DIAGNOSTIC & THERAPEUTIC INTERVENTIONS IN CHEST.

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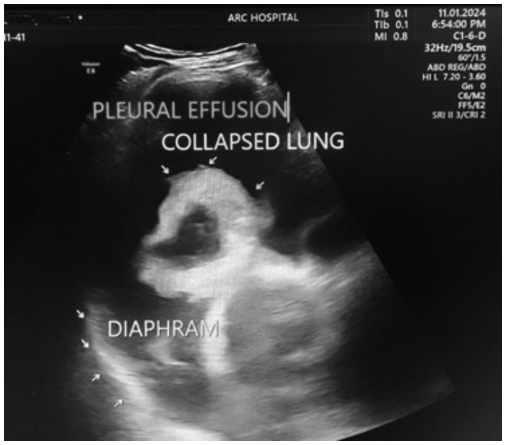
INTRODUCTION

Interventional chest radiology includes a variety of procedures used in the diagnosis and treatment of thoracic diseases. These procedures allow for pathologic diagnosis of pulmonary and mediastinal lesion and the treatment of pleural, parenchymal, vascular and airway diseases in a minimally invasive fashion. Improvements in needle and catheter designs, development of specialized stents and continued advances in image –guided technology have improved the safety and efficacy of these procedures.

DIAGNOSTIC THORACOCENTESIS

The two most common indications for diagnostic thoracocentesis are the evaluation of suspected infection or malignancy in the pleural space. Sonographic guidance is indicated following failed unguided thoracocentesis and for small or loculated effusions. Using an aseptic technique, appropriate size needle (mostly 22 gauge and thicker up to 18 gauge for viscous collections) is inserted at a point where sonography identifies the largest fluid dimension and fluid is aspirated. A post procedural chest X- Ray is routinely performed to rule out pneumothorax. US guided diagnostic aspiration is successful in upto 97 % of cases.[1,2] The yield for cytological examination in documented malignant effusion is approx 50%. The rate of pneumothorax is significantly lower as compared with blind aspiration. Fig 1.



PERCUTANEOUS DRAINAGE OF PLEURAL SPACE FLUID COLLECTIONS

Image guided percutaneous transthoracic catheter drainage of infected pleural collection is indicated in patients in whom diagnostic thoracocentesis shows a frank empyema, positive Grams stain on culture or a complicated parapneumonic effusion. Catheter drainage of pleural fluid is also performed for relief of symptoms (dyspnea, cough, pleuritic chest pain).[3]

PLEURAL SCLEROTHERAPHY OR PLEURODESIS.

Recurrent malignant effusions can be managed by instillation of a sclerosing agent into the pleural space to chemically induce pleurodesis. The agents used for this procedure include tetracycline, doxycycline, minocycline,

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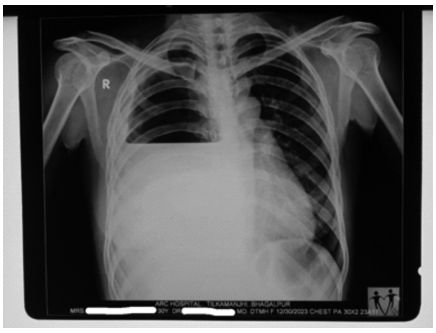
bleomycin and talc. The success rate has been reported to be in the range of 60-90% and no particular agent has been shown to be superior.

PNEUMOTHORAX DRAINAGE

Indications for pneumothorax drainage include for collections estimated to exceed 25% of the volume of one hemithorax, an enlarging pneumothorax indicating persistent air leak, tension pneumothorax, disease in the contra lateral lung or any sized pneumothorax that causes shortness of breath or severe chest pain. Although most pneumothoraces drainages are performed using fluoroscopic guidance, CT guidance may be used for small and loculated air collections. A chest radiograph is performed immediately after drainage to confirm correct catheter placement and reduction in pneumothorax. Once the lung has completely re-expanded and there is no evidence of air leak, the catheter is removed. Success rates range from 87 to 93 % with most pneumothoraces resolving within 24-72 hrs.[4,5] Fig 2.



LUNG ABSCESS DRAINAGE

Image guided percutaneous catheter drainage has been used successfully for treatment of lung abscesses that fail to resolve with medical therapy. CT is necessary to assess presence of pleural involvement and to plan a safe transthoracic route for catheter placement. The procedure can be performed under fluoroscopy, USG or CT guidance. Traversing normal lung should be avoided because of the risk of hemorrhage and bronchopleural fistula formation with empyema.

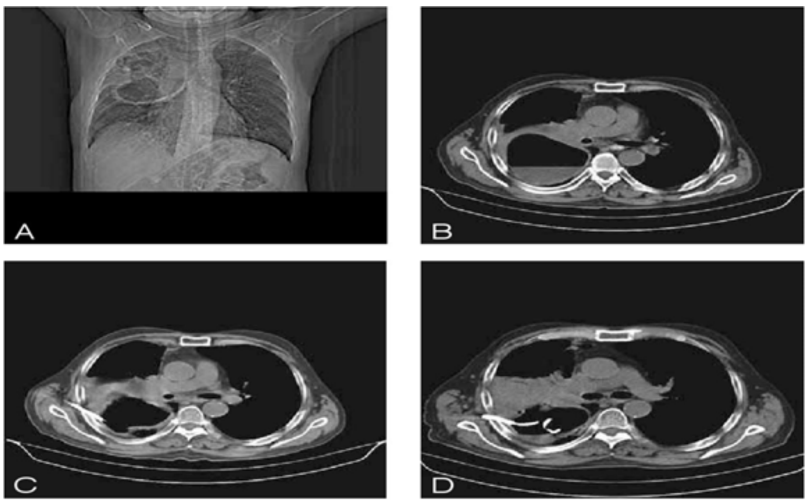


Fig 3. A 60 year old man with right lung abscess and failed medical treatment. Figures 3. (A,B.) Chest radiograph and CT scan (mediastinal window) show a cavitary lesion with air-fluid level almost filling the right hemithorax representing an abscess. Fig 3 (C.) CT scan after percutaneous drainage shows immediate decrease in fluid and size of lung abscess.The patient had a rapid symptomatic response to abscess drainage. Fig 3 (D.) A Follow up CT scan 6 days after the procedure shows almost complete drainage of the fluid. The abscess cavity completely resolved within 3 weeks and the patient did not need further surgical management.

MEDIASTINAL ABSCESS DRAINAGE

Mediastinal abscesses not considered for surgical drainage can be successfully drained percutaneously or by a transesophageal approach. Drainage is usually done under CT guidance which helps in planning a safe path for catheter that avoids major mediastinal structures.

TRANSTHORACIC NEEDLE BIOPSY OF PULMONARY LESIONS

The indications for transthoracic needle biopsy (TNB) include evaluation of a solitary pulmonary nodule or mass, confirming metastatic lung disease, staging of lung cancer or extrathoracic malignancy, and sampling of suspected focal infections.

CT guidance is useful for lesions that are adjacent to hilum or mediastium (to avoid injury to adjacent vascular structures, bronchi and esophagus), for small lesions and for lesions not clearly seen on fluoroscopy.

CT fluoroscopy allows real time visualization of the nodule and the needle with the potential to decrease the number of pleural punctures necessary to place the needle into the lesion.

USG guidance is limited to masses that are apical, juxtadiaphragmatic or adjacent to the chest wall. Some of the advantages of US guidance include real time imaging capability, lack of ionizing radiation, portability and the ability to target non necrotic portions of the lesion.

Pneumothorax is the most common complication.

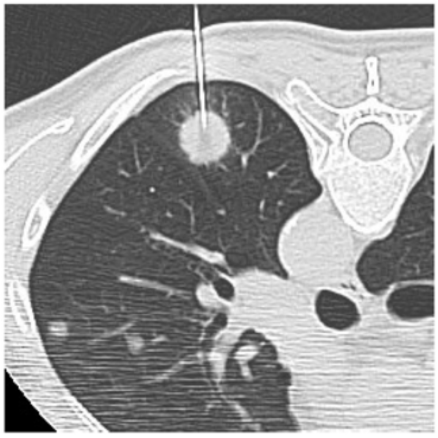


Fig 4. CT guided biopsy of a solitary pulmonary lesion from left lower lobe.

TRANSTHORACIC NEEDLE BIOPSY FROM OTHER SITES

FNAB of a mediastinal or hilar mass is usually performed under CT guidance as CT clearly demonstrates the location of the mass and its relation to normal mediastinal structures and allows selection of the optimal biopsy path. USG guidance can be used for large lesions that are in contact with the chest wall and a safe acoustic window is available for simultaneous lesion visualization and needle placement.

PERCUTANEOUS NEEDLE BIOPSY OF PLEURA

Indications for pleural biopsy include pleural masses or thickening with or without associated pleural fluid, small or loculated pleural effusions where thoracocentesis has been non-diagnostic and where there are recurrent pleural effusions of unknown aetiology. Most pleural biopsies can be performed using US guidance although small pleural lesions occasionally require CT for accurate needle placement. USG guidance is helpful in localizing small pleural effusion through which a core biopsy can be safely performed thus reducing the risk of pneumothorax.

LOCALISATION OF A NODULE FOR THORACOSCOPIC RESECTION

Thoracoscopic resection has established itself as an effective method for diagnosing and treating a peripheral lung nodule that is near the visceral pleura. The radiologist can help by marking the lesion with a hookwire. The hookwire is inserted into the lesion through the guide needle.

BRONCHIAL ARTERY EMBOLISATION FOR HEMOPTYSIS

Brochial artery embolisation can be used for controlling hemoptysis secondary to tuberculosis , bronchiectasis, cystic fibrosis, lung abscess and bronchogenic carcinoma. Flush ascending and descending aortography is performed followed by selective catheterization of the bronchial arteries and systemic collaterals. Extravasation of contrast material at bleeding site is rarely demonstrated angiographically. Embolic materials include Gelfoam particles, poly vinyl alcohol or stainless steel coils.[6]

PULMONARY ARTERY EMBOLISATION

Pulmonary artery embolisation is performed for pulmonary AV malformations and pulmonary artery psudoaneurysms. Complications include self-limited pleurisy, air emboli, and paradoxical embolisation of the embolic device.[7,8]

BRONCHIAL TREE DILATATION & STENTING

Tracheobronchial stenting has been used successfully for symptom palliation in patients with inoperable bronchogenic cancer, oesophageal or tracheal tumours and metastatic tumours. Brochial stenting is usually performed in a cooperative fashion by pulmonologists and interventional radiologists using bronchoscopy and fluoroscopy, often with bronchography for guidance. Usually more than 80% of patients will have improvement after airway stenting.

CONCLUSION

With the rapid advancement of imaging technology, the range of chest interventional procedures keeps on expanding due to improved angiographic, CT and US technology; better percutaneous assess devices; and advancing ablation and embolization techniques. All these permit procedures to be undertaken safely and effectively, and are able to escalate the role of Intervention Radiology in the treatment of chest diseases. A wider range and more complex conditions in the chest can be treated with Intervention Radiology. Constant review of indications and contraindications of various interventional procedures, and strategies to minimize the procedural risks are of utmost importance for ensuring these chest image-guided procedures are performed appropriately and at the highest standard to achieve the best patient care.

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