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Nitinol stent insertion for post-pneumonectomy syndrome

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Abstract
Post-pneumonectomy syndrome is an unusual condition, that can occur a variable period of time after a patient has had a pneumonectomy. Management of this syndrome has been described using a number of different techniques, often with considerable mortality. We present a case report where this condition was treated successfully by insertion of an expandable Nitinol stent. This is the first time this technique has been described to treat this condition, and we feel it may be the procedure of choice in managing these patients.

Key words: Pneumonectomy; Stents; Respiratory Function Tests

Case report

A 59-year-old woman was referred to our department complaining of increasing dyspnoea over the previous year.

She had had a right pneumonectomy at the age of 10, as a result of a lung abscess she developed after a post-tonsillectomy haemorrhage. She was diagnosed with asthma at the age of 40 which was treated with inhaled corticosteroids and beta-2 agonists.

In the 12 months prior to referral, she was admitted on four separate occasions with a left lower lobe pneumonia. She had also become increasingly dyspnoeic, with her walking distance reduced to 50 yards, and was experiencing dyspnoea with many daily activities such as showering and dressing.

Examination revealed a deviated trachea to the right, and some left basal atelectasis. Pulmonary function tests (PFTs) showed a markedly reduced forced vital capacity (FVC) of 0.78 (predicted = 2.35), and a forced expiratory volume (FEV_1) of 0.5 (predicted = 1.97). Peak-expiratory flow (PEF) was 89 (predicted = 332). Chest X-ray (Figure 1) showed a previous right pneumonectomy with a deviated trachea to the right. A computed tomography (CT) scan (Figure 2) revealed a hyper-inflated left lung with displacement of the mediastinum to the right, and compression of the right main-stem bronchus by the pulmonary artery. A flexible bronchoscopy was performed that showed a 60–70 per cent pulsatile compression of the left main stem bronchus, and a diagnosis of post-pneumonectomy syndrome was made.

She was referred at this stage to the department of Otolaryngology, head and neck surgery, with a view to stenting the bronchial obstruction. Under general anaesthetic a rigid bronchoscopy was performed and a Nitinol stent inserted in her proximal left main bronchus, without complication (Figure 3).

Initial insertion appeared adequate, but less than a week after discharge she developed a lower respiratory tract infection (LRTI) that settled on intravenous cefotaxime.

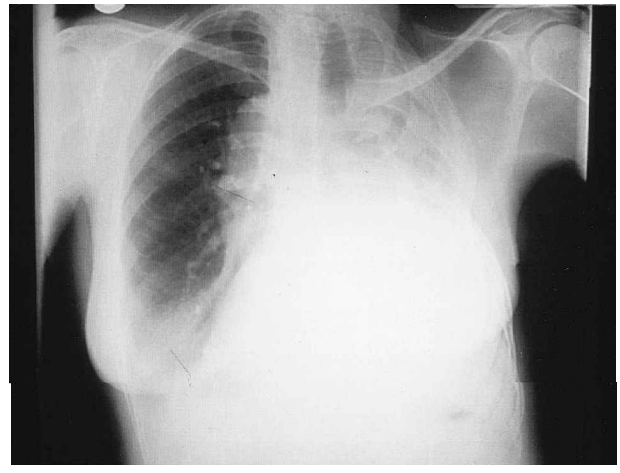

Fig. 1
Chest X-ray showing right pneumonectomy, with marked tracheal deviation.

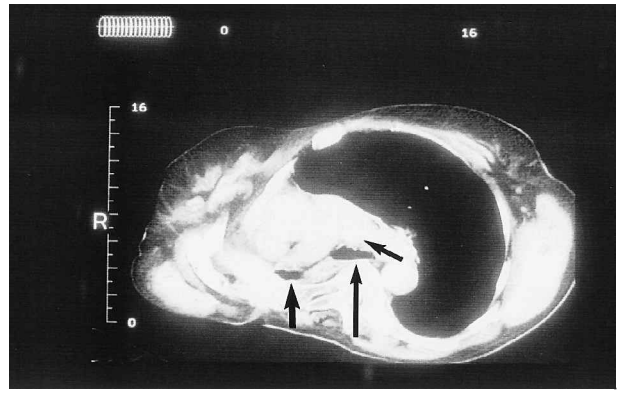

Fig. 2
CT showing left main-stem bronchus (long arrow) compressed by pulmonary artery (short arrow). Also shown is blind-ending right main stem bronchus (thick arrow).

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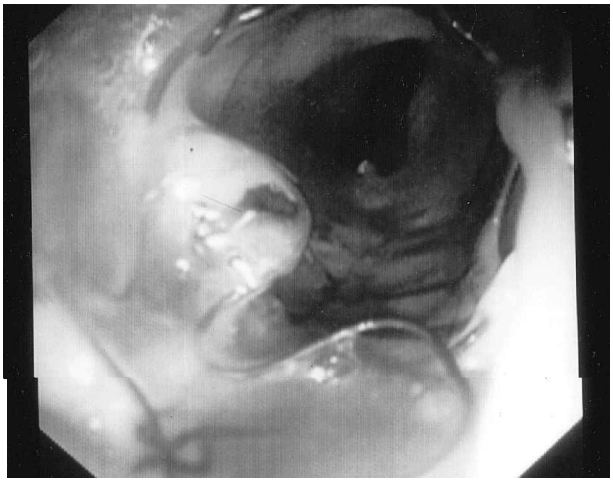

FIG. 3
Expandable Nitinol stent left main-stem bronchus.

Further rigid bronchoscopy revealed residual narrowing beyond the position of the original stent, and a further stent was inserted distally. She made an uneventful post-operative recovery and was discharged home three days later.

On review in clinic three months later, she had marked symptomatic improvement. She felt she had greater energy levels overall and that her exercise tolerance had increased dramatically from 50 yards to two kilometers. Objective measurements also confirmed an improvement, with her FVC increasing from 0.74 pre-operation, to 1.16 post-operation, and her FEV_1 increasing from 0.5 to 0.60. Post-operation PEF was unchanged at 85 (89 pre-operation). She has suffered no adverse consequences from the stent insertion, and is now 30 months post-operation. She continues to get intermittent respiratory tract infections, but none have required hospital admission.

Discussion

Post-pneumonectomy syndrome is a rare condition, and experience in both diagnosis and management of this disorder is limited. With the more common right post-pneumonectomy syndrome (as in our case), hyperinflation of the left lung occurs, and the mediastinum moves to the right and posteriorly. This re-alignment results in tracheal displacement to the right with compression of the distal trachea or left main stem bronchus between the aortic arch or pulmonary artery anteriorly, and the thoracic spine or descending aorta posteriorly. This can result in symptoms of dyspnoea, stridor, or recurrent respiratory tract infections.[1,2] It usually follows a right pneumonectomy,[1] although it has been shown to occur after left pneumonectomy with, or without, the presence of a right aortic arch.[1,3]

This syndrome can occur from a few weeks after pneumonectomy, up to many decades after surgery.[1,2,4] Our case, however, of 49 years interval before presentation, appears to be the longest reported in the literature.

Because of the paucity of individual experience in managing these cases, a number of treatment options have been utilized. The most common is that of thoracotomy with mediastinal repositioning, and insertion of a prosthesis (usually silicon) into the pneumonectomy space.[1,3,5,6] Aortic arch division with dacron bypass grafting,[1,4] partial vertebral resection,[3] and tracheo-bronchial resections[1] have also been described. The potentially lethal consequences of non-intervention was related by Stolar *et al.*,[7] with an infant dying from a cardiopulmunary crisis while awaiting aortic suspension, for a right post-pneumonectomy syndrome. Grillo *et al.*,[1] with the largest series of operated cases, illustrates what a serious management problem this can be, with a peri-operative mortality of 36 per cent (four out of 11 cases), using a variety of techniques, most of which (10/11) included mediastinal repositioning. Grillo relates the use of silicone T-tubes, in conjunction with mediastinal repositioning, in two patients, in whom he felt severe malacia of the airway was also present. This appeared to be unsuccessful in both patients, and both underwent a further aortic bypass procedure, and one had additional resection of the affected segment of bronchus.

Insertion of a Nitinol stent may have a number of drawbacks in treating these patients. Firstly, while it should ameliorate the patient's symptoms of dysponea as a result of relief of the mechanical obstruction, it does not correct the overdistension and subsequent herniation of the remaining lung, a problem that is addressed with mediastinal repositioning. Secondly, if the obstruction is distal to the point that can be reached by a stent, this procedure will not benefit the patient. Thirdly, stenting the airway with a rigid stent has the potential long-term problem of erosion of the wall of the bronchus or of one of the great vessels, with potentially lethal consequences. Use of an expandable Nitinol stent, has a number of advantages over more traditional open procedures. It is a relatively easy procedure to perform by rigid bronchoscopy, it is minimally invasive, and is likely to have less serious morbidity than major open procedures.

In view of this, the authors recommend that Nitinol stent insertion represents a suitable first-line treatment for patients with post-pneumonectomy syndrome, with the more major open procedures reserved for failed stentings or more complicated cases where stenting is unlikely to succeed.

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