Presentation and Management of Common Thoracic Diseases
Prof. Khaled Kattan

Embryological and anatomical view:

- Develops from the 3rd and 4th bronchial arches, forming a part that divides into right and left bronchi where each one divides into a bronchial tree. The blood vessels follow the bronchial tree and end up by alveoli.
- Bronchial system: supplied by the systemic arteries directly from the aorta.
- Alveolar system: supplied by pulmonary arteries.
- Lobes:
  - Right lung is composed of three lobes while the left lung is composed of two lobes.
- Fissures:
  - The oblique and horizontal fissures divide the right lung into: upper, middle and lower lobes, while the oblique fissure divides the left lung into: upper and lower lobes.
- Segments:
  - Left lung has eight segments, while the right lung has ten.
- Blood supply:
  - Mixed venous blood is returned to the lungs by the pulmonary arteries, the air passages themselves are supplied by small branches of the descending aorta (bronchial arteries).

Lung Diseases

A. Congenital:

1. Agenesis:

- Absence of the lungs results from failure of the bronchial buds to develop.
- Unilateral agenesis is more common than bilateral agenesis (failure to develop, a child has only one lung).

2. Hypoplasia:

- The lung is unable to develop normally because it is compressed by the abnormally positioned abdominal viscera or by a space occupying lesion as in pleural effusion, so there's no space for the lung to develop (the lung is small in size, less in function).

3. Cystic adenomatoid malformation:

- *The commonest* congenital abnormality. ☝
- There are cystic changes and adenomas within one or, maybe, both lungs.
- It appears early in life.
- Managed by surgical resection, either the whole lung or a lobe of the lung.
- We do lung resection because it's a source of infection and shunting and a risk of malignancy.

4. Pulmonary sequestration (small accessory lung):

- Very uncommon.
- Almost always located at the base of the left lung.
- Communicates with the tracheobronchial tree.
- Its blood supply is usually systemic rather than pulmonary in origin (abnormal growth of lung).

5. Lobar emphysema:

- Seen *only* in children. ☝
- There is pressure on the adjacent lung parenchyma.
- If the lung is not functioning, we remove it surgically.

NOTE:

- *Differentiate between lobar and acquired emphysema which have same morphologies but different etiologies (acquired emphysema is secondary to smoking and α_1 antitrypsin deficiency).*

6. Bronchogenic cyst:

- Formation of a cyst in one of the bronchi during the development of bronchial bulbs.
- Can be intrapulmonary or extrapulmonary.
- Presentation is late in life and treatment is surgically.
- It causes sequestration (abnormal growth of part of the lung).

NOTE:

- *It should be considered that these congenital disorders can be diagnosed early in intrauterine life during US screening of the pregnant, so it's treated immediately once the baby is born or proper procedures can be done during pregnancy.*

B. Infectious; common after surgical implementation:

1. Lung abscess:

- Necrosis of the pulmonary tissue and formation of cavities containing necrotic debris or fluid caused by microbial infection.
- Very prominent.
- This pus filled cavity is often caused by aspiration, which may occur during altered consciousness.
- Alcoholism is the most common condition predisposing to lung abscesses. ☝
- Any abscess should be drained.

Causes:

- Secondary to pneumonia or lung infection especially if you have obstruction of part of a bronchus with infection.

Clinical features:

- Cough with copious amount of foul smelling colored sputum.

Investigation:

- CXR shows abscess in lung.

Treatment:

- Antibiotics.
- Drainage of external and internal pus.
- Pulmonary resection (lobectomy) is indicated in:
  a. Failure of medical treatment.
  b. Giant abscess; more than 6 cm.
  c. Hemorrhage.
  d. Inability to rule out carcinoma.
  e. Rupture with resulting empyema.

NOTE:

- *A big abscess (more than 6 cm) with a thick wall, complicated with bleeding or undefined malignancy, indicates surgery either to the abscess itself or the lobe containing the abscess.*

2. Bronchiectasis:

- a chronic inflammatory or degenerative condition of one or more bronchi or bronchioles of the lungs marked by *permanent dilatation* and loss of elasticity of the walls. Infection is the mechanism by which the disease progresses. The disease, if left untreated, will continue to damage lung tissue and bronchial tubes and cause emphysema and severe breathing difficulties.
- Have two types:
  - Cylindrical.
  - Cystic (more advanced).

Causes:

- Congenital.
- Infection; secondary to childhood infection that was not treated well.
- Obstruction of bronchus with the distal part of the lung becoming dilated and containing a lot of infections causing bronchiectasis.
- Part of a general disease like cystic fibrosis might have bronchiectasis.

Clinical features:

- Long history of chronic productive cough.
- Dyspnea (if the affected areas are big).
- Hemoptysis; in 50% of long standing disease cases, it may cause ulceration.
- Clubbing.

Investigations:

- Bronchogram (not used nowadays).
- CXR.
- CT.
- Bronchoscopy.

Treatment:

- Medical (cylindrical type):
  - Treat the underlying cause.
  - Most cases resolve.
- Surgical (cystic type when limited, i.e. not diffused), indicated in:
  - Failure of medical treatment.
  - A localized disease.
- Diffuse cystic bronchiectasis requires transplantation. ☝

Cylindrical bronchiectasis	Cystic bronchiectasis
➢ Cylindrical dilatation of bronchial tree. ➢ Treated medically as conservative therapy in addition to treating the underlying cause.	➢ cystic dilatation of bronchial tree (More advanced stage). ➢ Does not respond medically, it requires surgical resection.

3. Tuberculosis:

- An infectious disease caused by *M. tuberculosis*.
- It causes either a pulmonary or extrapulmonary infection, or both.
- Most commonly affects the lungs (pulmonary TB), but can also affect the central nervous system (meningitis), lymphatic system, circulatory system (miliary tuberculosis), genitourinary system, bones and joints.
- 30,000 new cases occur annually in the U.S.A.

Investigations:

- Sputum.
- CXR.

Treatment:

- Medical is the primary treatment.
- Surgical; indicated in: ☝
  a. Failure of medical treatment.
  b. Destroyed lobe or lung.
  c. Pulmonary hemorrhage.
  d. Persistent open cavity with positive sputum.
  e. Persistent bronchopulmonary fistula.
  f. If it's complicated by hemoptysis, ulceration, bleeding, abscess or bronchiectasis.

4. Aspergillosis:

- The most common forms are allergic bronchopulmonary aspergillosis, pulmonary aspergilloma and invasive aspergillosis.
- Compromised immune system often allows aspergillus to colonize.
- It's caused by *A. fumigatus* or *A. niger*.
- The disease has three forms:
  - Allergic (*requires antifungal therapy).*
  - Saprophytic.
  - Invasive.

Clinical features:

- Aspergilloma causes fungal balls.
- Chronic productive cough.
- Hemoptysis (patients with preexisting disease).

Investigations:

- Skin test.
- Sputum.
- Biopsy.
- CXR.
- CT scan.

Treatment:

- Medical.
- Surgical (Segmentectomy, lobectomy, pneumonectomy), indicated in:
  - Significant aspergilloma. ☝
  - Hemoptysis.

4. Hydatid cyst:

- A parasitic infection.
- A cyst formed as a result of infestation by larvae of the *E. granulosus*, (a tapeworm), that's why it is called echinococcus cyst.
- Liver is affected *before* lung. ☝

Diagnosis:

- Appears in x-ray as a single or multiple cysts.
- CT scan confirms the diagnosis. ☝

Treatment:

- Surgical excision (make sure there aren't multiple cysts).

Tumors

- Benign.
- Malignant:
  A. Primary.
  B. Secondary.

A. Primary lung carcinoma:

- Two types:
  - Small cell lung cancer (SCLC).
  - Non small cell lung cancer (NSCLC).

Epidemiology:

- Incidence equals the number of new cases per 100,000 of the population.
- Death rate equals the number of deaths from the disease per 100,000 of the population in one year.
- In KSA, it is the *commonest cause of death (not the commonest tumor)* in males and females; the prognosis is not as good as lymphoma and hepatoma.
- Lung cancer comes in third place after lymphoma and hepatoma in males, and breast cancer in females.

Risk factors:

- Smoking:
  - 80% of patients are smokers.
  - *40 times higher risk.* ☝
- Exposure to asbestos.

Pathology:

- NSCLC:
  1. Adenocarcinoma:
     - Most common subtype of NSCLC. ☝
     - It is a form which starts near the gas exchanging surface of the lung.
     - Most cases of adenocarcinoma are associated with smoking.
  2. Squamous cell carcinoma:
     - A carcinoma that arises from squamous epithelium.
  3. Large cell carcinoma:
     - A fast growing form that grows near the surface of the lung.
     - It is primarily a diagnosis of exclusion.
     - When more investigations are done, it is usually reclassified as squamous cell carcinoma or adenocarcinoma.
- SCLC.

NSCLC	SCLC
➢ Grouped together because their prognosis and management are roughly identical. ➢ The subtypes are: 1. Squamous cell carcinoma. 2. Adenocarcinoma. 3. Large cell carcinoma.	➢ The less common form of lung cancer. It tends to start in the larger breathing tubes and grows rapidly becoming quite large. The oncogene most commonly involved is L-myc. The "oat" cell contains dense neurosecretory granules which give this an endocrine/paraneoplastic syndrome association. It is more sensitive to chemotherapy, but carries a worse prognosis and is often metastatic at presentation. This type of lung cancer is strongly associated with smoking.

Clinical features:

1. Asymptomatic (5%), so patients with risk factors need to be screened.
2. Symptomatic:
   - Depends on the site of the tumor and its invasion. The symptoms categorized as bronchopulmonary, extrapulmonary, nonspecific or nonmetastatic (i.e. paraneoplastic syndrome).
   - In the lung, a central tumor produces cough and hemoptysis, but a peripheral tumor will cause pain of the chest.
   - Surrounding structures:
     - Recurrent laryngeal nerve invasion causes hoarseness of voice.
     - Dysphagia follows esophageal involvement.
     - C_8, and T_1 nerve invasion affects the tracheal plexus.
     - Pleural effusion may develop.
     - Superior vena caval obstruction.
     - Paraneoplastic syndrome occurs in small percentage of patients and may be very early sign of primary lung cancer. It includes hypercalcemia (increased PTH) and syndrome of inappropriate secretion of antidiuretic hormone (SIADH), and hypertrophic pulmonary osteoarthropathy (HPO).
     - Joint pain and clubbing are common presentations.
     - A lot of patients who are smokers and have joint pain are suspected to have an underlying invasion.

Investigations:

- CXR, *showing a mass.*
- Bronchoscopy in a *central tumor (biopsy).*
- Transthoracic needle aspiration *in a peripheral tumor.*
- CT scan, for staging once *tumor is diagnosed.*
- MRI.

Staging (TNM):

Size and location of the tumor. ➢ **T_1**; less than 3 cm. ➢ **T_2**; more than 3 cm reaching visceral pleura . ➢ **T_3;** Reached parietal pleura or chest wall. ➢ **T_4**; Surrounding structures.
Presence and location of lymph node involvement. ➢ **N0** no nodal involvement. ➢ **N1** hilar node involvement. ➢ **N2** mediastinal node involvement, (nodes outside pleural cavity).
Presence of distant metastasis. ➢ Liver, adrenals, bone and brain.

Management:

- Depends on:
  - Stage.
  - Cell type.
  - Patient physical fitness.
- NSCLC:
  - Surgical.
  - Radiotherapy.
  - Chemotherapy.
- SCLC:
  - No surgical intervention.
  - Chemotherapy.
  - Radiotherapy.

Prognosis:

- Prognosis: 20% over all survival.
- According to five year survival rates:
  - Stage 1 after surgery 80%.
  - Stage 3 and 4, may be 0% (because they present with metastasis) and majority die within 2 years.

B. Secondary Lung Carcinoma:

- Caused by metastasis of multiple lesions elsewhere in the body such as
  - Solitary lung nodule.
  - Primary carcinoma.
  - Tuberculous granuloma.
  - Mixed tumor.
  - Miscellaneous

Mediastinal Mass Lesions

A. Anterior mediastinum:

- The differential diagnosis is made by 5 T's: ☝
  1. Retrosternal thyroid.
  2. Thymoma
  3. Teratoma.
  4. T-cell lymphoma.
  5. Tuberculouse lymphadenitis.

B. Middle mediastinum, e.g. a cyst.

C. Posterior mediastinum:

- the commonest masses are cysts such as bronchogenic and enteric cysts, and *neurogenic* tumors.

Thymoma

- A neoplasm of the thymus.
- Rare.
- Can cause symptoms similar to myasthenia gravis (MG).
- There are benign and malignant forms, which present similarly.

Incidence:

- The commonest tumor of anterior mediastinum.
- Peak at 40-60 years.
- Equal prevalence in both sexes

Pathology:

- Classified, according to tissue origin, into:
  - Epithelial.
  - Lymphocystic.
  - Lymphoepithelial.
  - Spindle cell.
- Stages:
  - Stage I: capsulated.
  - Stage II: invading the capsule.
  - Stage III: invading beyond the capsule.
  - Stage IV: metastasis.
- Stages I and II are benign, whereas stages III and IV are malignant.

Clinical features:

- Asymptomatic.
- The mass may have:
  - Chest effect.
  - Systemic effect; About 10-15% of patients with MG have an underlying thymoma, and 10-20% of thymoma cases can also present with MG, so there is an association between the gland and the disease, but not by a direct relation. ☝

Investigations:

- CXR.
- CT scan.
- Biopsy.
- In selected cases, we do:
  - Bronchoscopy.
  - Esophagoscopy.
  - Angiogram.

Treatment:

- Benign:
  - Complete excision.
- Malignant:
  - Complete excision if possible.
  - If it's nonresectable or resection is incomplete, use postoperative radiotherapy.

Chest Trauma

- Road traffic accidents (RTA) are the *commonest cause.* ☝
- Fractured ribs may be simple, or may be complicated by:
  - Hemothorax.
  - Pneumothorax.
- Flail chest (fracture of more than one rib at more than one side), leading to:
  - Lung contusion
  - Acute respiratory distress syndrome (ARDS).

Chest Wall Diseases

- Osteomyelitis.
- Osteosarcoma or chondrosarcoma.
- Deformity:
  - Pectus excavatum.
  - Pectus carinatum.
  - Mostly corrected for cosmetic reasons.
- Infection.
- Chest wall tear.
- Thoracic outlet Syndrome (TOS):
  - consists of a group of distinct disorders that affect the nerves in the brachial plexus and various nerves and blood vessels between the base of the neck and axilla. For the most part, these disorders are produced by positional compression of the subclavian artery and vein, the vertebral artery, and the nerve cords of the brachial plexus. The disorders are complex, somewhat confusing, and poorly defined, each with various signs and symptoms not only arising from the upper extremity but also from the chest, neck and head. The chest pain can mimic anginal pain.
  - Due to cervical rib compression of structures going through the thoracic outlet, C_8 and T_1 nerves and subclavien artery or vein are effected.

Pleura

- Spontaneous pneumothorax: air collecting within the chest wall compressing the lung. Spontaneous means rupture of the bullae from the lung leading to an air leak compressing the lung.
- Collection of fluid (transudate, exudates, blood, chyle).
- Pleural effusion.
- Empyema; surgical drainage by chest tube.
- Mesothelioma; malignancy related to asbestosis exposure.

Airway

- Tracheal congenital anomalies e.g. tracheoesophageal fistula in pediatric patients.
- Tracheal stenosis or compression by a surrounding structure.
- Tracheostomy: opening of trachea for breathing.

Lung Transplantation:

- Indication in end stage respiratory disease.
- Procedure:
  - May transplant one or both lungs and may give heart transplant with it.
- Outcome:
  - 80% 1st year survival.
  - 50% survival after 5 years.

Surgery:

- Thoracotomy; incision through the 5th intercostal space, at one side:
  - anterolateral.
  - posteroateral (classical).
- Thoracoscopy, like laparoscopy.
- Sternotomy. In cardiac problems, provides access to both thoracic cavities.
- Analgesia.

For extra reading
Lawrence's Essentials of Surgery Specialties
Chapter 6
277-287

Contact us at
surgeons-424@hotmail.com