

Learning Series - #19



Making sense of Pulmonary function tests (PFTs) and disorders affecting lung function

Spirometry is the most common noninvasive pulmonary function test. It measures **how much (volume/quantity)** and **how fast (flow/speed)** air is moved in and out of lungs. It is a screening test of general respiratory health.

Pulmonary function tests (PFTs) are an important tool in the investigation and monitoring of patients with respiratory pathology. They provide information relating to the large and small airways, the pulmonary parenchyma and the size and integrity of the pulmonary capillary bed. PFTs do not provide a specific diagnosis, but together with the history, physical exam, and laboratory data help clinicians reach a diagnosis.

Normal values of Pulmonary Function tests (PFTs)

Test	PFTs	Description	Normal values %Pred
Spirometry (Identifies airflow obstruction)	FEV ₁	Forced expiratory volume in one second; the volume of air exhaled in the first second under force after a maximal inhalation.	80% to 120%
	FVC	Forced vital capacity; the total volume of air that can be exhaled during a maximal forced expiration effort.	80% to 120%
	FEV ₁ /FVC ratio	The percentage of the FVC expired in one second.	Within 5% of the predicted ratio
Lung volumes (Identifies restriction and hyperinflation)	TLC	Total lung capacity; the volume of air in the lungs at maximal inflation.	80% to 120%
	FRC	Functional residual capacity; the volume of air in the lungs at resting end-expiration.	75% to 120%
	RV	Residual volume; the volume of air remaining in the lungs after a maximal exhalation.	75% to 120%
Diffusion capacity	DLCO	Measurement to assess the lungs' ability to transfer gas (CO) from inspired air to the bloodstream (RBC)	> 60% to < 120%



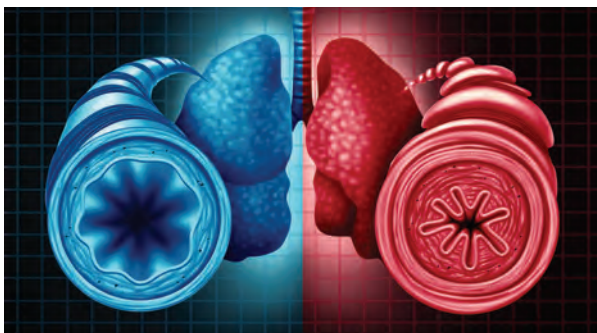
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Pulmonary Function Tests Abnormalities

Obstructive abnormalities	Restrictive abnormalities	Mixed abnormalities
<ul style="list-style-type: none"> • Reduction in airflow (Over expansion of lungs – loss of elastic recoil) • FEV₁/FVC < 70% 	<ul style="list-style-type: none"> • Reduction in lung volume • FEV₁/FVC ratio preserved but values (FVC & FEV₁) are decreased 	<ul style="list-style-type: none"> • A mixed ventilatory defect characterized by the coexistence of obstructive and restrictive elements
<ul style="list-style-type: none"> • Asthma • COPD/Emphysema • Chronic bronchitis • Bronchiectasis • Cystic fibrosis 	<ul style="list-style-type: none"> • Parenchymal disease (“<i>intrinsic</i>” lung disorder) <ul style="list-style-type: none"> - Idiopathic pulmonary fibrosis - Sarcoidosis - Tuberculosis - Interstitial lung diseases • Restrictive bellows <ul style="list-style-type: none"> - Neuromuscular disease (ALS, muscular dystrophy, diaphragm paralysis) - Chest wall abnormalities (“<i>extrinsic</i>” lung disorder): obesity, kyphoscoliosis, akylosing spondylitis 	<ul style="list-style-type: none"> • FEV₁/FVC & TLC < 5th percentile of their predicted values or FEV₁/FVC < 0.70 and TLC < 80% pred



Spirometry test	Normal %Pred	Abnormal	
FVC or FEV ₁	≥ 80%	Mild Moderate Severe	70-79% 60-69% <60%
FEV ₁ /FVC	≥ 70%	Mild Moderate Severe	60-69% 50-59% <50%

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Underwriting considerations

- A typical PFT report usually has four sections: demographics, test results, graphs, interpretation
- The interpretation of spirometry results can be challenging because the quality of the test is dependent on patient effort & cooperation, and the interpreter's knowledge of appropriate reference values. To enable the spirometer, the operator must select the correct **demographic information (age, height, gender, race)** as lung function is affected by these variables.
- The maximal effort is very important, and testing will be repeated at least three times to get the best results, with or without bronchodilator (i.e Ventolin)
- A positive response (reactivity) to a bronchodilator is generally defined as an increase of $\geq 12\%$ and ≥ 200 mL as an absolute value compared with a baseline in either forced expiratory volume at 1 second or FVC (many respirologists use this criteria to help distinguish asthma from COPD)
- The result can only be underestimated
- The computer cannot interpret flow volume loop patterns therefore can give an incorrect interpretation in more than half of cases
- FVC values add to the prediction of all-cause mortality provided by Framingham Risk Score alone: after accounting for age, smoking history, hypertension and other cardiovascular risk factors, it was found that the FVC was most highly correlated with cardiovascular mortality. The association was more pronounced in females than in males.

Example of a normal PFT result- spirometry section only

	Ref or Pred (Demographic measurements)	Pre-measure (Actual measurements before bronchodilators)	Pre % Ref/Pred	Post measure (Postbronchodilator measurements)	Post % Ref/Pred	Post % change (Pre%/Post%; Is there any reactivity?)
FVC	5.14	4.18	81	4.25	83	2
FEV ₁	4.17	3.32	80	3.56	86	7
FEV ₁ /FVC	81	79		84		



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