

Atelectasis (Collapse)

Mechanisms, structural changes and clinicopathologic reasoning

Resorption • Compression • Contraction

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Learning objectives

AFTER THIS SESSION, EXPLAIN:

- Why obstruction produces resorption atelectasis.
- How pleural collections compress lung parenchyma.
- Why fibrosis limits full inflation and reversibility.
- How major consequences follow loss of aerated lung.

The teaching boundary: Atelectasis versus adjacent topics

This lecture: Atelectasis

Definition; Resorption, compression, contraction; Mediastinal shift; Oxygenation; Infection; Reversibility.

Separate lecture: Pulmonary edema

The source introduces pulmonary edema immediately afterward, but it is a distinct indexed topic.

Mechanisms and cases are developed without importing unrelated disease sections.

Atelectasis: The definition

TWO ROUTES TO POORLY AERATED PARENCHYMA

- Incomplete expansion of lung: Neonatal atelectasis.
- Collapse of lung that was previously inflated.
- Both produce regions of poorly aerated pulmonary parenchyma.

The definition describes an inflation state, not a single etiology.

Neonatal and acquired atelectasis

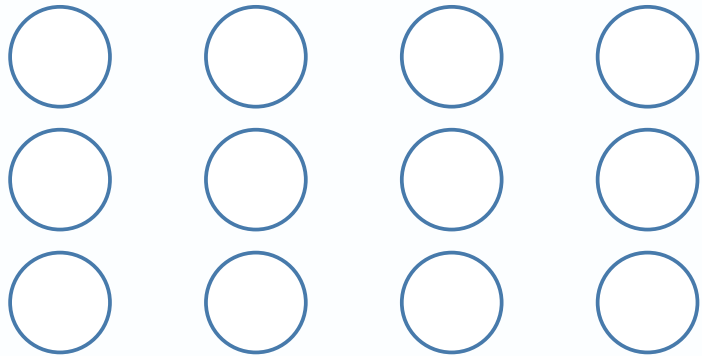
Dimension	Neonatal	Acquired
Initial state	Incomplete initial expansion	Previously inflated lung
Shared outcome	Poor aeration	Poor aeration
Emphasis in this lecture	Definition only	Three major mechanisms

Robbins specifically classifies the acquired forms that predominate in adults.

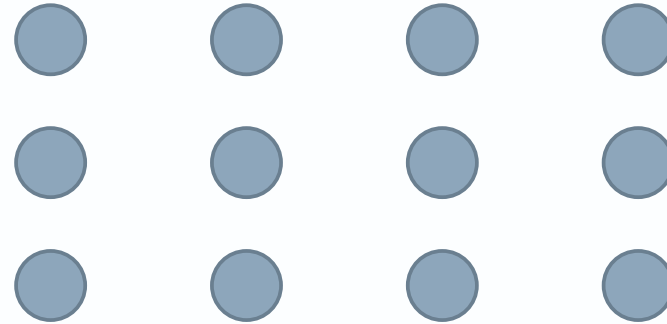
Air-filled lung versus collapsed lung

SCHEMATIC • CONCEPTUAL AIR
SPACES, NOT HISTOLOGY

Normally aerated parenchyma



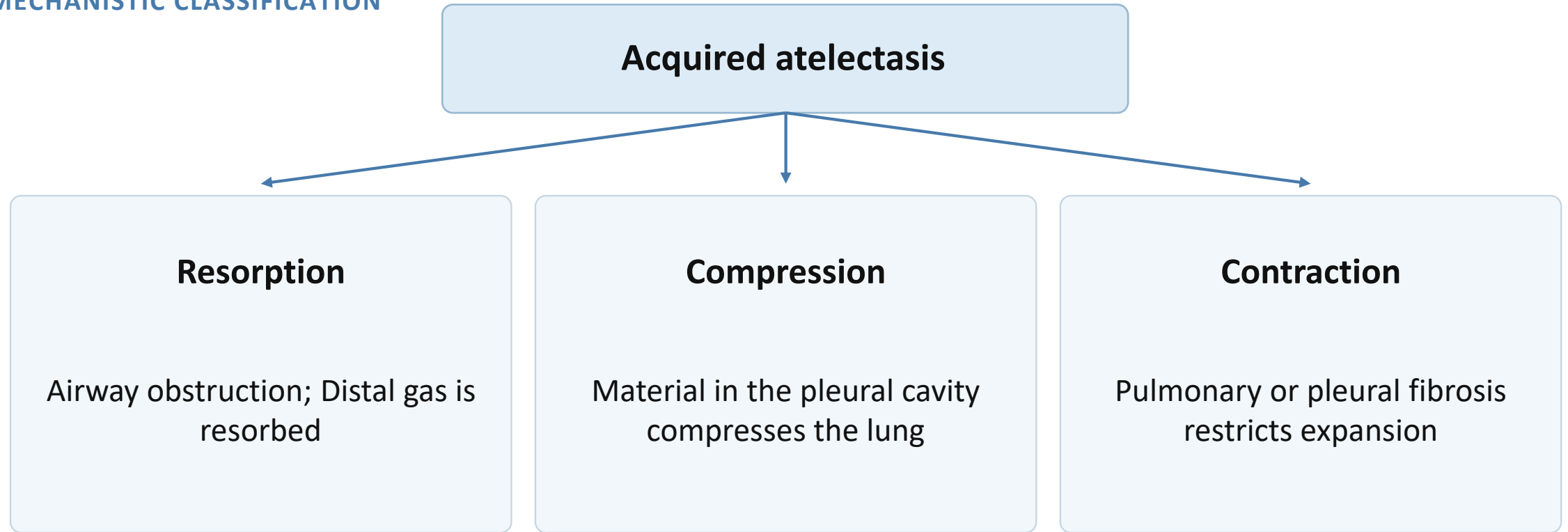
Atelectatic parenchyma



Reduced air content → poorly aerated lung parenchyma; Schematic circles are not a photomicrograph.

Three mechanisms of acquired atelectasis

MECHANISTIC CLASSIFICATION



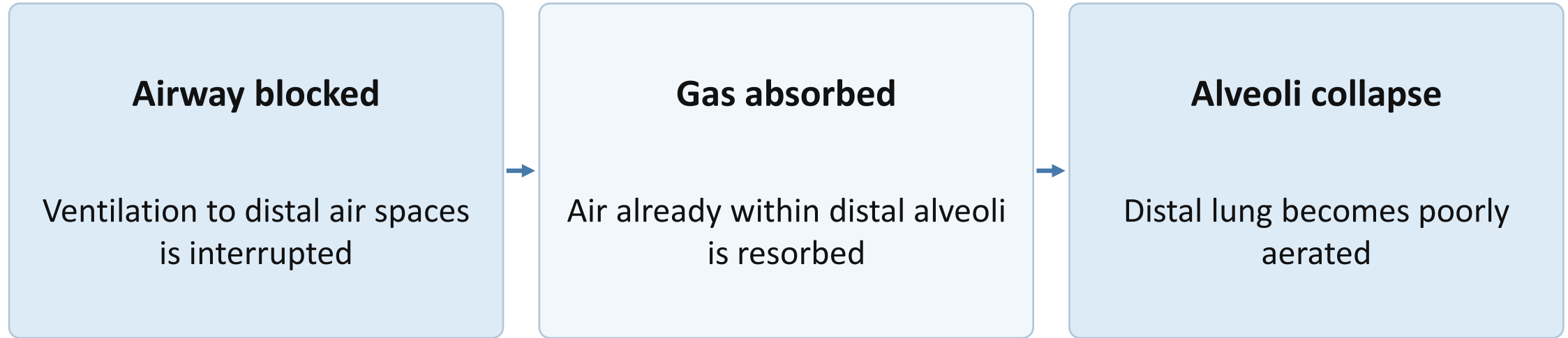
The categories are mechanistic: The location and nature of the barrier differ.

What distinguishes the three types?

Feature	Resorption	Compression	Contraction
Primary site	Airway lumen	Pleural cavity	Lung / pleura
Immediate problem	No fresh distal air	External compression	Fibrotic restriction
Reversibility	Usually reversible	Usually reversible	Fibrotic exception

Ask what physically prevents adequate alveolar inflation.

Resorption atelectasis: Causal chain



Obstruction initiates volume loss in the affected pulmonary territory.

The airway obstruction comes first

RESORPTION MECHANISM

- The initiating lesion lies in a bronchus or smaller airway.
- Alveoli distal to that lesion are no longer supplied normally with air.
- Existing intra-alveolar gas is progressively resorbed.

Cause: Blocked airway. Effect: Distal atelectasis.

Airway patency determines distal aeration



The lesion may be mucus, exudate, an aspirated object or an intrabronchial tumor.

The time sequence of resorption

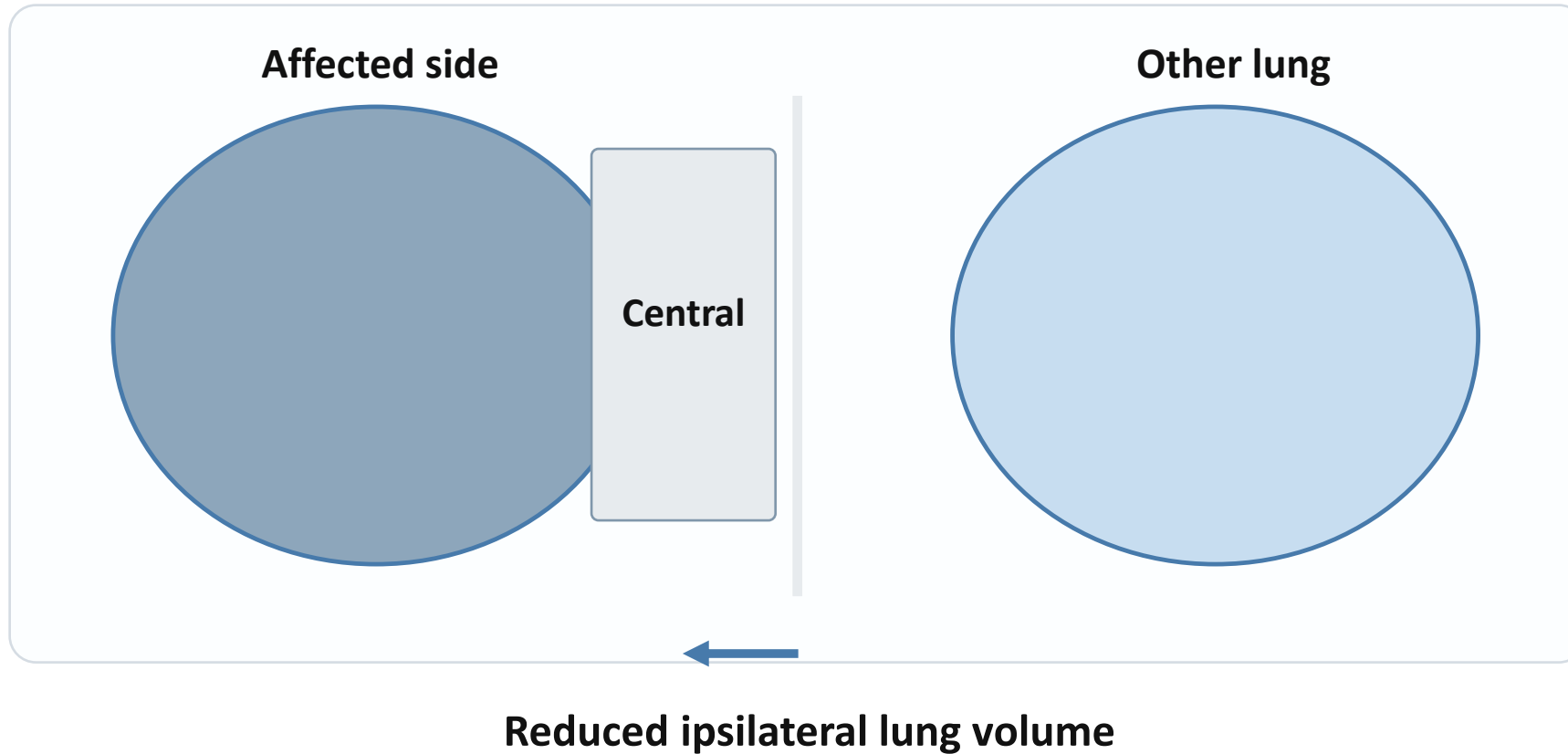
MECHANISM OVER TIME

- Obstruction occurs before the alveoli are fully airless.
- The distal gas pool diminishes as air is resorbed.
- The territory then becomes collapsed and poorly aerated.

Atelectasis is downstream of obstruction, not synonymous with it.

Volume loss attracts the mediastinum

SCHEMATIC DIRECTION ONLY •
NOT A RADIOGRAPH



With resorption, mediastinum shifts toward the collapsed lung.

Why the mediastinum moves toward collapse

RESORPTION-SPECIFIC VOLUME LOSS

- The affected lung has lost part of its normally aerated volume.
- The ipsilateral hemithorax therefore contains less expanded lung.
- Mediastinal shift toward the atelectatic side.

The direction of shift is linked to loss of lung volume.

Mucus plugging: Prototypical obstruction

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Excess airway secretions or a
mucus plug



Immediate mechanism

Physical occlusion of a
bronchus or smaller airway



Resulting consequence

Gas resorption and distal
collapse

Excessive secretions among the commonest obstructive causes.

Bronchial asthma and atelectasis

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Bronchial asthma with
obstructing secretions



Immediate mechanism

Mucus or exudate obstructs
smaller bronchi



Resulting consequence

Distal resorption atelectasis

A listed clinical setting is not proof of collapse in every individual episode.

Chronic bronchitis and atelectasis

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Chronic bronchitis with
excessive secretions



Immediate mechanism

Intraluminal secretions
obstruct distal air delivery



Resulting consequence

Collapse of downstream
lung units

The causal link is retained secretions and obstruction.

Bronchiectasis and atelectasis

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Bronchiectasis with luminal
secretions



Immediate mechanism

Mucus or exudate obstructs
an airway segment



Resulting consequence

Poorly aerated parenchyma
beyond blockage

An airway disease can coexist with the mechanical process of resorption.

Postoperative resorption atelectasis

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Postoperative airway
secretions or mucus plug



Immediate mechanism

An obstructed airway ceases
to ventilate distal units



Resulting consequence

Distal volume loss after
resorption

Robbins explicitly identifies postoperative states among the settings for mucus plugging.

Exudates can obstruct smaller bronchi

ENDOBONCHIAL MATERIAL

- Obstruction need not be a solid object.
- Exudate occupying an airway lumen can block air delivery.
- Downstream gas resorption leads to reduced aeration.

The mechanism depends on luminal obstruction, not the label applied to the material.

Aspirated foreign body

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Aspirated material lodged
within an airway



Immediate mechanism

Mechanical endobronchial
obstruction



Resulting consequence

Resorption of distal gas and
collapse

Follow the sequence from lodged object to distal loss of aeration.

Intrabronchial tumor

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

A mass situated inside an
airway



Immediate mechanism

Tumor blocks air passage
through the bronchial lumen



Resulting consequence

Collapse of lung
downstream of the
obstructed airway

This is airway-obstructive atelectasis, not pleural compression.

Resorption: Classify the obstructing material

SOURCE-DERIVED CONCEPTUAL
REASONING, NOT A VALIDATED
DIAGNOSTIC RULE

What prevents the lung from inflating?

```
graph TD; A[What prevents the lung from inflating?] --> B[Secretions]; A --> C[Other luminal material]; A --> D[Mass in airway]; B --> E[Mucus plugs in airway disease / postoperative state]; C --> F[Exudate or aspirated foreign body]; D --> G[Intrabronchial tumor causing blockage];
```

Secretions

Mucus plugs in airway disease /
postoperative state

Other luminal material

Exudate or aspirated foreign
body

Mass in airway

Intrabronchial tumor causing
blockage

Different lesions share the same distal resorption mechanism.

Application: A postoperative mucus plug

HYPOTHETICAL CLINICAL APPLICATION

An adult develops reduced aeration after surgery; An airway is blocked by mucus.

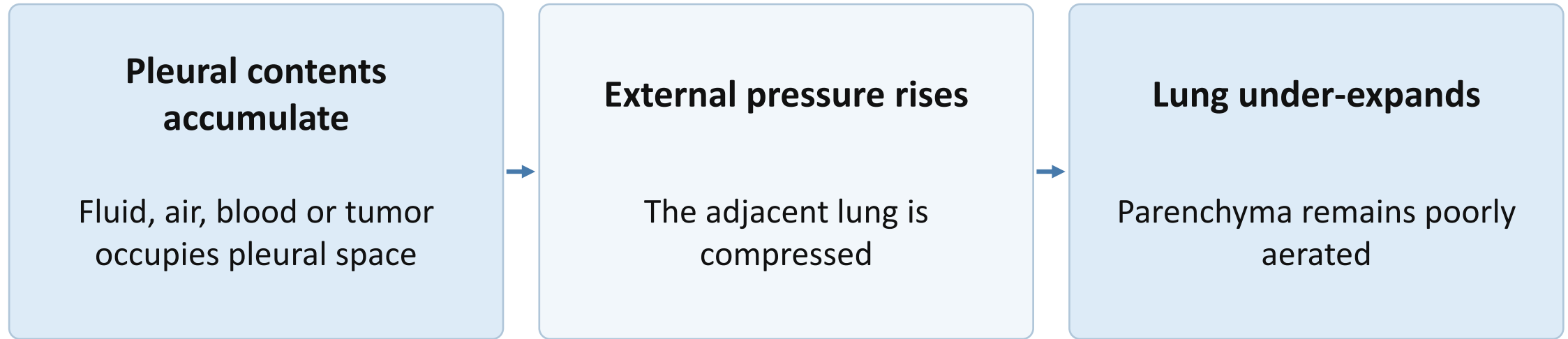
FIND THE MECHANISM

- The lesion is intraluminal.
- Distal air is no longer replaced.

Answer: Resorption atelectasis

Obstruction precedes gas resorption and distal collapse.

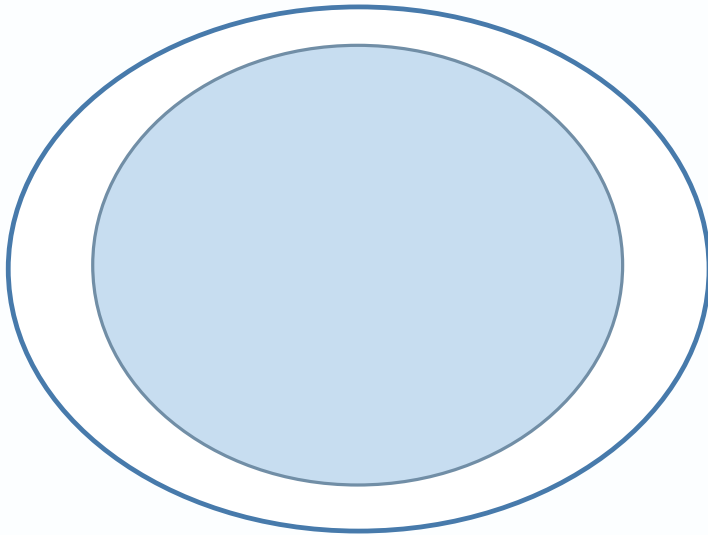
Compression atelectasis: Causal chain



Unlike resorption, the initiating problem lies outside the airway.

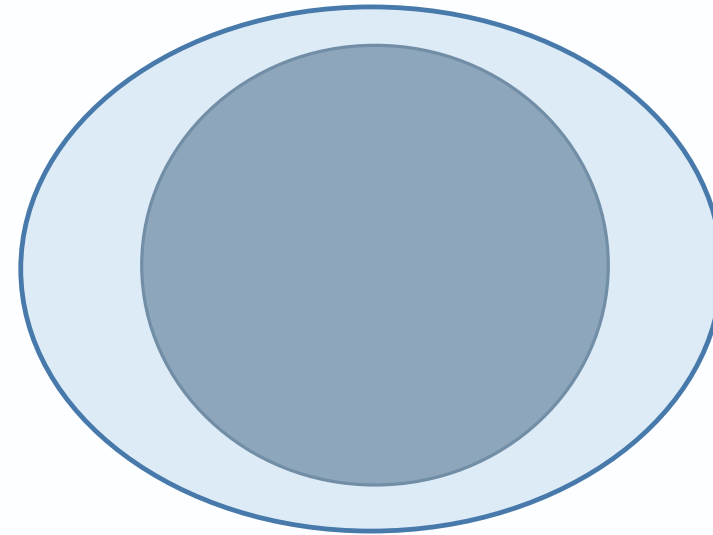
Pleural space occupancy limits expansion

Baseline



Uncompressed lung

Compression



Pleural material + smaller lung

Space-occupying pleural contents mechanically restrict expansion of adjacent lung.

Compression is external to the airways

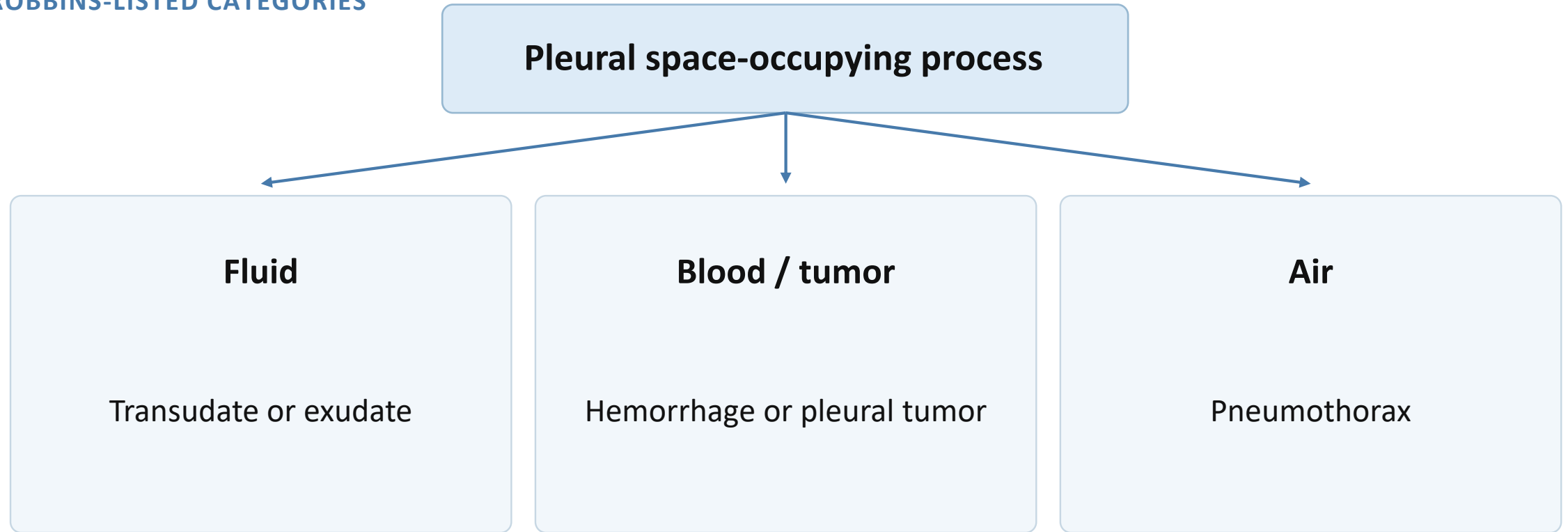
LOCATION MATTERS

- The collection occupies the pleural cavity.
- The lung is physically crowded or compressed by the collection.
- The end result is incomplete inflation of adjacent parenchyma.

Compression is defined by the pleural compartment.

Pleural collections responsible for compression

ROBBINS-LISTED CATEGORIES



The categories are mechanistic: The location and nature of the barrier differ.

Pleural transudate

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Significant transudative fluid
in pleural cavity



Immediate mechanism

Pleural fluid occupies space
and compresses lung



Resulting consequence

Compression atelectasis

The composition of the fluid differs; The mechanical result is compression.

Pleural exudate

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Significant exudative fluid in
pleural cavity



Immediate mechanism

Pleural fluid externally
restricts lung inflation



Resulting consequence

Compression atelectasis

Transudate and exudate can produce the same mechanical end point.

Pleural blood

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Significant pleural blood
accumulation



Immediate mechanism

The expanding collection
displaces/compresses lung



Resulting consequence

Compression atelectasis

Blood is explicitly included alongside other pleural collections.

Tumor within the pleural cavity

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Pleural cavity occupied by
tumor



Immediate mechanism

Space-occupying tissue
mechanically compresses
lung



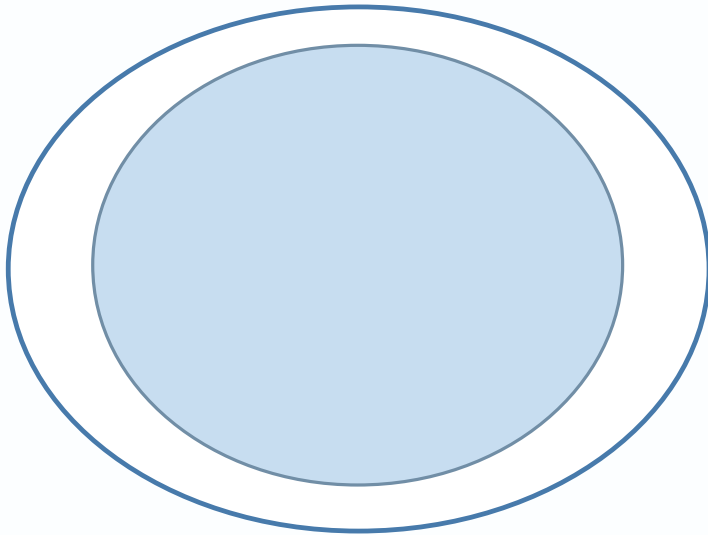
Resulting consequence

Incompletely inflated
adjacent lung

Distinguish a pleural-space lesion from an intrabronchial tumor.

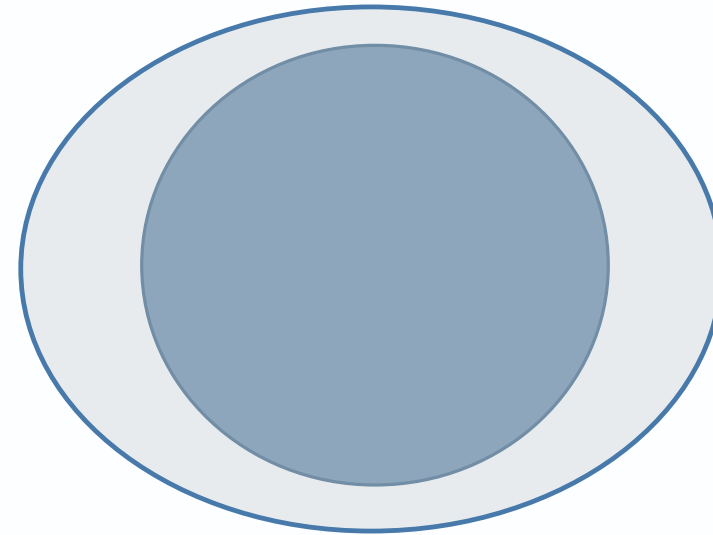
Pneumothorax causes compression

Baseline



Uncompressed lung

Compression



Pleural air + smaller lung

Space-occupying pleural contents mechanically restrict expansion of adjacent lung.

Pneumothorax: Pleural air

CAUSE → AIRWAY / PLEURAL /
FIBROTIC LESION → COLLAPSE

Initiating condition

Air accumulated within the
pleural cavity



Immediate mechanism

Pleural air prevents normal
inflation of adjacent lung



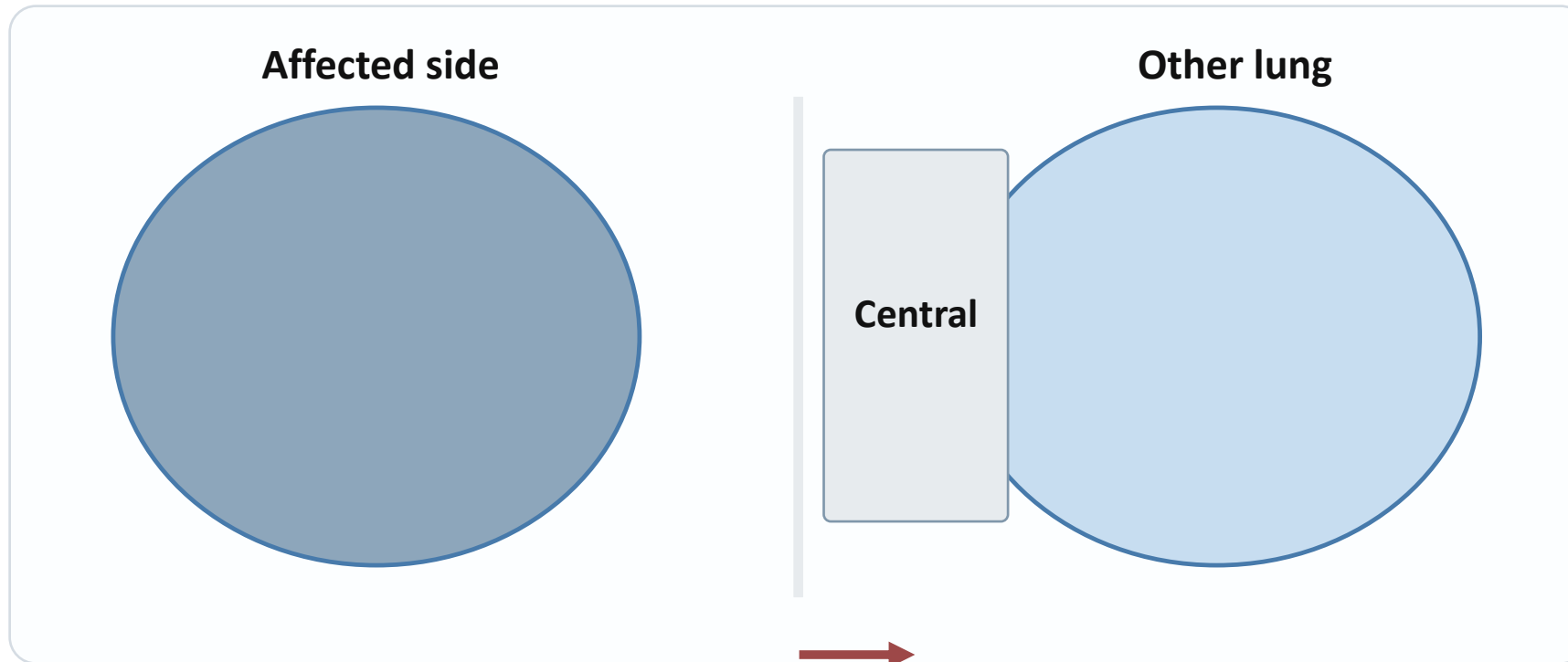
Resulting consequence

Compression and poor
aeration

Pleural air and an airway plug belong to different categories.

Mediastinal shift in compression

SCHEMATIC DIRECTION ONLY •
NOT A RADIOGRAPH



Pleural contents exert displacement

With compression, mediastinum shifts away from the affected lung.

Application: Fluid in the pleural cavity

HYPOTHETICAL CLINICAL APPLICATION

A large pleural fluid collection compresses one lung and the mediastinum is displaced contralaterally.

FIND THE MECHANISM

- The initiating abnormality lies in the pleural cavity.
- The lung is externally compressed.

Answer: Compression atelectasis

Pleural compression with a shift away.

Application: Pleural air

HYPOTHETICAL CLINICAL APPLICATION

A pneumothorax occupies pleural space and restricts the neighboring lung.

FIND THE MECHANISM

- Air is outside the lung parenchyma.
- The problem is pressure/space, not distal gas resorption.

Answer: Compression atelectasis

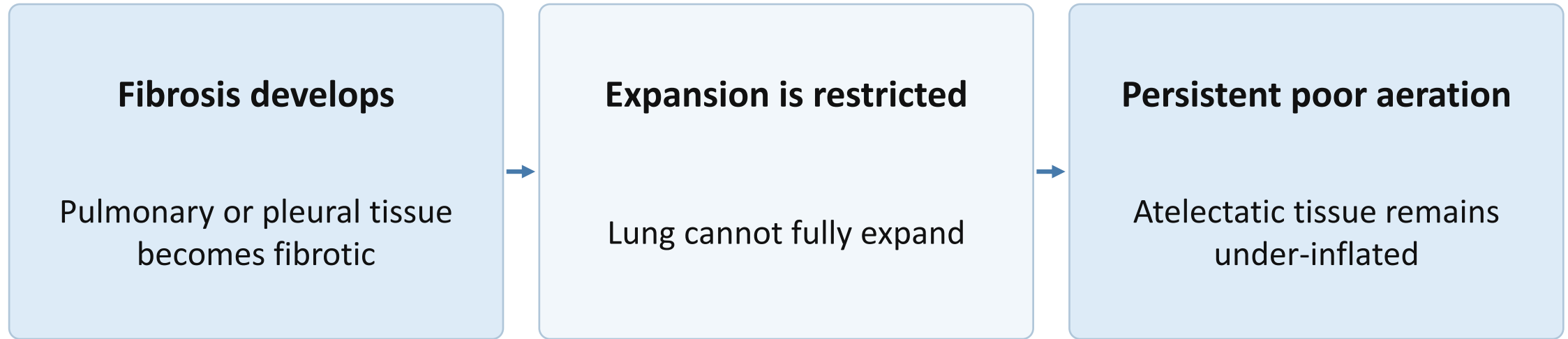
The pleural location determines the mechanistic category.

Same collapse; Different intrathoracic source

Question	Mucus plug	Pleural collection
Origin	Inside airway	Inside pleural cavity
Mechanism	Distal gas resorption	External lung compression
Shift in source	Toward lesion	Away from affected lung

Identify where the initial lesion is located before naming the mechanism.

Contraction atelectasis: Causal chain



Fibrotic contraction is the important exception to usual reversibility.

Pulmonary fibrosis restricts inflation

CONTRACTION MECHANISM WITHIN LUNG

- Fibrosis can involve the pulmonary parenchyma.
- Fibrotic restriction prevents full lung expansion.
- The resulting atelectasis is not simply gas loss after an airway plug.

An intrinsic structural restriction distinguishes contraction.

Pleural fibrosis restricts inflation

CONTRACTION MECHANISM INVOLVING PLEURA

- The pleural surface may be fibrotic.
- Restricted expansion prevents the lung from attaining full volume.
- The mechanism is fibrosis, not a freely space-occupying pleural collection.

Fibrosis of lung or pleura can cause contraction atelectasis.

Fibrotic contraction versus pleural compression

Feature	Contraction	Compression
Primary abnormality	Fibrosis	Pleural space contents
Physical effect	Lung cannot fully expand	Lung is externally compressed
General reversibility	Fibrotic exception	Reversible unless another fixed lesion

Fibrosis is a lasting structural impediment; Pleural compression is space occupation.

Application: Pleural fibrosis

HYPOTHETICAL CLINICAL APPLICATION

An individual has impaired lung inflation associated with pleural fibrosis.

FIND THE MECHANISM

- The lesion is fibrotic.
- No airway plug or free pleural collection is required.

Answer: Contraction atelectasis

Fibrosis prevents full lung expansion.

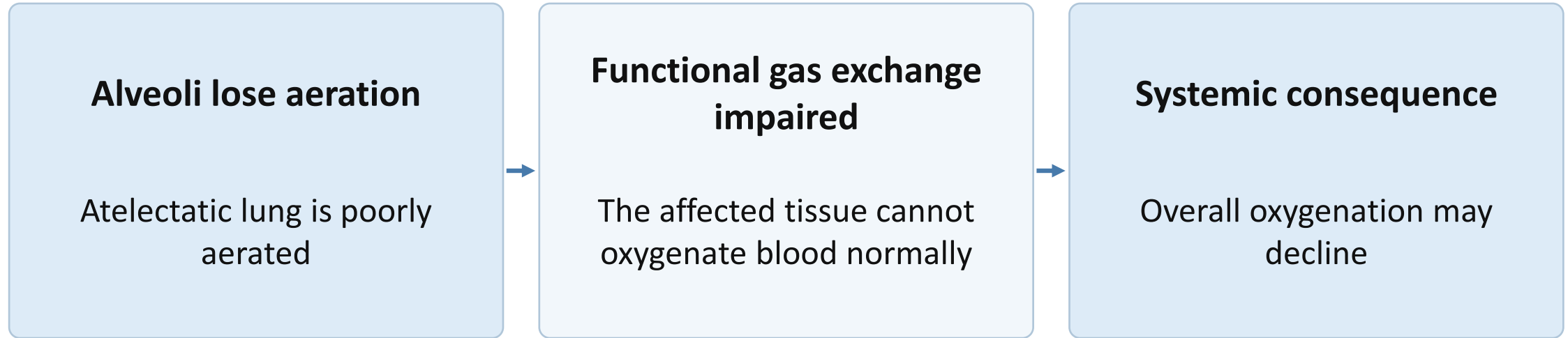
Reversibility depends on the mechanism

PRINCIPLE STATED

- Atelectasis is generally a reversible condition.
- Fibrotic contraction is the stated exception.
- Identifying an underlying cause matters for anticipating reversibility.

Collapse due to fibrosis is not expected to behave like transient obstruction.

Why oxygenation falls in significant collapse



Significant atelectasis reduces oxygenation.

Collapse predisposes to infection

CLINICAL CONSEQUENCE

- Poorly aerated pulmonary regions are more vulnerable to infection.
- The association becomes important when the area of atelectasis is significant.
- Infection risk is a consequence, not a fourth atelectasis type.

Infection susceptibility alongside reduced oxygenation.

Two consequences; One underlying collapse

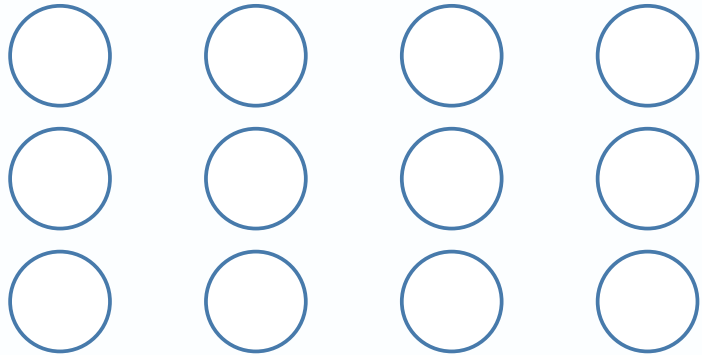
Consequence	Immediate interpretation	Lecture significance
Reduced oxygenation	Less effectively aerated lung	Physiologic impairment
Predisposition to infection	Affected lung is vulnerable	Complication risk

The primary classification concerns cause; The clinical effects concern function.

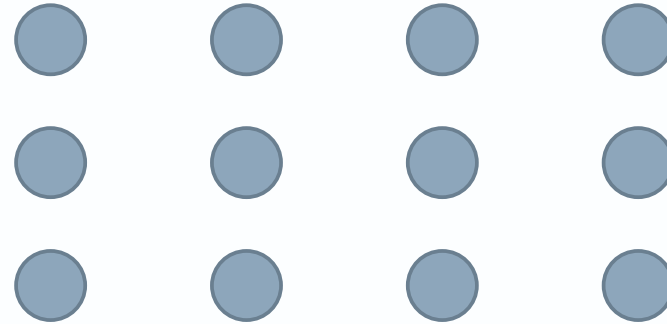
Structural correlate: Loss of aerated air spaces

SCHEMATIC • CONCEPTUAL AIR SPACES, NOT HISTOLOGY

Normally aerated parenchyma



Atelectatic parenchyma



Reduced air content → poorly aerated lung parenchyma; Schematic circles are not a photomicrograph.

A mechanism-first interpretation table

Mechanism	First lesion	Distal or lung effect
Resorption	Airway occlusion	Gas absorption; Collapse
Compression	Pleural air/fluid/blood/tumor	Mechanical under-inflation
Contraction	Pulmonary/pleural fibrosis	Full inflation prevented

This is a causal classification rather than a grading scheme.

A conceptual approach to an atelectatic lung

SOURCE-DERIVED CONCEPTUAL
REASONING, NOT A VALIDATED
DIAGNOSTIC RULE

What prevents the lung from inflating?

```
graph TD; A[What prevents the lung from inflating?] --> B[Airway obstruction?]; A --> C[Pleural collection?]; A --> D[Fibrotic restriction?]; B --> B1[Secretions, exudate, foreign body, airway tumor]; C --> C1[Fluid, tumor, blood, pneumothorax]; D --> D1[Pulmonary or pleural fibrosis];
```

Airway obstruction?

Secretions, exudate, foreign
body, airway tumor

Pleural collection?

Fluid, tumor, blood,
pneumothorax

Fibrotic restriction?

Pulmonary or pleural fibrosis

This teaching decision map is not a validated clinical diagnostic algorithm.

Distinguish three different anatomic compartments

IDENTIFY THE FIRST ABNORMAL STRUCTURE

- Airway lumen: Obstruction causes resorption.
- Pleural cavity: Space-occupying contents cause compression.
- Pulmonary/pleural tissue: Fibrosis causes contraction.

Compartment determines the mechanism and the natural explanation of collapse.

Which type is expected to reverse?

Mechanism	Robbins reversibility principle	Reason
Resorption	Generally reversible	An obstructive mechanism, not fibrosis
Compression	Generally reversible	External space occupancy
Contraction	Exception	Fibrosis limits expansion

Do not overpromise reversibility in an individual patient without etiologic assessment.

Mediastinal shift: Use the mechanism

COMPARATIVE SPATIAL REASONING

- Resorption: Volume loss draws the mediastinum toward the affected lung.
- Compression: Pleural space-occupying contents displace the mediastinum away.
- Contraction: Robbins provides no separate direction-of-shift rule.

Avoid assigning a shift direction where the supplied source is silent.

Application: Intrabronchial mass versus pleural tumor

HYPOTHETICAL CLINICAL APPLICATION

Two patients have poorly aerated lung. One has a tumor within a bronchus; The other has tumor in pleural space.

FIND THE MECHANISM

- Airway mass interrupts distal airflow.
- Pleural mass occupies space outside the lung.

Answer: Resorption in the first; Compression in the second

Tumor location, not merely tumor presence, determines the category.

Application: Blood versus exudate

HYPOTHETICAL CLINICAL APPLICATION

Two pleural cavities contain significant collections: One blood, the other exudate.

FIND THE MECHANISM

- Both collections occupy the pleural cavity.
- Both restrict expansion by the same broad mechanical route.

Answer: Compression in both settings

Fluid identity differs, but the mechanism is external compression.

Application: Asthma and secretions

HYPOTHETICAL CLINICAL APPLICATION

A patient with bronchial asthma develops an obstructing mucus plug.

FIND THE MECHANISM

- The plug sits within a bronchus.
- Gas within alveoli beyond obstruction is absorbed.

Answer: Resorption atelectasis

Asthma is a source-listed setting for an obstructive cause.

Application: Chronic bronchitis versus fibrosis

HYPOTHETICAL CLINICAL APPLICATION

Patient A has chronic bronchitis with obstructing secretions; Patient B has pulmonary fibrosis preventing inflation.

FIND THE MECHANISM

- A: The lumen is blocked.
- B: Tissue expansion is restricted.

Answer: A: Resorption; B: Contraction

The two conditions impair inflation by different starting events.

Application: Three mechanisms, three lesions

HYPOTHETICAL CLINICAL APPLICATION

A clinical teaching set includes an aspirated foreign body, a pneumothorax and pulmonary fibrosis.

FIND THE MECHANISM

- Foreign body obstructs an airway.
- Pneumothorax occupies pleural space.
- Fibrosis restricts full lung expansion.

Answer: Resorption; Compression; Contraction

Classify by the initiating pathoanatomic lesion.

Mechanism checkpoint

Given clue	Correct type	Why
Distal lung behind a mucus plug	Resorption	Airway obstruction
Lung compressed by pleural blood	Compression	Pleural contents
Inadequate inflation with fibrosis	Contraction	Restricted expansion

Correct classification requires a causal explanation, not memorizing a label.

Atelectasis: Essential cause–effect links

SYNTHESIS

- Blocked airway → distal air resorption → reduced lung volume.
- Pleural material or air → compression → impaired inflation.
- Pulmonary/pleural fibrosis → contraction → restricted expansion.

All three ultimately produce poorly aerated parenchyma.

Atelectasis: Clinical relevance

SYNTHESIS

- Significant collapse lowers oxygenation.
- Affected lung becomes predisposed to infection.
- Nonfibrotic atelectasis is usually reversible.

The cause determines both the mechanics and likely reversibility.

References and source limitations

Primary source

Robbins, Cotran & Kumar: Pathologic Basis of Disease. 11th ed. (2026). Chapter 15, “The Lung”; “Atelectasis (Collapse),” p. 614.

Scope and limitations

- Case vignettes and diagrams are original teaching schematics, not clinical evidence.
- The provided excerpt does not include usable authentic microscopy or radiology images.
- No external clinical guideline or quantitative evidence is claimed.