

RESPIRATORY FUNCTION TESTS

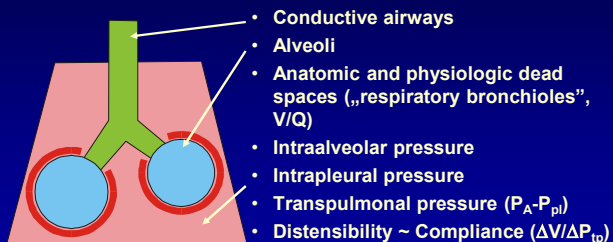
UNIVERSITY OF DEBRECEN
FACULTY OF MEDICINE
DIVISION OF CLINICAL PHYSIOLOGY

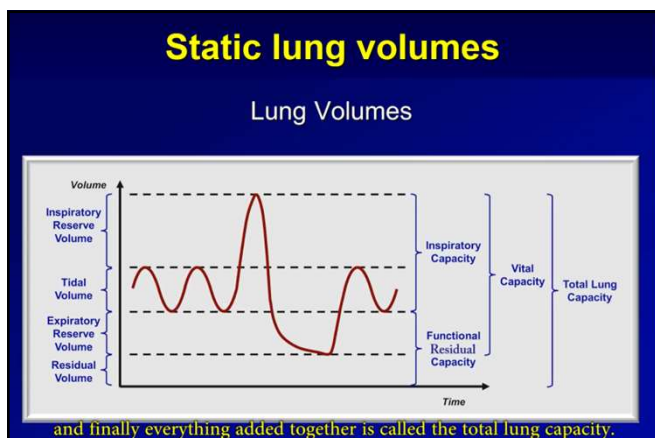


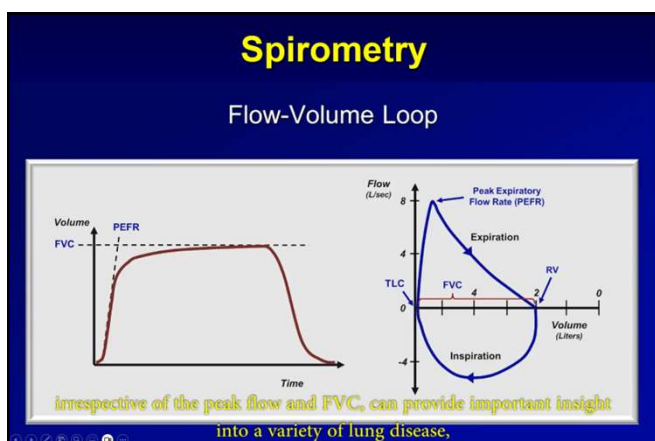
Application

- Diagnosis
- Time course of changes (changes with aging, expositional effects, course of diseases)
- Screening
- Testing drug effects
- Provocation tests
- Estimation of the risk of surgery

Basic terms in pulmonology







Interpretation of Spirometry


Interpretation of FEV₁, FVC, and FEV₁/FVC Ratio

	FEV ₁	FVC	FEV ₁ / FVC Ratio (Tiffeneau Index)
Obstructive Lung Disease	Normal (very mild obstruction)	Normal (mild/mod obstruction)	Decreased ($< 70\%$)
	or Decreased (mod/severe obstruction)	or Decreased (severe obstruction)	
Restrictive Lung Disease	Normal or Decreased	Decreased	Normal or Increased ($\geq 70\%$)

is literally the single most important thing to remember about interpreting PFTs.

Functional Residual Capacity

Nitrogen Washout

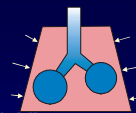
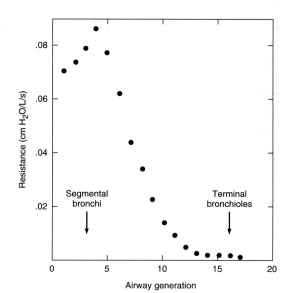


Initial Amount of N₂ in Lungs = Total Amount of N₂ Exhaled

with severe COPD due to the 100% oxygen affect on overcoming

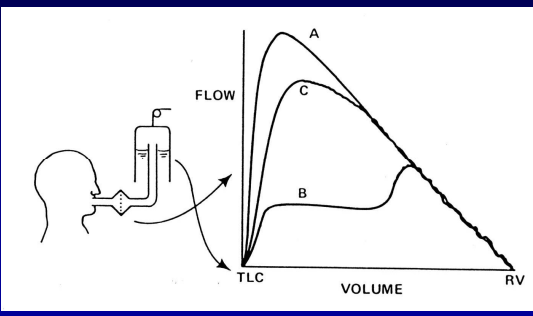
$$FRC = \frac{V_{\text{exhaled}} \times C_{\text{exhaled, N}_2}}{C_{\text{alveolar, N}_2}}$$

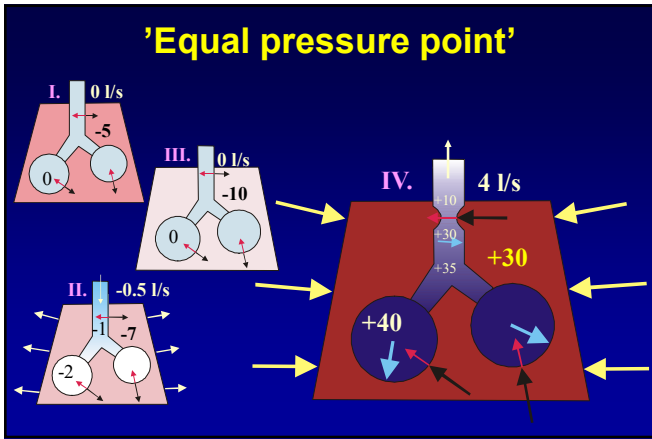
Airway resistance

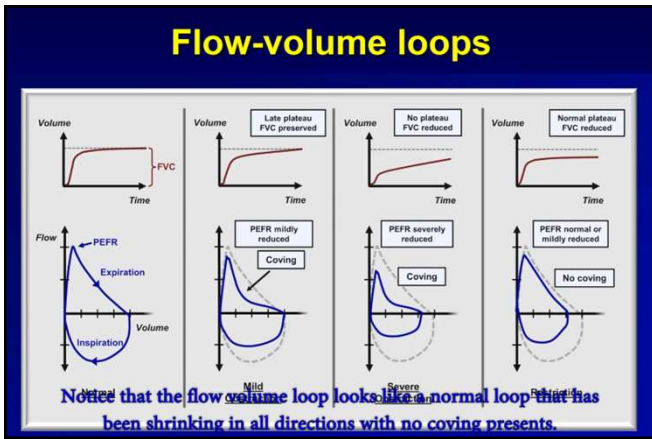



- $R_{aw} = \Delta P_{(A-mo)} / \Delta V'$
- $R_{aw} = R_{\text{laminar}} + R_{\text{turbulent}}$
- Laminar component:
- $R_{\text{laminar}} = 8nl / \pi r^4$
- Turbulent component:
- $R_{\text{turbulent}} \sim V'$
- Measurement requires body plethysmography

Effort independent flow







Interpretation of lung volumes

Interpretation of Lung Volumes

Here is how the 4 individual lung volumes break down for some categories of lung disease.

Case presentation - 1

Patient:
56 year-old woman

Complaints:
Progressive, productive cough, Dyspnea over 3 month

Exams:

General: thin, appears comfortable

Vitals: Body temperature: 36.6°C

Heart rate: 95/min

Blood pressure: 125/80 mmHg

Respiratory rate: 24/min

O₂ saturation on room air: 95%

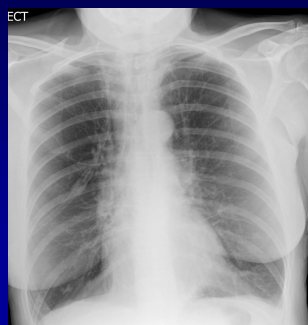
Chest: Diminished lung sounds throughout both lungs

Cardiac: Regular rhythm, no murmurs, normal jugular venous pressure

Case presentation - 1

Control

Patient



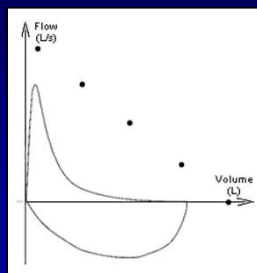
Case presentation - 1

Spirometry (ref. values):

FVC: 2.3 L (3.8 L)
FEV₁: 1.2 L (3.1 L)
FEV₁/FVC: 52 % (82 %)
PEF: 3.9 L/s (5.9 L/s)

Lung volumes (ref. values):

TLC: 7.1 L (5.9 L)
VC: 3.0 L (4.0 L)
IC: 2.5 L (3.2 L)
FRC: 4.6 L (2.7 L)
RV: 4.1 L (1.9 L)
RV/TLC: 58 % (32 %)



Case presentation - 1

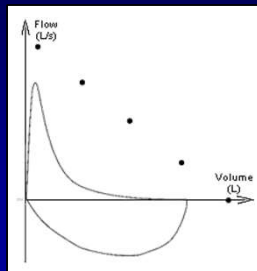
Spirometry (ref. values):

FVC: 2.3 L (3.8 L)
 FEV₁: 1.2 L (3.1 L)
 FEV₁/FVC: 52 % (82 %)
 PEF: 3.9 L/s (5.9 L/s)

Lung volumes (ref. values):

TLC: 7.1 L (5.9 L)
 VC: 3.0 L (4.0 L)
 IC: 2.5 L (3.2 L)
 FRC: 4.6 L (2.7 L)
 RV: 4.1 L (1.9 L)
 RV/TLC: 58 % (32 %)

Obstructive lung disease – COPD



Case presentation - 2

Patient:

68 year-old retired woman

Complaints:

Shortness of breath

Exams:

General: appears in mild respiratory discomfort

Chest: Fine crackles throughout both lungs

Vitals: Body temperature: 36,3°C

Heart rate: 104/min

Blood pressure: 135/85 mmHg

Respiratory rate: 28/min

O₂ saturation on room air: 88%

Cardiac: Regular rhythm, no murmurs, normal jugular venous pressure

Case presentation - 2

Control



Patient



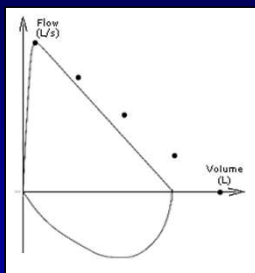
Case presentation - 2

Spirometry (ref. values):

FVC: 1.85 L (2.4 L)
 FEV₁: 1.6 L (1.8 L)
 FEV₁/FVC: 86 % (70 %)
 PEF: 4.7 L/s (6.5 L/s)

Lung volumes (ref. values):

TLC: 2.7 L (4.12 L)
 VC: 1.9 L (3.7 L)
 FRC: 1.3 L (2.1 L)
 RV: 0.83 L (1.4 L)
 RV/TLC: 30 % (34 %)



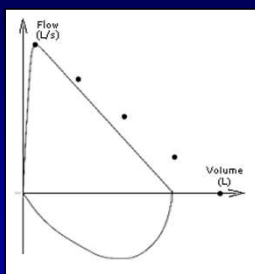
Case presentation - 2

Spirometry (ref. values):

FVC: 1.85 L (2.4 L)
 FEV₁: 1.6 L (1.8 L)
 FEV₁/FVC: 86 % (70 %)
 PEF: 4.7 L/s (6.5 L/s)

Lung volumes (ref. values):

TLC: 2.7 L (4.12 L)
 VC: 1.9 L (3.7 L)
 FRC: 1.3 L (2.1 L)
 RV: 0.83 L (1.4 L)
 RV/TLC: 30 % (34 %)



Restrictive lung disease – pulmonary fibrosis

Final exam test bank – Int-4.1

The factor that mostly effects the prognosis of a COPD patient is:

- A) The continuation of smoking
- B) The reversibility of obstruction when using steroids
- C) The degree of hypoxia
- D) The value of FEV1
- E) The presence of hypercapnia

Final exam test bank – Int-4.2

In case of suspected chronic obstructive pulmonary disease, the most important examination that can confirm the diagnosis is:

- A) The determination of the daily amount of sputum
- B) Physical examination
- C) Chest radiograph
- D) Pulmonary function testing
- E) Blood gas analysis
