PULMONARY FUNCTION TESTS

BY

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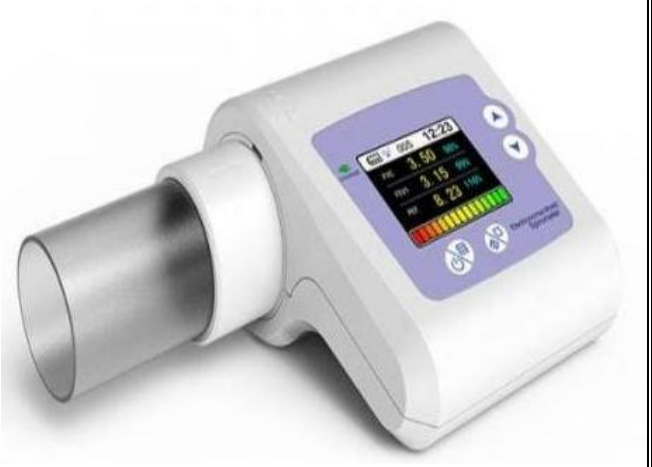
Pulmonary function tests

- Pulmonary function tests can be used to determine whether a respiratory disease is obstructive or restrictive.
- Those PFTs are done by **SPIROMETRY**



1. Tidal Volume (TV)

- Volume inspired or expired with each breath at rest
- 500ml in ♂s, 350ml in ♀s

2. Residual volume (RV) = 1.2L

- Volume of air remaining after maximal expiration
- it decreases with age
- Increased in obstructive lung disease due to air trapping
- RV = FRC – ERV (Functional Residual Capacity - Expiratory Reserve Volume)

3. Vital Capacity (VC) = 5L

- Maximum volume of air that can be expired after a maximal inspiration
- 4,500ml in ♂s, 3,500 mls in ♀s
- it decreases with age
- VC = IC + ERV
- In the absence of equipment, having the patient count at a steady rate for one breath gives a rough estimate of how much air they can expel.
  This is a common bedside or outpatient procedure that is done with myasthenic patients.

4. Forced vital capacity FVC

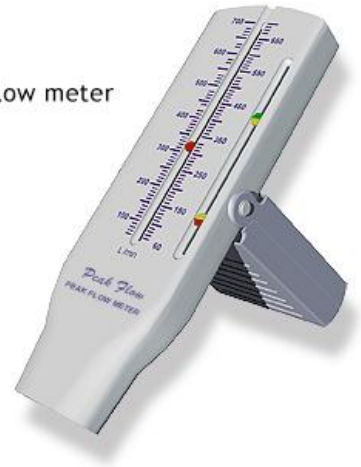
- It is a measure of the force, volume, and speed with which air can be maximally expelled from the lungs.
- The maneuver would be to take a deep breath, and then blow it out as hard as you can for as long as you can to maximally expel air from the lungs.
- This is commonly done to assess patients with asthma and chronic obstructive pulmonary disease.
- Respiratory muscle function is best monitored by frequent assessment of the forced vital capacity (FVC).
- FVC is also the best way to monitor respiratory function in any neurological disorders that can affect the respiratory muscles (e.g. GBS, myasthenia gravis)
- Diaphragmatic weakness occurs in one-third of patients with Guillain-Barré syndrome (GBS) and involvement of the neck muscles, tongue and palate leads to further respiratory compromise
- ITU (intensive therapy unit) admission is recommended when FVC is less than 20 mL/kg and intubation is recommended in most cases when FVC is less than 15 mL/kg.

5. FEV1 : forced expiratory volume in one second

- The FEV1/FVC ratio:
  It is < 70% in obstructive lung disease

6. PEFR

- Peak expiratory flow rate is an objective measure of airway obstruction
- It is carried out by peak flowmeter (bedside test) , and it is used mainly to assess the severity of bronchial asthma and acute asthma exacerbation



7. Transfer factor

(DLCO or TLCO (diffusing capacity or transfer factor of the lung for carbon monoxide (CO))

- The transfer factor describes the rate at which a gas will diffuse from alveoli into blood. Carbon monoxide(C O) is used to test the rate of diffusion.
- Results may be given as the total gas transfer (TLCO) or that corrected for lung volume (transfer coefficient, KCO).

➢ Causes of a raised TLCO

- Asthma
- Pulmonary hemorrhage (Wegener's, Good pasture's)

➢ Causes of a lower TLCO

- Pulmonary fibrosis
- pneumonia
- pulmonary emboli
- pulmonary edema
- emphysema

8. Transfer coefficient (KCO)

- It is useful to understand the relationship between TLCO and transfer co-efficient of carbon monoxide (KCO), to know why they are affected differently in different diseases.
- KCO is a measure of the efficiency of gas exchange into the blood stream.
- It is reduced if the lungs are damaged and increased if there is additional blood in the lungs to remove carbon monoxide.
- TLCO = KCO x Alveolar volume (VA)

- **Causes of an increased KCO with a normal or reduced TLCO**

- (Low TLCO but normal/high KCO) i.e. the same cardiac output is going through a smaller alveolar volume) is characteristic of extra-thoracic restriction:
- Pneumonectomy /lobectomy
- scoliosis/kyphosis
- neuromuscular weakness
- ankylosis of costovertebral joints e.g. ankylosing spondylitis
- Severe thoracic skin thickening, pleural involvement
- And > 70% in restrictive lung disease.

9. Lung Compliance

Lung compliance is defined as change in lung volume per unit change in airway pressure

- **Causes of ↓ compliance**

- Pulmonary edema
- Pulmonary fibrosis
- Pneumonectomy
- Kyphosis

- **Causes of ↑ compliance**

- Age
- Emphysema

Obstructive SPIROMETRY versus Restrictive SPIROMETRY

Obstructive Spirometry	Restrictive Spirometry
☞ FEV1/FVC < 80% ☞ (FEV1/FVC <0.7) ☞ FEV1 - significantly reduced (<80% predicted - normal) ☞ FVC: reduced or normal ☞ FEV1/FVC: reduced المحصله **Examples** ▪ Chron ic obstructive ▪ pulmonary disease ▪ chronic bronchitis ▪ emphysema ▪ Asthma ▪ Bronchiectasis	☞ FEV1/FVC > 80% ☞ (FEV1/FVC >0.7) ☞ FEV1 - reduced (<80% predicted - normal) ☞ FVC - significantly reduced (<80% predicted normal) ☞ FEV1% (FEV1/FVC) - normal (>0.7) or increased **Examples** ➡ **Intrapulmonary** ▪ Interstitial lung diseases ▪ idiopathic pulmonary fibrosis ▪ extrinsic allergic alveolitis ▪ coal worker's pneumoconiosis /progressive massive fibrosis ▪ silicosis ▪ sarcoidosis ▪ histiocytosis ▪ drug-induced fibrosis: amiodarone, bleomycin, methotrexate ▪ asbestosis ➡ **Extrapulmonary** ▪ neuromuscular disease: polio, myasthenia gravis ▪ obesity ▪ scoliosis