positioning of a tracheostomy tube'.

A 69-year old male underwent left pneumonectomy for a non small cell bronchial carcinoma complicated by aspiration pneumonitis and bronchopleural fistula. He underwent percutaneous tracheostomy followed by deployment of a covered expandable metallic tracheobronchial stent to occlude the left main bronchus and stop the persistent air leak. The tracheostomy tube was reinserted through the

existing stoma using the rigid bronchoscopy and bougie technique, so that the tracheostomy cuff was positioned within the lumen of the stent.

Two episodes of stent migration were successfully treated bronchoscopically, and the tracheostomy tube was reinserted using the bronchoscopy and bougie technique. Unfortunately, after accidental decannulation, another tracheostomy tube was inserted under emergency conditions without the aid of a bronchoscope. Although chest expansion and oxygen saturation seemed clinically adequate, mechanical ventilation showed large discrepancies between high measured inspiratory and low expiratory volumes. A chest radiograph showed the tracheostomy tube to be misplaced, being positioned in a false track between the stent and the trachea. He became hypoxic and suffered another respiratory arrest. He was successfully resuscitated once the tracheostomy tube and stent were drawn back into the correct place using the fibreoptic bronchoscope. He was discharged back to the ward 3 weeks later.

Case report 4

'Complications of severe subglottic stenosis and failure to use the fibreoptic bronchoscope to correctly identify optimal tracheal tube positioning.'

A 48-year old male, who had a previous tracheostomy, presented to the emergency department in respiratory distress. Severe subglottic stenosis precluded translaryngeal intubation, so he underwent emergency surgical tracheostomy. Bronchoscopy showed granulation tissue obstructing the trachea distal to the previous tracheostomy site with significant tracheomalacia. A covered expandable metallic stent was deployed and an ETT inserted using the bronchoscope and bougie direct visualization technique, followed by fibreoptic confirmation of tube and stent position.

He recovered to home discharge but was readmitted 2 weeks later in respiratory failure. Intubation was achieved easily on this occasion and bronchoscopy demonstrated good stent position with no further granulation tissue overgrowth, and he was weaned and discharged over the proceeding 12 days.

The final emergency admission came 5 weeks later with cough and breathlessness leading to respiratory failure requiring ventilatory support. There were multiple attempts at tracheal intubation resulting in misplacement of the ETT and creation of a false track, through which ventilation was attempted. The patient developed bilateral tension pneumothoraces and suffered two cardiorespiratory arrests. Three tracheal tears were revealed on rigid bronchoscopy. After resuscitation, stent position was restored and an ETT was inserted using the bronchoscope and bougie direct visualization technique. He was extubated 3 days later and discharged after 2 weeks. The patient has since had several follow-up bronchoscopies. He required laser therapy to the granulation tissue on one occasion but is now well.

Discussion

As demonstrated from the above case reports, without endoscopic visualization, the potential complications of inadvertent, incorrect airway manipulation in patients with tracheobronchial stents *in situ* can be catastrophic. It is therefore important to proceed with caution when faced by a patient with tracheobronchial stent *in situ*.

In the awake, orientated patient a full history (as in any preoperative visit) is essential to establish the reason for stent insertion, its position and type. This information can be particularly useful as conditions treated with covered stents are usually malignancies or when there is a need to seal a hole such as a fistula. They pose a significantly higher risk of airway obstruction if misplaced. If the patient has had concomitant radiotherapy or chemotherapy, this may increase the likelihood of difficult laryngoscopy.[10] If an uncovered stent was used there may be significant overgrowth of granulation tissue leading to difficult intubation or ventilation. Crucial to the management of these patients is the risk of intubation without the use of bronchoscopy. This may lead to bronchial occlusion, perforation or 'dissection' of the trachea leading to the creation of a false passage or causing damage to the stent.

We recommend that for tracheal intubation of patients with tracheobronchial stents *in situ*, bronchoscopic visualization of the trachea and stent and careful guidance of the ETT into position is required.

Our suggested management of patients with large airway stents *in situ* presenting for anaesthesia includes the following.

For elective procedures when there is no risk of aspiration the use of a supraglottic airway device such as the standard laryngeal mask airway (LMA) or Proseal™ LMA would be the safest option as it obviates the need for tracheal intubation.

If tracheal intubation is necessary and hand ventilation is possible, a fibreoptic technique under general anaesthesia should be used to ensure correct positioning of the tracheal tube within the stent or just above if the stent is in the lower part of the trachea. In a known difficult intubation, an awake fibreoptic intubation is essential.

In emergency surgery, an awake fibreoptic intubation provides a safe approach of securing the airway while maintaining the integrity of the stent and correct positioning of the tracheal tube. If the airway is critically compromised, and the requirement for oxygenation immediate, then the most familiar method to the anaesthetist should be used, ensuring fibreoptic confirmation of the tracheal tube position as soon as feasible. Gentle introduction of a gum elastic bougie followed by railroading of the tracheal tube over the bougie may minimize the risk of ETT malposition and tracheal damage. Fibreoptic confirmation is, however, still mandatory.

The formation of a tracheostomy in patients with tracheal stents is difficult and may lead to stent damage, compression

or misplacement and airway compromise. Risk of these complications is particularly high with the percutaneous technique. Recently, however, rigid bronchoscopy assisted percutaneous tracheostomy has been shown to provide excellent visibility and optimal surgical conditions by anterior displacement of the trachea resulting in reduction of risk of stent damage or misplacement.[11 12] We recommend this technique if percutaneous tracheostomy is considered in the patient with a tracheobronchial stent.

In all situations, the emphasis has to be on direct endoscopic visualization of the trachea and stent, while ensuring optimal positioning of the tracheal tube.

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