The use of a bovine pericardial buttress in the bilateral staple resection of emphysematous bullae

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Bullectomy has been shown to be an effective treatment of severe compressive bullous emphysema. However, persistent air leak is a common complication from this procedure. We report a case of a 48-year-old man with severe bilateral bullous emphysema and disabling dyspnoea treated by bilateral staple resection with bovine pericardial buttress through the median sternotomy approach. Despite a post-operative need for ventilatory support, air leak was not a problem and the patient was able to have both chest drains removed shortly after extubation. The patient had a pre-operative forced expiratory volume in 1 second of 0.5 L/sec, forced vital capacity of 1.25 L and peak expiratory flow rate of 100 L/min. These parameters were increased to 1.4 L/sec (180% increase), 1.9 L (52% increase) and 270 L/min (170% increase), respectively, one month later, in association with a marked clinical improvement. We conclude that bilateral bullectomy in carefully selected patients is useful and bovine pericardium buttress is probably helpful in achieving pneumostasis.

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Introduction

The benefit of performing bullectomy in patients with giant emphysematous bullae occupying more than one third of the hemithorax has long been recognised.[1,2] However, one of the most frequent complications of this type of surgery on emphysematous lung is persistent air leak.[3] Connolly and Wilson report their experience of bullectomy on 19 patients using the thoracotomy approach. Air leaks persisted from one to three weeks and necessitated the use of multiple chest drains.[3] In the discussion of that paper,[3] Peters suggested the use of Teflon felt to buttress the staple line although he did not comment on his results. More recently, Cooper advocates the use of bovine pericardium strip as a buttress.[4] This is a report of our experience using pericardial buttress obtained from a research centre in India.

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Case report

A 48-year-old man with a history of tuberculosis, severe chronic obstructive airway disease, and a thirty-year smoking history presented with increasing dyspnoea over the previous two years. He had to stop after walking for ten yards on the flat and could only just retain his job as a cashier. A physical examination revealed a thin man with mild dyspnoea at rest. His chest was almost fixed in full inspiration, with little respiratory movement. There was no sign of right ventricular failure. Auscultation showed decreased breath sounds in both upper zones. There was no wheezing or crepitations. A chest X-ray showed marked hyperinflation of both lung fields with giant bullae occupying more than three-quarters of each hemithorax. A computed tomography scan showed diffuse em-physematous changes in the remaining lung area (Fig 1).

The serum α_1-antitrypsin level was 2 g/L (normal range, 1.5-3.5 g/L). A pulmonary function test showed

Fig 1. Pre-operative CT scan of the thorax showing large bullous disease and emphysematous changes of the remaining lung

Fig 2. Intra-operative photograph of a large apical bulla

a peak expiratory flow rate (PEFR) of 100 L/min (19% of predicted value), a forced expiratory volume in 1 second (FEV1) of 0.5 L/sec (16% of predicted value); and a forced vital capacity (FVC) of 1.25 L (33% of predicted value). After extensive discussion with the patient and his family about the potential benefits and risks of surgery, he consented to surgery and agreed to stop smoking.

Under general anaesthesia and endobronchial intubation with a Robert-Shaw tube, the patient was placed supine on the operating table. A median sternotomy was performed and the left lung was collapsed; the left mediastinal pleura was opened. Almost the entire left upper lobe had been replaced by a huge bulla which occupied more than three-quarters of the left chest (Fig 2). There were diffuse emphysematous changes in the remaining left upper and lower lobes.

A strip of glutaraldehyde-treated bovine pericardium (Baruah Heart Valve Institute & Research Centre PVT Ltd., India) 3.5 cm wide was cut to length to cover the opposing surfaces of the two limbs of the GIA stapling device (Autosuture, United States Surgical Corp., Norwalk, Connecticut, US). We found that when the pericardial strip was carefully applied, the surface tension alone was sufficient to hold the strip in place. As the lung was collapsed, the demarcation between the bulla and the adjacent non-bullous lung became apparent. The stapler was applied close to the transition zone on the side of the non-bullous lung. Several applications of the stapling device were necessary and strips of pericardium were left buttressing the entire staple line.

After re-expansion of the left lung, the right side was then approached in a similar fashion. There were moderately dense adhesions between the chest wall and a large posteriorly located bulla. The bulla was first decompressed to facilitate mobilisation. The rest of the procedure was almost identical to that for the left side. A 32 FR chest drain was left in each side and the sternotomy wound was closed in the usual manner.

Post-operatively, the patient was observed in the intensive care unit. Epidural narcotics were given for analgesia and the patient was extubated immediately after the operation. Due to sputum retention, however, the patient had to be reintubated on post-operative day 4. Daily flexible bronchoscopy was performed for pulmonary toilet. The patient remained on the ventilator for five days. Despite positive pressure ventilation, persistent air leak was not a problem. The right chest tube stopped bubbling three days after surgery, while the left persisted for six more days. Both chest drains were removed shortly after the patient was taken off the ventilator. The patient stayed in hospital for a total of five weeks for chest physiotherapy and rehabilitation because of a lack of social support.

At the time of discharge, he was able to climb five flights of stairs and a repeat pulmonary function test one month later revealed an FEV1 of 1.4 L (180% increase from the pre-operative value), FVC 1.9 L (52% increase) and PEFR 270 L/min (170% increase). He has now been followed up in the outpatient clinic for four months. A recent chest X-ray showed normalisation of the thoracic dimensions (Fig 3). He remains well and has returned to his job as a cashier.

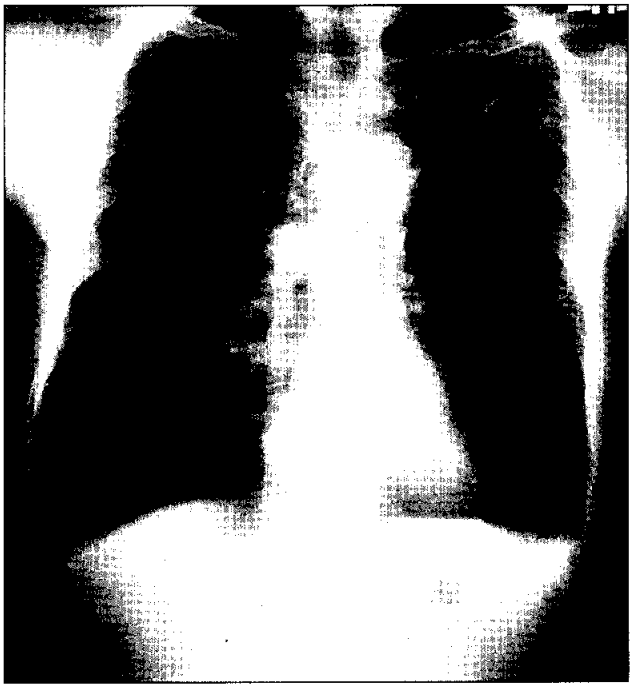

Fig 3. A recent chest X-ray showing normalisation of the thoracic dimensions

Discussion

Giant bullae occupying more than one-third of the hemithorax are relatively uncommon. In our 1500 bed University teaching hospital, which serves a population of 1.3 million in Hong Kong, we have encountered only four cases in the past two and a half years. For practical purposes, it is important to differentiate between simple giant bullae and vanishing lobes from emphysematous bullae with compression.[5-7] Simple giant bullae refer to those bullae that occupy more than one-third of the hemithorax and produce compression of the adjacent lung. The lung parenchyma, however, is normal and the lung function tests are usually only mildly deranged. Three of the four cases we have seen belonged to this group. The bullae may be sessile or pedunculated and we have successfully operated on these using video-assisted thoracoscopic surgery. A vanishing lobe on the other hand, refers to a lobe that has been destroyed by bullae in a patient with severe emphysema. There is, however, no displacement of the adjacent tissue. The destroyed lobe serves as a buffer that prevents the remaining lung from being over-distended. Hence, surgery is unhelpful in this group of patients.[5] The third and last group refers to the emphysematous bullae that occupy more than one-third of the hemithorax with definite compression of the adjacent lung. As the underlying non-bullous lung is emphysematous, the pulmonary function test is often markedly deranged with an obstructive pattern (as in this patient).[1-3] The rest of our discussion focuses on this group.

There is now much literature that supports the resection of emphysematous bullae.[1-3] Improved lung function comes from recruiting the compressed lung by restoring the tension on the airways as well as from improved chest wall mechanics.[4] Several surgical approaches have been described and these include thoracotomy,[1] median sternotomy, and more recently, a thoracoscopic approach with carbon dioxide laser, argon beam coagulation, and staple resection with or without laser.[8] Irrespective of the approach used, however, one common complication with surgery on an emphysematous lung is persistent air leak. It is not at all uncommon for chest drains to leak for many weeks[3] and occasionally patients may have to be discharged with chest drains connected to a flutter valve (Wakabayashi A, personal communication). O'Brien et al describe the use of mechanical pleurodesis (in six of 14 cases of bullectomy) to minimise air leaks.[9] This approach, however, may compromise future surgery such as lung transplantation, should it be needed. The use of Teflon felt to buttress the staple line has been described[3] although the authors could not find any published data on the results of this approach. Infection from using foreign material is at least a theoretical concern. Using biological tissue such as pericardium as the buttress has recently been described[4] and was used in this case with satisfactory results.

Although it is difficult to draw conclusions from a single case, our limited experience is in agreement with the existing literature that with careful pre-operative selection and post-operative care, bullectomy can be tolerated by and is beneficial to patients with even very advanced emphysema. These patients should not be denied surgery on the basis of their poor lung function alone.

Acknowledgment

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PICTORIAL MEDICINE

Appearance of the nails secondary to chemotherapy

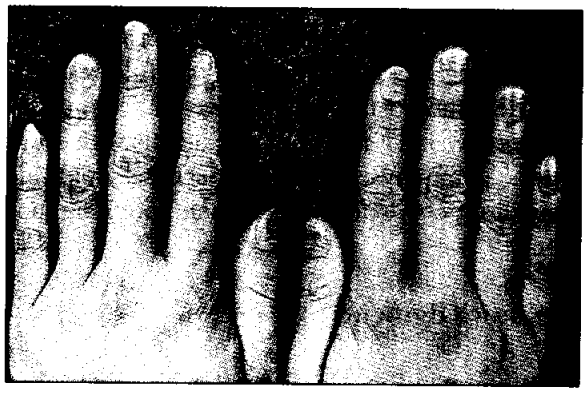

Figure A shows the appearance of the finger nails of a female patient who had undergone three cycles of chemotherapy for metastatic carcinoma of the breast. Horizontal grooves (Beau's lines) may appear in all of the nails following severe illness, physical, or psychological stress. In this case, several Beau's lines occur equidistant from each other in each nail; each line represents the time at which chemotherapy was given and by measuring the intervals between the lines (see close-up photo, Figure B), one can estimate that the time interval between each cycle of chemotherapy was around three weeks.—*Submitted by W Yeo, PJ Johnson, Department of Clinical Oncology, Prince of Wales Hospital, Shatin, Hong Kong.*