



OBSTRUCTIVE vs RESTRICTIVE PULMONARY DISEASES

Diffuse pulmonary diseases are broadly classified into:

- 1] Obstructive (Airway) Diseases
 - 2] Restrictive Diseases
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1] OBSTRUCTIVE (AIRWAY) DISEASES

- ◆ Definition

Characterized by increased resistance to airflow due to partial or complete obstruction at any level of the airway.

- ◆ Core Functional Defect

Air gets in, but cannot get out properly → expiratory obstruction.

◆ Spirometry Pattern

- FEV1 ↓ ↓ ↓ (markedly decreased)
- FVC → Normal or slightly ↓
- FEV1/FVC ratio ↓ (< 0.7)

📌 Diagnostic cut-off: FEV1/FVC < 0.7 → Obstructive disease

◆ Why Does FEV1 Decrease?

Two major mechanisms:

Airway narrowing (e.g., asthma)

OR

Loss of elastic recoil (e.g., emphysema)

- ◆ Pathophysiology Flowchart

Airway narrowing / Loss of elastic recoil → Increased airway resistance → Difficulty in expiration → Air trapping → Hyperinflation → Decreased FEV1 → ↓ FEV1/FVC ratio

- ◆ Major Obstructive Diseases

Disease	Anatomic Site	Major Pathologic Change	Etiology	Symptoms
Emphysema	Acinus	Airspace enlargement, wall destruction	Tobacco smoke	Dyspnea
Chronic Bronchitis	Bronchus	Mucous gland hypertrophy & hyperplasia	Smoking, pollutants	Cough + sputum

Bronchiectasis	Bronchus	Airway dilation & scarring	Severe infections	Purulent sputum, fever
Asthma	Bronchus	Smooth muscle hypertrophy, mucus, inflammation	Immunologic / unknown	Episodic wheeze
Small airway disease (Bronchiolitis)	Bronchiole	Inflammatory scarring	Smoking	Cough, dyspnea

2 RESTRICTIVE PULMONARY DISEASES

- ◆ Definition

Characterized by reduced lung expansion and decreased total lung capacity (TLC).

Here, the problem is inspiration, not expiration.

◆ Spirometry Pattern

- FVC ↓ ↓ ↓
- FEV1 → Normal or proportionately ↓
- FEV1/FVC ratio → Normal or near normal

🧠 Why? Because both values decrease proportionately.

◆ Pathophysiology Flowchart

Reduced lung compliance / Chest wall restriction →
Impaired lung expansion → Decreased lung volumes →
Reduced FVC → Normal FEV1/FVC ratio

◆ Types of Restrictive Diseases

☐ Chest Wall Disorders (Lungs Normal)

Examples:

- Severe obesity
- Pleural diseases

- Neuromuscular disorders (e.g., Guillain-Barré syndrome)

Mechanism:

Impaired chest expansion → Reduced inspiratory capacity
→ Restrictive pattern

② Interstitial Lung Diseases

Acute

- ARDS (classic acute restrictive disease)

Chronic

- Pneumoconioses
- Interstitial fibrosing disorders
- Sarcoidosis

Mechanism:

Interstitial inflammation / fibrosis → Stiff lungs →
Reduced compliance → Restrictive defect

Comparison Table

Feature	Obstructive	Restrictive
Main problem	Expiration	Inspiration
FEV1	↓ ↓ ↓	↓ (proportionate)
FVC	Normal / slight ↓	↓ ↓ ↓
FEV1/FVC	↓ (<0.7)	Normal / ↑
TLC	Normal / ↑	↓
Example	COPD, Asthma	ARDS, Fibrosis

SPIROMETRY VALUES

Spirometry is the most important pulmonary function test (PFT) used to differentiate obstructive vs restrictive lung diseases.

☐ Forced Vital Capacity (FVC)

- ◆ Definition

FVC = Maximum volume of air that can be forcefully exhaled after taking a full deep inspiration.

In simple words:

Deep breath in → Blow out as forcefully and completely as possible → Total air expired = FVC

- ◆ What Does It Represent?

- Reflects lung volume
 - Indicates ability of lungs to expand
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- ◆ Changes in Disease

Condition	FVC
Normal	Normal
Obstructive	Normal or mildly ↓
Restrictive	↓↓↓ (significantly decreased)

- ◆ Why FVC Decreases in Restrictive Disease?

Fibrosis / chest wall restriction → Decreased lung compliance → Reduced lung expansion → Less air inhaled → Reduced FVC

② Forced Expiratory Volume in 1 Second (FEV1)

- ◆ Definition

FEV1 = Volume of air expelled in the first second of forced expiration.

This is the most important indicator of airflow obstruction.

◆ What Does It Represent?

- Reflects airway resistance
 - Measures speed of expiration
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◆ Changes in Disease

Condition	FEV1
Normal	Normal
Obstructive	↓ ↓ ↓ (markedly decreased)

Restrictive	↓ (proportionate to FVC)
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- ◆ Why FEV1 Decreases in Obstructive Disease?

Airway narrowing / loss of elastic recoil → Increased airway resistance → Slower air flow → Less air expelled in first second → ↓ FEV1

③ FEV1 / FVC Ratio ★ (Most Important)

- ◆ Definition

Percentage of total expired air that comes out in the first second.

Formula:

$$\text{FEV1} \div \text{FVC}$$

Normal $\approx 0.75-0.85$

Diagnostic cutoff for obstruction = < 0.7

- ◆ Diagnostic Significance

Condition	FEV1/FVC Ratio
Normal	0.75-0.85
Obstructive	↓ (<0.7)
Restrictive	Normal or ↑

- ◆ Why Does It Decrease in Obstruction?

FEV1 decreases much more than FVC → Numerator

↓ ↓ ↓ → Ratio ↓

- ◆ Why Is It Normal in Restriction?

Both FEV1 and FVC decrease proportionately → Ratio remains near normal

④ Total Lung Capacity (TLC)

- ◆ Definition

Total volume of air in lungs after maximal inspiration.

$$TLC = RV + VC$$

- ◆ Changes in Disease

Condition	TLC
Obstructive	Normal or ↑ (due to air trapping)
Restrictive	↓ ↓ ↓

- ◆ Mechanism in Obstructive Disease

Air trapping → Incomplete expiration → Residual air accumulates → Hyperinflation → Increased TLC

S Residual Volume (RV)

- ◆ Definition

Volume of air remaining in lungs after maximal expiration.

Cannot be measured directly by simple spirometry.

- ◆ Changes

Condition	RV
Obstructive	↑ (air trapping)
Restrictive	↓

6 Vital Capacity (VC)

- ◆ Definition

Maximum air expelled after full inspiration (but not necessarily forced).

$$VC = TLC - RV$$

- ◆ Changes

- Decreased in restrictive disease
- May be mildly reduced in obstructive disease

COMPLETE INTERPRETATION FLOWCHART

Step 1: Look at FEV1/FVC ratio

If < 0.7 → Obstructive disease

If normal → Go to Step 2

Step 2: Look at FVC

If ↓ ↓ ↓ → Restrictive disease

If normal → Normal spirometry

 Obstructive vs Restrictive Summary Table

Parameter	Normal	Obstructive	Restrictive
FEV1	Normal	↓ ↓ ↓	↓
FVC	Normal	Normal / ↓	↓ ↓ ↓
FEV1/FVC	0.75-0.85	↓ (<0.7)	Normal / ↑
TLC	Normal	↑	↓
RV	Normal	↑	↓

Clinical Interpretation Examples

Example 1:

FEV1 ↓ ↓ ↓

FVC normal

Ratio 0.55

→ Obstructive disease (likely COPD/asthma)

Example 2:

FEV1 ↓

FVC ↓ ↓ ↓

Ratio 0.82

→ Restrictive disease (likely fibrosis)

 Exam Pearls

- ✓ FEV1 is the best indicator of airflow obstruction
 - ✓ FEV1/FVC < 0.7 confirms obstruction
 - ✓ Restrictive diseases reduce lung volumes
 - ✓ Obstructive diseases cause air trapping
 - ✓ TLC helps differentiate true restriction
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Pathophysiology Summary Flow

Obstructive disease → Expiratory airflow limitation →
↓ FEV1 → ↓ FEV1/FVC

Restrictive disease → Reduced lung expansion → ↓ FVC
→ Normal FEV1/FVC

Summary

FEV1 reflects airflow, FVC reflects lung volume, and the FEV1/FVC ratio differentiates obstructive (<0.7) from restrictive (normal ratio) pulmonary diseases. ✨

-> The End <-

