

## Use of expandable metal stents in the treatment of bronchial obstruction

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**ABSTRACT** An expandable metal stent has been used to treat bronchial collapse due to polychondritis in one patient and extrinsic bronchial compression secondary to bronchogenic tumour in another.

Large airway obstruction may be due to intraluminal disease, stenosis, tracheobronchial collapse, or extrinsic compression. Surgical reconstruction of the diseased segment of an airway may be successful,<sup>1</sup> and in some cases of intraluminal malignancy laser treatment restores airway patency.<sup>2</sup> Tracheobronchial stents are an alternative, however, in patients with airway collapse, stenosis, and obstruction caused by extrinsic compression.<sup>3-5</sup> Wallace and coworkers have described the modification of an expandable intravascular stent for use in the tracheobronchial tree.<sup>6</sup> We have examined its clinical application in two patients with bronchial obstruction.

### Methods

The stents (Cook Inc) comprise 0.46 mm stainless steel wire arranged in zigzag fashion to form a cylinder (fig 1). Various widths and single or double stent lengths are available. Hooks on the outer aspect of the stent are designed to become embedded in tracheobronchial mucosa and hence secure the device.

The stents are inserted in compressed form, loaded into a

delivery catheter. In both cases described below the patient had a general anaesthetic. After insertion of an oral endotracheal tube the site and extent of bronchial obstruction were assessed by means of a fiberoptic bronchoscope. Under fluoroscopic control a skin marker was placed on the chest wall at the site of maximal airway obstruction. Balloon dilatation of the bronchus was carried out if extrinsic compression was found (patient 2). The delivery catheter was then introduced with the help of radiographic screening and the stent was released from the catheter once aligned with the skin marker. Correct placement was confirmed with the fiberoptic bronchoscope. An alternative method of introduction would be to place the stent under direct vision through rigid bronchoscope.

### Case reports

#### CASE 1

A 55 year old ex-smoker presented with shortness of breath and a non-productive cough. He had a mildly hyperinflated chest with no added respiratory sounds, normal heart sounds, and no evidence of peripheral cartilage abnormality or joint disease. The chest radiograph was normal. Pulmonary function tests showed an FEV<sub>1</sub>/FVC of 1.5/3.0 litres with normal transfer coefficient and 1.7 l of trapped gas. There was no improvement after a trial of terbutaline or prednisolone 30 mg/day for two weeks. The full blood count was normal with an erythrocyte sedimentation rate of 3 mm in

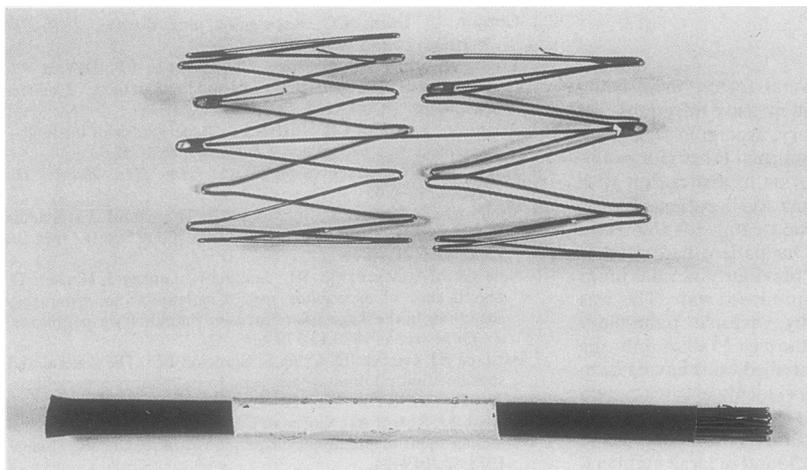


Fig 1 Expandable metal stent. Above: Double stent in expanded form. Below: Delivery catheter containing compressed stent.

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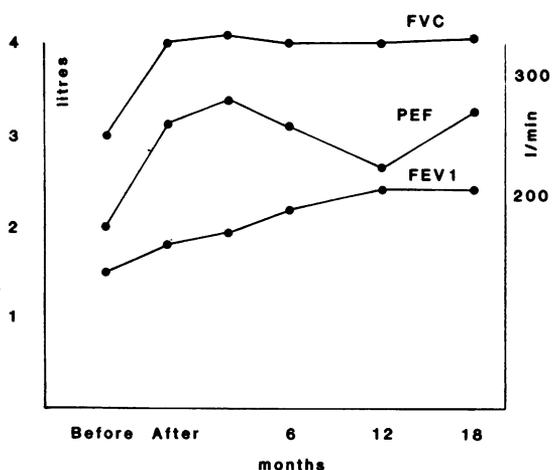


Fig 2 Case 1: Spirometry before and after insertion of stent.

one hour and negative findings in the autoantibody screen apart from a high titre of cartilage antibodies, consistent with a diagnosis of polycondritis.<sup>8</sup> Rigid bronchoscopy showed a normal trachea and left main bronchus, but the right main bronchus was completely collapsed, opening only on forced inspiration. A diagnosis of probable polycondritis affecting the cartilage of the right main bronchus was made, and a 2.5 × 2 cm right endobronchial stent was inserted by the method described above. Within a day of insertion of the stent breathlessness had lessened. Serial spirometric values obtained over the next 18 months are shown in figure 2. No adverse effects have been seen during follow up and chest radiographs have shown no change in the position of the stent.

#### CASE 2

A previously active 81 year old man presented with progressive shortness of breath of several months' duration. A squamous cell carcinoma of the right upper lobe had been diagnosed three years previously and treated with radiotherapy. On examination the trachea was deviated to the right with signs of fibrosis of the right upper lobe and monophonic wheeze in this region. Computed tomography showed recurrence of tumour with extrinsic compression of the right and left main bronchi by mediastinal lymphadenopathy. His peak expiratory flow (PEF) was 280 l/min and FEV<sub>1</sub>/FVC 2.0/2.5 l. These spirometric indices were thought to reflect a combination of large airway obstruction and pulmonary fibrosis secondary to previous radiotherapy. The patient was treated by inserting two stents into the right main bronchus and one stent in the left main bronchus. A reduction in breathlessness was noted on recovery from the general anaesthetic, and his PEF had increased to 350 l/min and FEV<sub>1</sub>/FVC to 2.6/3.4 l. Over seven months of follow up chest radiography has shown no alteration in the position of the stents. Symptomatic improvement was maintained and spirometric indices remained at values achieved after insertion of the stents for four months, enabling the patient to cope independently at home. He then became more breathless, with a fall in PEF to 300 l/min and in FEV<sub>1</sub>/FVC to

2.0/2.5 l. Computed tomography showed further mediastinal tumour spread with extension to the left hemithorax and encasement of left upper lobe. Tomography and fibreoptic bronchoscopy confirmed continued patency of the stents. Subsequent management has been on a symptomatic basis.

#### Discussion

Various stents have been used to maintain tracheobronchial patency.<sup>3-5</sup> Expandable metal stents offer greater flexibility than silastic tube prostheses, a small surface area in contact with tracheobronchial mucosa, and minimal risk of occluding bronchial orifices if misplaced. Expandable stents should be considered only for permanent placement, however, as fixation of stent hooks to mucosal wall makes removal difficult. Experience with expandable metal stents placed in the airway has been limited to use in dogs and in patients with terminal disease.<sup>6</sup> In dogs use of the stents was associated with the development of moderate cough. Neither of our patients developed cough or haemoptysis and there was no clinical evidence of bronchial inflammation in the present study.

Disease of the larynx, trachea, and main bronchi occurs in more than half of patients with relapsing polycondritis and is a major cause of morbidity and mortality.<sup>9,10</sup> Stenting may prove a useful adjunct to immunosuppression in this condition. Extrinsic tracheobronchial compression due to malignant disease is common and stents may provide important short term palliation of breathlessness. In both patients endobronchial placement of the expandable metal stent was technically simple and associated with no significant side effects. Further exploration of their clinical application in cases of permanent airway obstruction appears warranted.

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