CASE REPORT

SURGERY FOR BULLOUS EMPHYSEMA

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Summary: The present indications for surgery are mainly large or increasing bullae that result in compression of apparently good lung tissue, and the complications of bullous diseases such as pneumothorax. The results of local resection of localized giant bullae are dramatic. The resection of small bullae generally has little effect on lung function. Lobectomy should not be done until bullae have been removed locally and the remaining lung has been tested by positive ventilation. The indications for the resection of large bullae in the presence of diffuse emphysema require very careful individual study. Pulmonary function tests are mandatory but computed tomography is the single most useful method of assesing the extent of the bullous disease and the underlying lung disease. If the underlying lung is diffusely cystic then any surgical treatment is palliative only.

Key words: *Bullous emphysema; Surgical treatment*

The surgical treatment for bullous disease in emphysema has been redefined over the past decades. The indications for surgical intervention, the types of surgical procedures and the objectivity of the results have been questioned repeatedly. Althought there is no way in vivo to recognize with certainty the type of emphysema producing bullae of the lung, the term of bullous emphysema is firmly established in clinical nomenclature. The key to good results in the surgical treatment is proper selection of patients. Bullectomy for giant bulla is the method of choice.

Case report

A 44-year old man was admitted to the department of Cardiosurgery in May 1995 with increasing shortness of breath. The patient's symptoms dated back to six years ago when he had noticed the gradual onset of dyspnea on exertion. His symptoms gradually worsened to the point that he was dyspnoic at rest. The patient, non-smoker and, worked for 25 years as a mechanic in nondusty environment.

Chest roentgenogram (Fig. 1) revealed bilateral bullous emphysema with hyperlucency of left upper lung field caused by giant bulla and compression of left lower lobe. Computed tomographic scan showed small emphysematous bullae over the right lung field and one large bulla occupying 50 % of left hemithorax. Pulmonary function studies : forced vital capacity (FVC) was 55 % and forced expiratory volume (FEV1) was 41 % of predicted value. DCLO (diffusion lung capacity) was 53 %. Lung perfusion scanning demonstrated a decreased perfusion in the upper part of the right lung and a heavy damage of perfusion of upper two thirds of the left lung. Arterial blood gases breathing room air were: PaO_2 9,19 kPa, $PaCO_2$ 5,03 kPa.

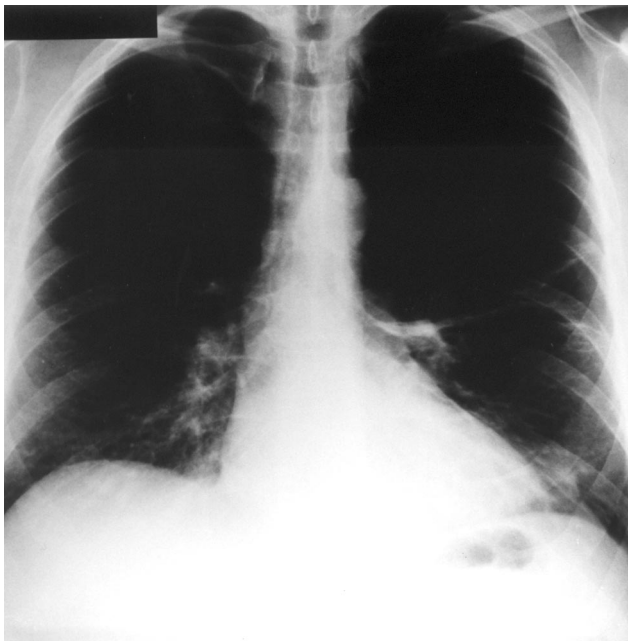

Fig. 1: Chest roentgenogram with hyperlucency of the left upper lung field caused by giant bulla and compression of left lower lobe.

At operation on May 4th, 1995 90 % of the upper lobe of the left lung and the lingula were found to be involved with bullae. There were also the two small bullae along the upper margin of the superior segment of the lower lobe.

The giant bulla was excised and their base stapled and oversewn with atraumatic material. The two small bullae along the upper margin of the lower lobe were ligated. By removal of bullae the compressed lung tissue was allowed to expand. The postoperative course was uneventful and air leaks stopped in 2 days.

Morphological findings

Grossly, the resected pulmonary parenchyma was irregularly cysticly transformated, up to 90 mm in maximal diameter and up to 1,5 mm in wall thickness. The cyst was well demarcated from the remaining pulmonary tissue (40x15x10 mm) and contained air and a small amount of fluid. No abnormal bronchus or systemic arteries supplied the lesion (Fig. 2).

Fig. 2: Gross photograph showing the cystic appearence of the resected pulmonary parenchyme.

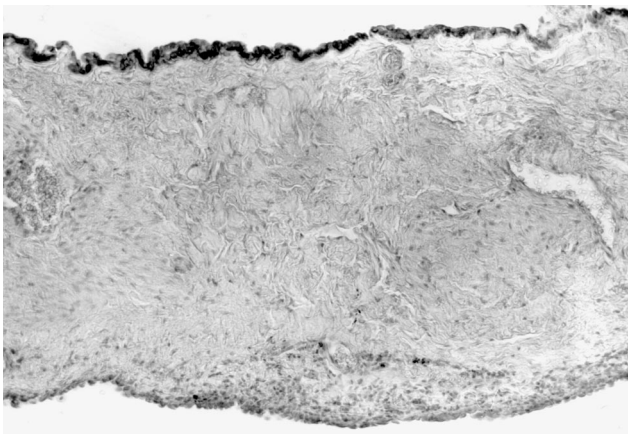

Fig. 3: The wall of the lesion formed of collagen covered by cytokeratin positive cuboidal elements (arrows).

Histopathologically, the wall of the lesion was formed of partly hyalinized collagen covered by cuboidal cells on mesothelial surface. These cells stained positively for cytokeratin. The opposite wall surface was lined by flattened cytokeratin negative elements. Scattered foci of chronic inflammation together with bundles of smooth muscle were found in the wall. In spite of extensive examination, no structure of primitive mesenchyma were found in the lesion (Fig. 3).

A diagnosis of bullous emphysema was made on the basis of these findings.

Postoperative X ray film and CT (Fig. 4) showed re-expansion of the remaining lung tissue.

Results of pulmonary function testing showed: FVC 78 %, FEV1 55 % of predicted value. It is very important that the DLCO raised up to 83 %.

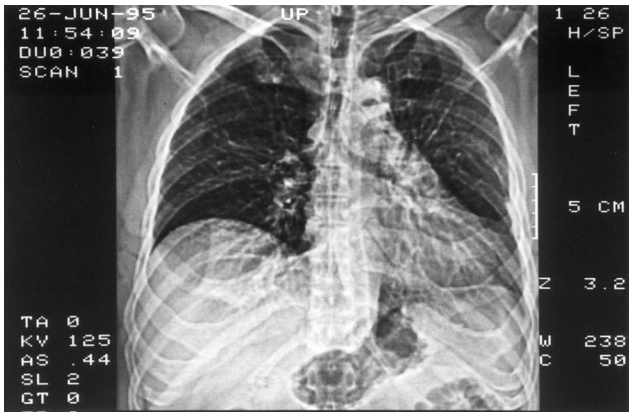

Fig. 4: Postoperative CT scan with reexpansion of the remaining lung tissue.

Arterial blood gases breathing room air were: PaO_2 10,5, $PaCO_2$ 4,3 kPa.

The patient has been significantly clinically improved and doing well until this time.

Discussion

A practical classification of bullous emphysema was defined by DeVries (3). Group I identifies emphysema with an underlying healthy lung. Group II identifies multiple bullae of the lung, also with an underlying normal lung. Group III and IV identify bullous disease in the lung in generalized emphysema and in patients with other diffuse lung disease. Group I and II are indicated to surgical exstirpation with predictably good functional result. Bullectomy for giant bulla has been indicated for many reasons: a) to relieve restrictive changes in the normal lung tissue in the vicinity of the giant bulla, b) to increase both the elasticity of the remaining normal lung and the diameter of the airway caliber, thus increasing the exspiratory force, c) to increase the ventilation - perfusion ratio in the nonbullous region thereby minimizing the effect of venous admixture and d) to decrease the physiological dead space that exists in the giant bulla (10).

Throughout the recent literature, there has been uniform agreement that a bulla must occupy more than 30 % of hemithorax before surgery is advised. There are subjective and objective data suggesting that anything less than this produces little if any functional improvement after surgery. Clinical improvement occurs in almost all moderately to severely symptomatic patients with bullae occupying more than 30 % of a hemithorax (2).

Extreme breathlessness in the presence of a giant bulla is the test indication for an operation. With the relief of the space-occupying lesion, the underlying lung expands, the vasculature reopens, and the resistence in both the airways and the vessels may be sizably reduced.

For the selection of patients for surgery there is important that progressivelly enlarging nonfunctioning pulmonary units are detected. Bullae should be compressing a significant volume of potentially functional lung parenchyma. The best results occur in patients with localized bullous disease. Removal of a bulla eliminates the functionless unit and results in reexpansion and return to function of a significant volume of lung.

Prophylactive bullectomy in patients with asymptomatic giant bulla has not been published.

Bullectomies are performed through a standard posterolateral approach through the fourth and fifth intercostal space. Recently videoassissted thoracoscopy has developed as an alternative to open thoracotomy. The development of surgical staplers has made this procedure easier and is now used routinely. Tephlon pledget incorporated into bullectomy staple line ensures pneumostasis postoperatively (11).

Following bullectomy pleural symphysis by poudrage, abrasion of the pleural surfaces, introduction of irritating chemicals or parietal pleurectomy were advocated.

It is important to realize that chemical or mechanical pleurodesis is contraindicated unless immediately after the procedure, the parietal-visceral contact is ensured. This suggests that bronchopleural fistulae must be closed before pleurodesis is attempted, a condition that is rarely satisfied after excision of a bulla in emphysema (6). Though the same authors recommended lobectomy or even segmental resection for bullous emphysema, most of others agree that simple excision of all bullae with preservation of relatively uninvolved lung is the procedure of choice (2).

By removal of nonfunctioning bulla the compressed lung tissue is allowed to expand to increase the patient's ventilatory reserve and thereby result in successfull operation. Median sternotomy has been advocated for bilateral pulmonary operations including bilateral resections of emphysematous bullae (7). There is a number of diagnostic tests to ascertain lung tissue compression including tomograms, angiograms, lung perfussion studies and computerized tomography.

The differential diagnosis of the cystic pulmonary lesions includes bullous emphysema, placentoid bullous lesion (8), bronchogenic cyst, cystic adenomatoid malformation (13), cystic bronchiectasis, abscess, arteriovenous malformation, lymphangiomatosis, mesenchymal cystic hamartoma (9) or metastatic tumors.

The clinical differential diagnosis depends on the age of the patient, the number and size of cystic lesion, the content of the cyst, and character of surrounding pulmonary tissue. From this point of view, on the basis of clinical outcome and radiographic finding, the diagnosis of abscess, cystic bronchiectasis, eosinophilic granuloma, vascular malformation, lymphangiomatosis and secondary tumor may be excluded. The remaining spectrum of pathological processes formed of bullous emphysema, placentoid bullous emphysema, cystic adenomatoid malformation, bronchogenic cyst and mesenchymal cystic hamartoma must be excluded morphologically. From end-diagnosis point of view there were two lesions considered morphologically in presented case, i. e. bullous emphysema and very rare mesenchymal cystic hamartoma. Cystic hamartoma was excluded after extensive examination of the lesion wall because no structures of primitive mesenchymoma were found. A diagnosis of bullous emphysema was made on the basis of exclusionary principle. Fitzpatrick (4) demonstrated that in most instances it is difficult to correlate postoperative subjective findings with postoperative quantitative objective data. Goldberg (6) suggested that one evaluation seems to correlate better than do other parameters, this is the measurement of the work of breathing. Boushy (1) and Gaensler (5) demonstrated, that in general after bullectomy pulmonary function changes toward normal, when compared preoperative and postoperative FEV1.

Resection of larger bullae, indicated by open circles, generally caused 50 to 20 % improvement. Patients who had lobectomies showed little increase in FEV1 after surgery.

Pearson ond Ogilvie (12) demonstrated that any improvement shown by spirometric data postoperatively persists for several years and then gradually returns to normal preoperative values and beyond.

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