Fluid Balance Concepts

1. Pleural Cavity a.k.a. Intrapleural Space
2. Starling filtration forces
3. Lymphatics
Parietal Pleura

Visceral Pleura

Pleural Cavity a.k.a. Intraplural Space
Systemic Capillary Mesothelial Cells

\[ P = -5 \]
\[ \Pi = 7 \]
Pulmonary Fluid Balance Factors

P = 15
Π = 25

P = 10
Π = 25
Protein Leak

P = 5

P = -2
Π = 17

Pulmonary Interstitium

Alveolus

Pulmonary capillary

visceral pleura

Lymphatic drainage

Pressures in mmHg

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Pulmonary Fluid Balance Factors

Small enough volume to maintain cohesive force
Large enough volume to provide lubrication

Pulmonary Interstitium

visceral pleura

Parietal pleura

P = -5
\( \Pi = 7 \)

P = 10
\( \Pi = 25 \)

P = 15

Large enough volume to provide lubrication
Small enough volume to maintain cohesive force

Protein Leak

Lymphatic drainage

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Pulmonary Fluid Balance Factors

Small enough volume to maintain cohesive force
Just large enough volume to provide lubrication

visceral pleura

P = -2
Π = 17

P = -5
Π = 7

Extrapleural Interstitium

P = -5
Π = 7

P = 15
Π = 25

Lymphatic drainage

Protein Leak

Alveolus

Pulmonary Interstitium

P = 10
Π = 25

P=5

Systemic capillary

P = 25
Π = 25

P = 15
Π = 25

Parietal pleura

Pulmonary capillary

P = 15

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**Pulmonary Fluid Balance Factors**

- **Route for Alveolar Flooding**
- **Pulmonary Interstitium**
  - Protein Leak
  - Interstitial Edema
  - 4
  - Lymphatic drainage
- **Pleural Effusion**
  - 7
  - Pressures in mmHg
- **Systemic Capillary**
  - P = 25
  - Π = 25
  - Pressure
  - Systemic
- **Intrapleural**
  - P = -5
  - Π = 7
- **Interstitium**
  - P = 10
  - Π = 25
- **Alveolus**
  - P = 15
  - Π = 25
  - Small enough volume to maintain cohesive force
  - Just large enough volume to provide lubrication
- **Extrapleural Interstitium**
  - P = 35
  - Π = 17
  - Pleural Effusion
- **Visceral Pleura**
  - P = -2
  - Π = 17
- **Parietal Pleura**
  - P = -5
  - Π = 7
- **Systemic Lymphatic Drainage**

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Transudative → P/Π imbalance → mostly H₂O

Exudative → Inflammation/Infection/Cancer
   + wbc → fluid secretion
   + ca cells → fluid secretion
   + mesothelial cell secretion

Hemothorax → blood accumulation
Empyema → pus accumulation

Alveolar Flooding

- Threshold Edema
- Epithelial Cell Injury

Pleural Effusion → Fluid Accumulating in pleural space

Interstitial Edema → Interstitial excess fluid

Lung → P/Π imbalance e.g.
Pulmonary HTN/+ permeability/lymph deficit
Clinical Correlation: Pleural Effusion