Peripheral Bronchopleural Fistula (BPF): CT imaging analysis in 9 patients.

Poster No.: C-0508
Congress: ECR 2014
Type: Scientific Exhibit
Authors: V. Papalouka, V. Bizimi, K. Spyrou, M. Tsitskari, S. Argentos, E. Alexopoulou; Chaidari Athens/GR
Keywords: Infection, Chronic obstructive airways disease, Atelectasis, Computer Applications-Detection, diagnosis, CT, Respiratory system, Lung
DOI: 10.1594/ecr2014/C-0508

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.
As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.
You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.
Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.
www.myESR.org
Aims and objectives

Bronchopleural fistula (BPF) is defined as the direct communication between the pleural space and the bronchial tree or the lung parenchyma. It is a relatively rare pathology, associated with high morbidity and mortality, rising up to 70% [1, 2].

By far, Bronchopleural fistulas most frequently occur after pneumonectomy, while most of the cases complicate right sided pulmonary resection. The incidence of death associated with this condition is approximately 16%-23% as been reported [2], when Adult Respiratory Distress Syndrome (ARDS) as a result of aspiration pneumonia, appears to be the principal cause of death [3, 4]. A BPF appears more frequently within 8 to 12 days after surgery, but it can also occur any time during the postoperative period [5]. The filling of residual pleural space rapidly with fluid suggests infection, hemorrhage, or malignant effusion. Empyema can develop either alone or coexist with a BPF. In contrast, a BPF may be present without being associated with empyema [5].

Other causes of BPFs are pleuropulmonary infections, including necrotizing pyogenic pneumonia, septic pulmonary emboli, infected pulmonary infarctions and tuberculosis. BPFs can also occur secondary to chest injury, traumatic or iatrogenic, such as blunt and penetrating lung wounds (stab and gunshot), complications of pleural drains or positive ventilation support postoperatively. In addition, malignant lesions especially with pleuraparenchymal component, preoperative radiation therapy and faulty closure of a bronchial stump can be associated with BPFs [5, 6].

There are two main types of BPFs: BPFs formed by a direct communication between the pleura cavity and a main bronchus, so called True - Central BPFs and those formed by the communication between the pleura cavity and lung parenchyma or a peripheral bronchial branch, so called Peripheral BPFs (PBPFs). Central BPFs are typically a result of pneumonectomy or trauma, whereas peripheral BPFs usually occur in the setting of suppurative lung infection (lung abscess/ necrotizing pneumonia), neoplasms, chronic obstructive pulmonary disease (COPD) with bullae or peripheral bronchiectasis or in trauma - post traumatic pneumatocele and cannot be visualized with bronchoscopy [6]. Consequently, the contribution of imaging modalities, especially of Computed Tomography becomes essential in the diagnosis and localization of this pathology.

Imaging findings of BPFs includes continuous increase in residual pleural space with air-fluid levels formation, development of tension pneumothorax, progressive subcutaneous or mediastinal emphysema, drop of the air-fluid level exceeding 2 cm during the postoperative period and mediastinal shift to the opposite side of the fistula. Moreover, in patients with pulmonary infection, post-radiation therapy, COPD or neoplasms additional imaging findings can be seen related to the underlying disease [6, 7].

The side of the air- leak, especially regarding PBPFs, can be rarely distinguished.
The aim of this study is to emphasize the usefulness of conventional and multi (thin) slice computed tomography (MDCT) in detecting and characterizing this complication in patients with suspected peripheral bronchopleural fistulas (PBPFs). We evaluate the radiology features suggestive of this pathology in 9 patients and review the etiologies, types and predisposing conditions for the development of PBPFs.

**Methods and materials**

Nine patients with suspected PBPF underwent a helical and multislice CT scan with slice thickness 1.5cm (MDCT, 16- and 64-sliced), followed by multiplanar reconstruction (MPR).

Four patients suffered from high fever, dyspnea and/or productive cough during the subacute or late postoperative period after pneumonectomy. Four patients presented with bronchopulmonary infection, 3 of which had a history of COPD. One patient was admitted to the hospital with high fever and dyspnea and was initially diagnosed with lung cancer.

Median age of patients was 58 years.

The appearance of PBPFs was also correlated with the preoperative and perioperative history of these patients in addition to confirm or exclude the presence of other predisposing conditions. Thus, two patients had a history of preoperative radiotherapy and one had a known remnant lung parenchyma at the bronchial stump after a surgical lung resection. Three patients were suffering from diabetes, while the other three had no known medical history.

**Results**

MDCT in patients with pneumonectomy revealed:

- Air - fluid level (Hydropneumothorax) in the pleural cavity at the resected side in 2 patients.
- Air-leak source was demonstrated in 2 patients.
- The left/ right BPF ratio was 3/1 (According to the literature, BPFs mostly occur after a right pneumonectomy and form in the ipsilateral side due to anatomical characteristics of the right main bronchus).

MDCT in patients with pulmonary infection showed:

- Air- fluid level in the pleural cavity (hydropneumothorax) in 3 patients.
- Necrotizing pneumonia in 2 patients.
• Patients with COPD (3) had bronchiectasis and bronchiolectasis.
• The patient with acute lung infection presented opacities and empyema.

A necrotic tumor adjacent to the pleura and air-leakage was found in the patient with lung cancer.

Mediastinal shift to the opposite side was found in 4/9 patients.

Images for this section:

Fig. 1: Patient with SCLC, after left pneumonectomy and postoperative radiotherapy. 5 months later he presented with dyspnea. Chest XR F/Pr shows left hydropneumothorax and mediastinal shift to the right.
Fig. 2: MDCT - Axial images in chest and lung window (left) in the same patient (fig. 1) shows: Left hydropneumothorax, presence of small atelectasis of the bronchial stump (secondary to pneumonectomy) (thin arrows) and a communication - fistula (PBPF) between the bronchial stump and the ipsilateral pleural cavity (arrowhead). Subcutaneous emphysema coexists. Coronal image MIP reconstruction (right) emerges the apparent communication between peripheral bronchus and pleural space (thick arrow).
**Fig. 3:** MDCT in a patient with a cavitating pulmonary TB lesion of right lung hilum. Axial, coronal and sagittal reconstructed images (left to right) in lung window. Peripheral Bronchopleural fistula (PBPF) (arrows) between the cavitary lesion and pleural space.

**Fig. 4:** Postradiation MDCT in a patient with unresectable lung cancer of right pulmonary hilum. Right spontaneous hydropneumothorax secondary to PBPF (arrows).
Fig. 5: Axial (left) and coronal (right) CT images in a patient with lung lesion of right lower lobe presented with hemoptysis and fever. Hydropneumothorax of the left pleural cavity (axial image) and mediastinal shift to the opposite side were present. According to the patient's clinical history the pleural collection could be attributed to an empyema. On the other hand, the existence of a small amount of air, confined to a tiny area between the pleural sheets along the apical-posterior segment of the left upper lobe, it could be a product of lung parenchyma necrosis as a result of necrotizing pneumonia or aggressive lung cancer, with bronchopleural fistula, as it was finally verified.

Fig. 6: MDCT in the same patient (fig. 5) (sagittal - left, axial - right): Large mass in the apical segment of right lower lobe and closure along with infiltration of left lower lobe main bronchus, were depicted. A left hilar mass was found after collection drainage. PBPF of the remaining left upper lobe with the ipsilateral pleural cavity causing an air-fluid level in the collection, also existed.
**Conclusion**

Diagnosis and localization of BPF, especially of the peripheral type, is sometimes very difficult and may require multiple imaging. We verified that the use of CT scan, in particular thin-section CT with multiplanar reconstruction (MPR) remains the imaging modality of choice that can provide significant help for directly visualizing and localizing PBPFs, compared to chest radiography and bronchoscopy, according to literature. Furthermore, it can contribute in the treatment planning and management of this life threatening condition.

**Personal information**

**References**

5. Bronchopleural Fistulas. An Overview of the Problem With Special Focus on Endoscopic Management, Manuel Lois, MD, FCCP; and Marc Noppen, MD, PhD, reviews, CHEST 2005; 128:3955-3965.