PFT Interpretation

Presented by:

Shazhad Manawar, MD

Medical Director Respiratory Care &
Pulmonary Rehab McLaren Bay Region

Introduction

- History or symptoms suggestive of lung disease.
- Risk factors for lung disease are present.

Pulmonary Function Tests

- Spirometry
- Spirometry before and after bronchodilator
- Lung volumes
- Diffusing capacity for carbon monoxide
- Maximal respiratory pressures
- Flow volume loops

Spirometry

- Volume of air exhaled at specific time points during forceful and complete exhalation.
- Total exhaled volume, know as the FVC (forced vital capacity).
- Volume exhaled in the first second, know as the forced expiratory volume in one second (FEV1)

Spirometry - continued

- Ratio (FEV1/FVC) are the most important variables
- Minimal risk
- Key diagnostic test
  - Asthma
  - Chronic Obstructive Pulmonary Disease (COPD)
  - Chronic cough

Spirometry - continued

- Monitor a broad spectrum of respiratory diseases.
  - Asthma
  - COPD
  - Interstitial Lung Disease
  - Neuromuscular diseases affecting respiratory muscles

Spirometry - continued

- Slow vital capacity (SVC)
- Useful measurement when FVC is reduced and airway obstruction is present

Post-bronchodilator

- Determine the degree of reversibility
- Administration of albuterol
- Technique is important
- Increase in the FEV1 of more than 12% or greater than 0.2 L suggests acute bronchodilator responsiveness.
- Subjective improvements

Post-bronchodilator - continued

- Thus, the lack of an acute bronchodilator response on spirometry should not preclude a one to eight week therapeutic trial of bronchodilators and /or inhaled glucocorticoids, with reassessment of clinical status and change in FEV1 at the end of the time.

Flow-volume loop

- Stridor is heard over the neck
- Unexplained dyspnea
- Pharynx, larynx, or trachea
- Impossible ato detect from standard FVC
- Variable extrathoracic
- Fixed upper airway obstruction (UAO)

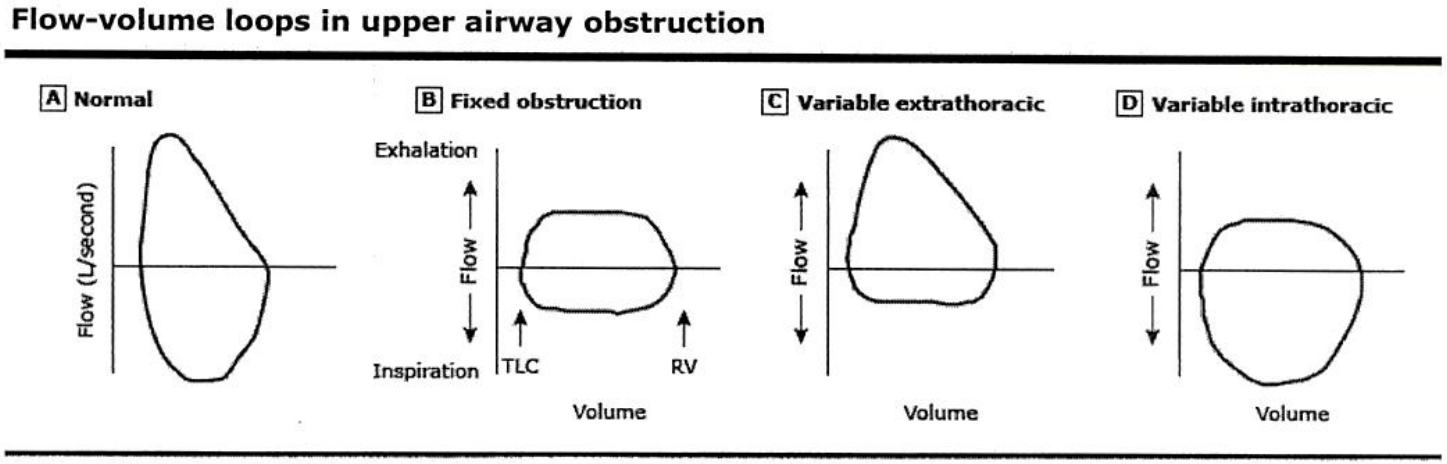
Lung volumes

- Body plethysmography
- Helium dilution
- Nitrogen washout
- Chest imaging
- Chest radiograph or high resolution tomography
  - 15% of those

Lung volumes

- Common lung volumes
  - Vital capacity (VC)
  - Functional residual capacity (FRC)
  - Residual volume (RV)
  - Expiratory reserve volume (ERV)
  - Inspiratory capacity (IC)
  - Total lung capacity (TLC)

Interpretation of PFT



Interpretation of PFT - continued

- Air trapping
  - FRC or RV is increased (>120% of predicted)
- Hyperinflation
  - TLC is increased (>120% of predicted)
- Obstruction in pharnyx, larnyx, & trachea is impossible to detect from FVC
- Variable intrathoracic obstruction

Maximal respiratory pressures

- Unexplained decrease in VC
- Respiratory muscle weakness is suspected
  - Maximal inspiratory pressure (MIP)
  - Maximal expiratory pressure (MEP)
  - The average MIP & MEP for adult men are -100 & + 170
  - For adult women are about -70 & +110

Diffusion capacity

- Carbon monoxide (DLCO also known as transfer factor)
- Restrictive and obstructive disease

6MWT (Six-minute walk test)

- Index of physical function
- Therapeutic response
  - COPD
  - Pulmonary Arterial hypertension
  - Pulmonary Fibrosis

Six-minute walk test - continued

Six minute walk test technique

▪ Flat, straight corridor 30 m (100 feet) in length
▪ Turnaround points marked with a cone
▪ Patient should wear comfortable clothes and shoes
▪ Patient rests in chair for at least 10 minutes prior to test (ie, no warm-up period)
▪ Record baseline heart rate and pulse oxygen saturation (SpO_2); monitoring pulse oxygen saturation during test is optional
▪ If the patient is using supplemental oxygen, record the flow rate and type of device
▪ Have patient stand and rate baseline dyspnea and overall fatigue using Borg scale*[1]
▪ Set lap counter to zero and timer to six minutes
▪ Instruct the patient: Remember that the object is to walk AS FAR AS POSSIBLE for 6 minutes, but don't run or jog. Pivot briskly around the cone.
▪ At each minute mark, inform the patient of the time remaining. It is okay to say, "you are doing well" or "keep up the good work", but do not use words of encouragement to speed up.
▪ At the end of the test, mark the spot where the patient stopped on the floor
▪ If using a pulse oximeter, measure the pulse rate and SpO_2 and record
▪ After the test record the Borg*[1] dyspnea and fatigue levels
▪ Ask, "What, if anything, kept you from walking farther?"
▪ Calculate the distance walked and record

Six-minute walk test - continued

- Typically walk 400 to 700 meters
- Magnitude of desaturation
- Timing of heart rate recovery
- Improvement of about 30 m in distance walked.

Pulse oxygen saturation – Identify using pulse oximetry

- A gas transfer defect
- Titrate the amount of oxygen
  - SpO2 ≤ 95% are considered abnormal
  - Exertional decreases in SpO2 ≥ 5%
  - SpO2 ≤ 88%

Arterial blood gases

- Adjunct to pulmonary function testing
- Confirm hypercapnia
- Elevated serum bicarbonate
- Chronic hypoxemia

Clinical use of Pulmonary Function Testing

- **Indications for pulmonary function tests**

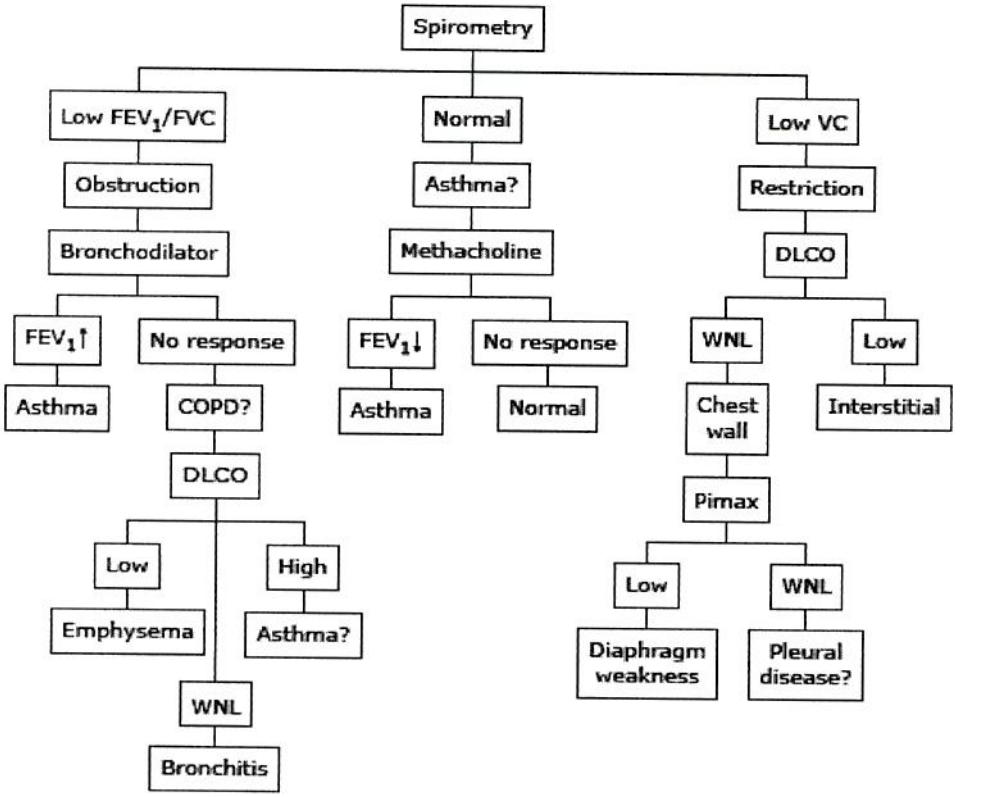
Test	Indication
Spirometry	Evaluate dyspnea
	Symptomatic smokers over age 45 to detect COPD
	Monitor recovery from exacerbation of asthma, COPD
Spirometry with bronchodilator	Chronic cough or chest tightness
	Suspected asthma or COPD
Diffusing capacity for carbon monoxide (DLCO or transfer factor)	Differential diagnosis of abnormal spirometry
	Obstruction: asthma versus COPD or bronchiolitis obliterans
	Restriction: interstitial lung disease versus chest wall
	Diffuse opacities on chest radiograph
	Suspected pulmonary vascular disease
	Evaluate dyspnea
Lung volumes	Low FVC on spirometry: restriction versus hyperinflation or mixed
Oximetry with exercise or sleep	Dyspnea on exertion, disability evaluation
	Check adequacy of supplemental oxygen
	Screen for abnormal breathing during sleep
Bronchoprovocation challenge	Suspected asthma but normal spirometry
Respiratory pressures	Suspected muscle weakness or diaphragm paralysis
	Monitoring of myasthenia, ALS, polio
Flow volume loop	Inspiratory stridor
	Suspected upper airway obstruction: vocal cord paralysis, tracheal stenosis
	Evaluate unexplained dyspnea

Chronic dyspnea

- Dyspnea on exertion
- Spriometry on exertion
- Spirometry before & after a bronchodilator

Chronic dyspnea - continued

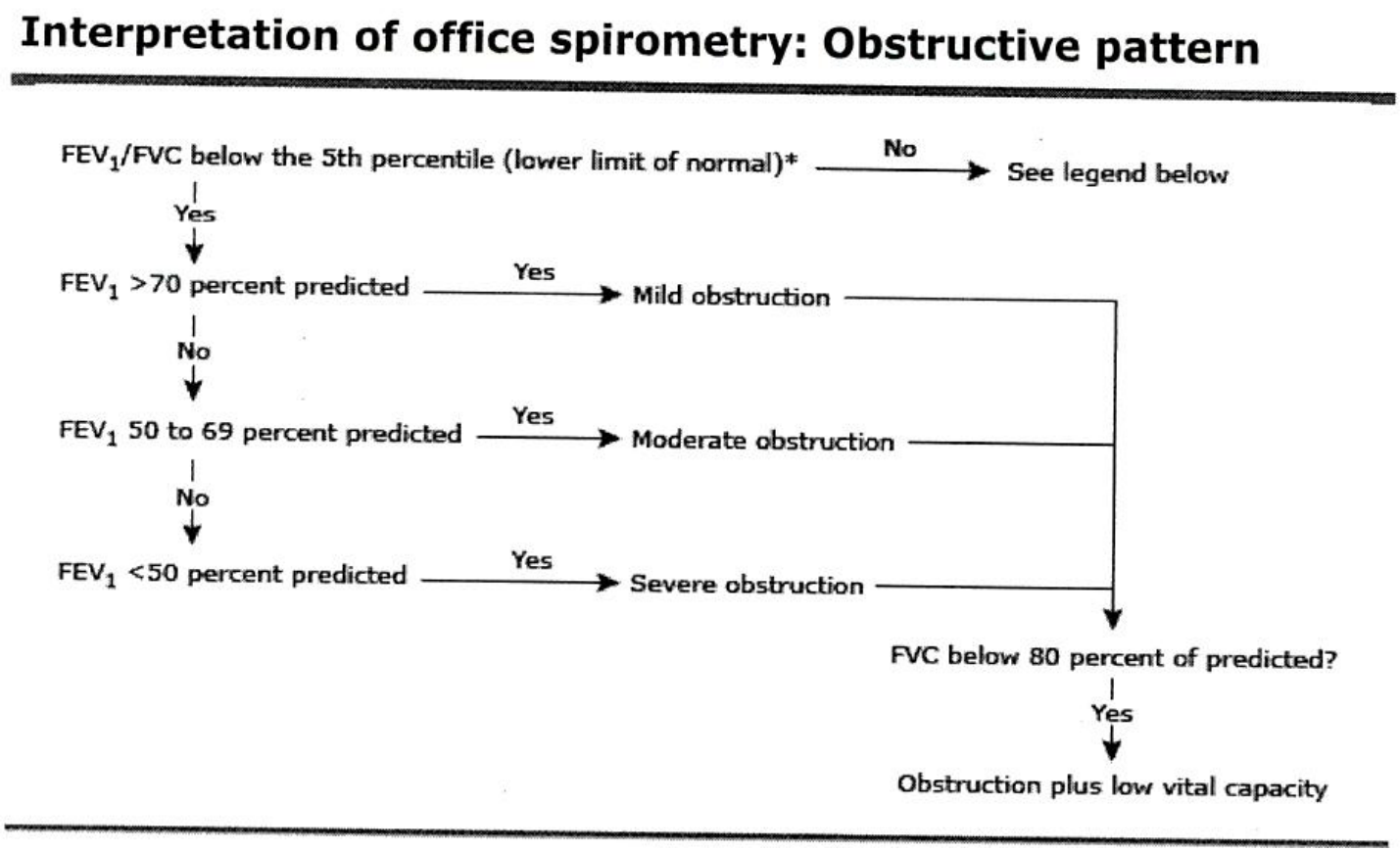
Approach to the patient with dyspnea



Asthma

- Spirometry before and after a bronchodilator
- Follow-up office
- Bronchial hyperresponsiveness (BHR)
- Measurement of airway lability

Asthma - continued



Chronic Obstructive Pulmonary Disease

- Spirometry before & after an inhaled bronchodilator
- Confirm airways obstruction in smokers
- Irreversible airflow limitation
- Fifth percentile lower limit of normal (LLN)

Chronic Obstructive Pulmonary Disease - continued

- Total lung capacity (TLC)
  - Body plethsmography
  - Helium dilution
  - Nitrogen washout
- Course and response to therapy
- Decline in FEV1 (90 to 150 mL/yr) in smokers
- Nearly normal rate of FEV1 decline (20 to 30 mL/yr)

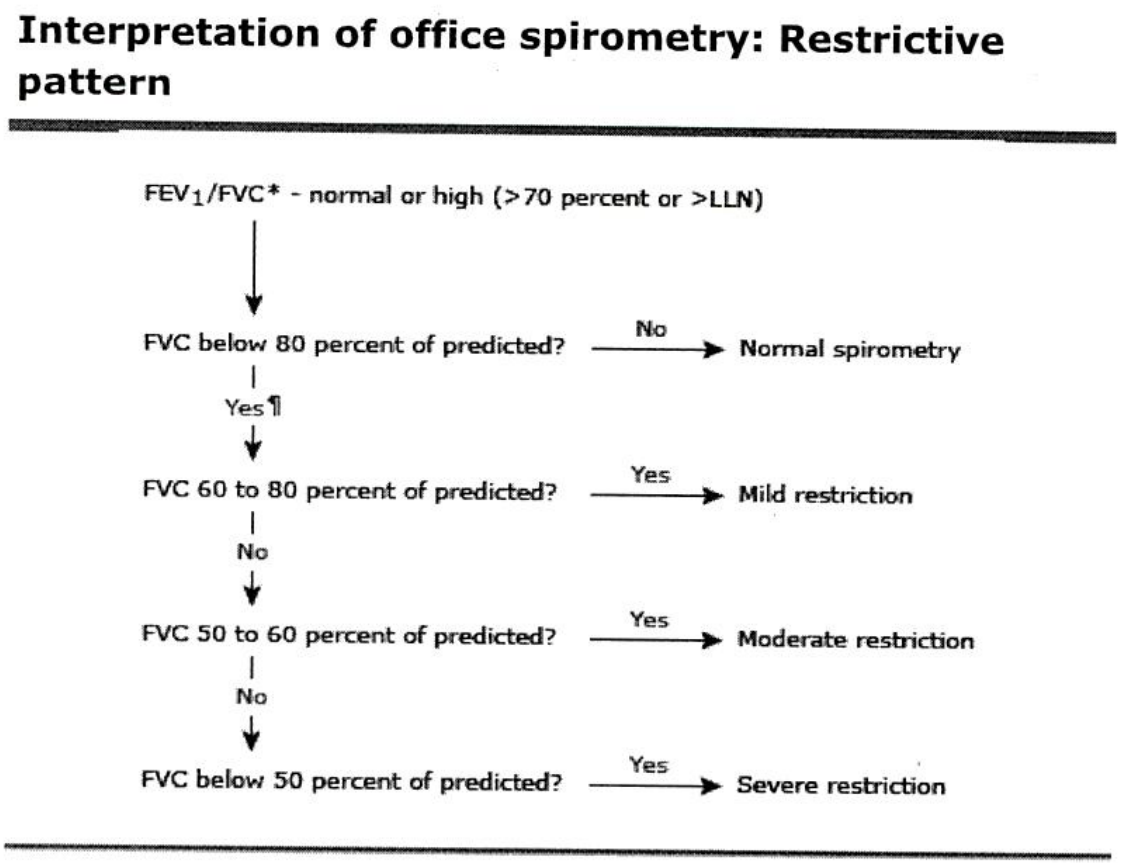
Chronic Obstructive Pulmonary Disease

- Severe, with and FEV1 < 30% predicted
- Diffusion capacity for carbon monoxide (DLCO)
  - Emphysema
  - Obstructive chronic bronchitis
  - asthma

Restrictive Ventilatory defect

- History, physical examination
- Chest radiograph
- Reduced FEV1 and/or FVC
- Normal or increased FEV1/FVC ratio
- Lung volumes
- Diffusion capacity

Restrictive - continued



Preoperative testing

- COPD or asthma
- Current smokers
- Thoracic or upper abdominal surgery
- Elevated aterial tension of carbon dioxide (PaCO2)
- Pneumonia, Prolonged mechanical ventilation, atelectasis,respiratory failure.

Preoperative testing - continued

- Surgery can be delayed
- Should not be used to deny surgery
- Maximum oxygen uptake

Impairment or disability

- Rough indication of an individual's ability.
- Measure maximal oxygen consumption (VO2 max)
- Severe impairment
  - Constant severe dyspnea despite continuous treatment or intermittent extreme dyspnea despite continuous therapy.

Impairment or disability - continued

- Severe impairment
  - FVC < 50% predicted
  - FEV1 < 45% predicted
  - DLCO < 45% predicted
  - VO2 max < 15 mL/kg per min