ARCHIVES OF HELLENIC MEDICINE: ISSN 11-05-3992

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ARCHIVES OF HELLENIC MEDICINE 2014, 31(4):509–510
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2014, 31(4):509–510

Thoracic Surgery Quiz – Case 13

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A 50-year-old female, non-smoker presented with a history of progressive exertional dyspnea. There was no history of cough, chest pain, or hemoptysis. Examination of the respiratory system revealed absent breath sounds in the whole of the right hemithorax. A chest radiograph showed an air-filled space in the right, occupying almost the whole of the lung (fig. 1). Computed tomography (CT) confirmed this finding, and also showed absence of emphysema in the left lung (fig. 2). A provisional diagnosis of bullous lung disease was made. Pulmonary function tests showed a restrictive defect and confirmed the presence of non-communicating air spaces, as evidenced by a 3.5-Lt difference between the total lung capacity (TLC) value measured via body plethysmography and the TLC value measured via the helium-dilution technique. Bullectomy (fig. 3), using an autosuture stapler with bioabsorbable staple line reinforcement (fig. 4) was performed. The patient has been asymptomatic on regular follow-up.

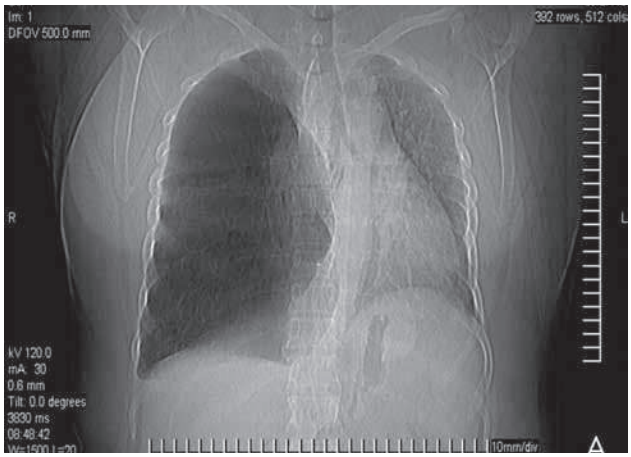

Figure 1

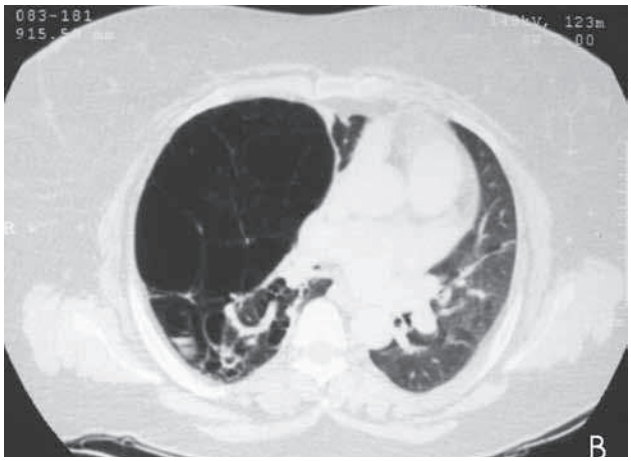

Figure 2

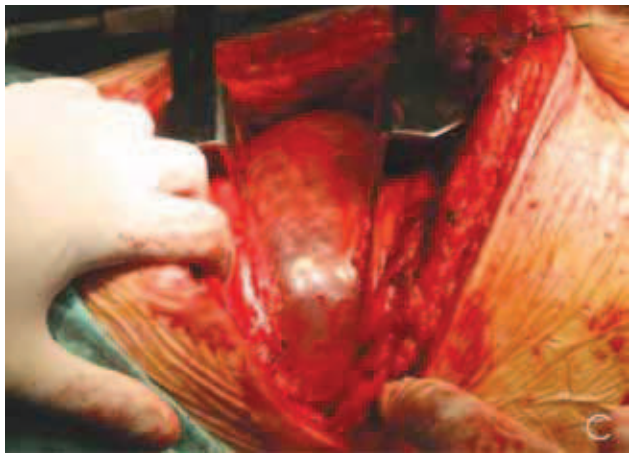

Figure 3

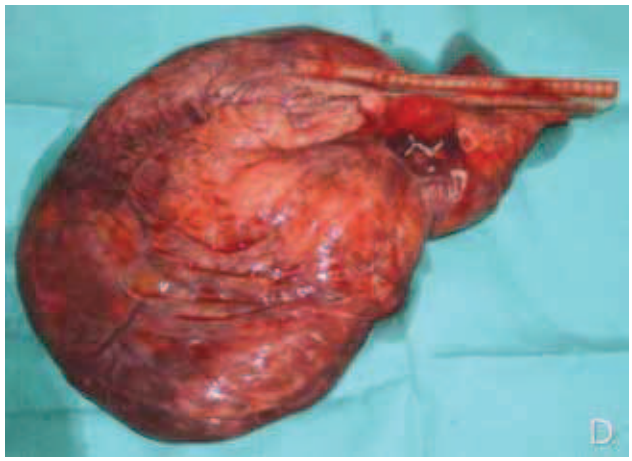

Figure 4

Comment

Bullous lung disease is different from bullous emphysema in that bullous lung disease has bullae with structurally normal intervening lung, whereas bullous emphysema has bullae associated with more diffusely abnormal lung parenchyma because of chronic obstructive pulmonary disease (COPD). Giant bullous lung disease, as seen in our patient, is said to be present if the bullae occupy at least one third of the hemithorax and compress the surrounding lung parenchyma. Bullectomy, either via videothoracoscopy or conventional thoracotomy, is the treatment of choice for giant bullous lung disease, even if asymptomatic. Bullectomy is indicated for symptomatic patients who have incapacitating dyspnea or chest pain, and who have complications related to bullous disease such as infection or pneumothorax. Bullectomy needs to be differentiated from lung volume reduction surgery (LVRS), which is surgical removal of 20–30% of non-bullous emphysematous lung from each side. The National Emphysema Treatment Trial showed that LVRS benefits selected subgroups of COPD patients who have upper-lobe disease and poor exercise capacity. Specifically, LVRS improves 6-min walk distance (6MWD), forced expiratory volume in the first second (FEV_1), dyspnea score, and quality of life score, and decreases residual volume and the need for supplemental oxygen. However, patients with FEV_1 20% of predicted and either homogenous emphysema or carbon-monoxide diffusion capacity 20% of predicted do not benefit from LVRS and have unacceptable perioperative mortality. Thus, taking a corollary from the National Emphysema Treatment Trial, some patients with bullous emphysema may also benefit from bullectomy. However, LVRS has distinct indications applicable only to a subset of patients, and with different expectations and outcomes than bullectomy. Patient selection remains one of the most important aspects of successful surgery, since bullous lung disease is associated with excellent postoperative outcomes, whereas surgery for bullous emphysema is not very rewarding, except probably in a select group of patients. In general, the freedom from long-term return of dyspnea is proportional to the quality of the remaining lung after bullectomy. High-resolution CT is an important tool for preoperative assessment, because it can identify underlying centrilobular emphysema, which is synonymous with a diagnosis of bullous emphysema. Moreover, high-resolution CT also allows assessment of associated diseases such as bronchiectasis, infected cysts, pleural disease, and pulmonary hypertension. PFTs can also differentiate between the two entities. PFT values from a patient with bullous lung disease typically show a restrictive defect, whereas those from a patient with bullous emphysema show an obstructive defect. In addition to helping in differential diagnosis, PFTs also help in quantifying the size of bulla and objectively documenting postoperative improvement. There is a difference between the lung volume measured via the helium-dilution technique and that measured via body plethysmography. In the former, the subject rapidly breathes in and out of a reservoir that contains a known volume of gas and a trace amount of helium (an inert gas, very little of which absorbs into the pulmonary circulation). The helium is diluted by the gas that was previously present in the lung. With the knowledge of the gas in the reservoir and the initial and final helium concentrations, the functional residual capacity and the TLC can be calculated. The helium-dilution technique may underestimate the exact volume of gas in the lung because of inadequate time to equilibrate with slowly communicating and non-communicating air spaces, such as bullae. However, lung volume can be more accurately measured and should be measured in these cases, with body plethysmography, which measures the total volume of the thorax. In fact, the difference in TLC between the two techniques (body plethysmography minus helium-dilution) approximates the volume of the bullae.

In conclusion, this case exemplifies the importance of selecting the correct pulmonary function test (body plethysmography) for measuring lung volume, and the utility of CT in the evaluation of patients with bullous lung disease. The presence of bullae and the etiology (in this case, bullous lung disease) was confirmed by high-resolution CT. PFTs suggested the etiology and confirmed physiologic improvement after surgery.

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