

Carcinoid Tumors

Pulmonary neuroendocrine neoplasms

Morphology • Grading • Clinical consequences

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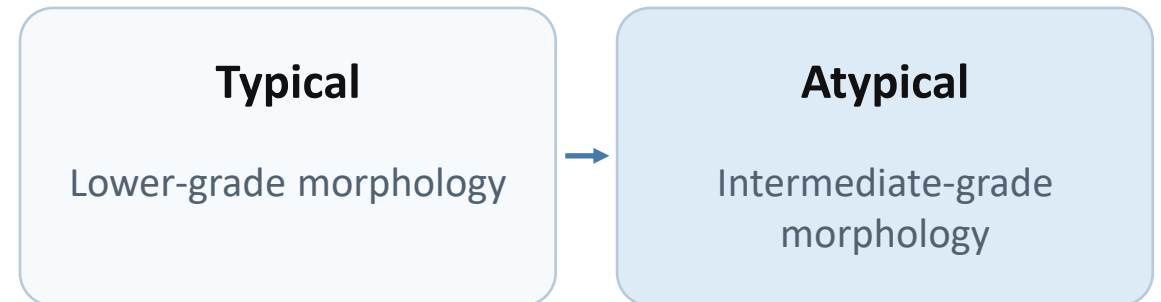
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Learning objectives

- Place pulmonary carcinoids within the neuroendocrine spectrum of lung lesions.
- Recognize characteristic gross and microscopic growth patterns.
- Apply Robbins morphologic criteria for typical versus atypical carcinoids.
- Explain how bronchial obstruction, secretory activity, and tumor spread shape clinical findings.

Normal pulmonary neuroendocrine cells

- Normal airway epithelium contains scattered neuroendocrine cells.
- These cells may occur singly or in clusters termed neuroepithelial bodies.
- This cell lineage provides the background for the pulmonary neuroendocrine spectrum.



Reactive neuroendocrine cell hyperplasia

- Most pulmonary neuroendocrine hyperplasias accompany airway fibrosis or inflammation.
- Their association with damaged airways distinguishes reactive proliferation from an independent neoplasm.
- Do not automatically classify every neuroendocrine cell cluster as a carcinoid tumor.

Clinicopathologic interpretation

The surrounding airway pathology is part of the interpretation: Inflammatory scarring is a common setting for reactive hyperplasia.

Diffuse idiopathic hyperplasia: The exception

- Diffuse idiopathic pulmonary neuroendocrine cell hyperplasia is rare.
- Unlike most hyperplasias, it occurs without an inflammatory stimulus.
- This as an exception to the usual reactive setting.

Clinicopathologic interpretation

“Idiopathic” identifies the absence of a recognized inflammatory trigger in the supplied source, not a molecular cause.

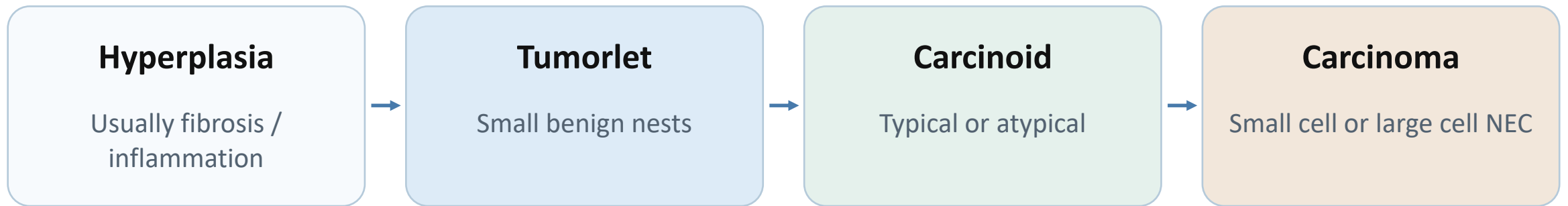
Tumorlets: The benign end of the spectrum

- Tumorlets are small nests of pulmonary neuroendocrine cells.
- They are usually encountered with scarring or chronic inflammation.
- These as benign and inconsequential compared with malignant neuroendocrine tumors.

Clinicopathologic interpretation

Site, extent, and tissue context separate a small benign tumorlet from a clinically significant pulmonary mass.

Pulmonary neuroendocrine spectrum



The entities belong to one cellular lineage but differ markedly in clinicopathologic behavior.

Why carcinoids form a separate category

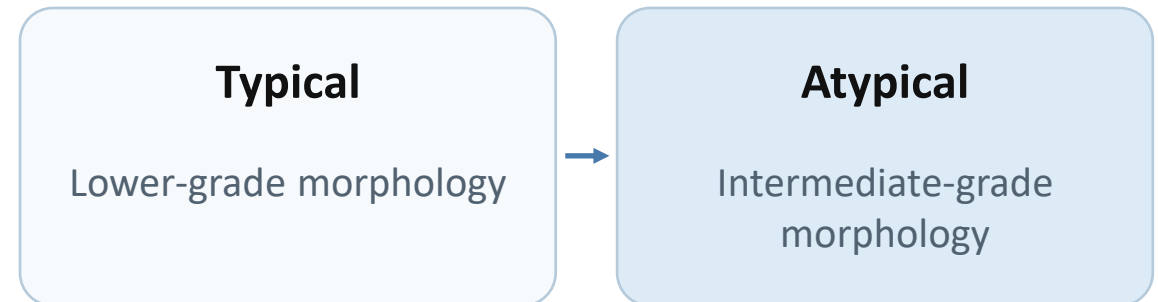
- Carcinoids are distinguished from highly aggressive pulmonary neuroendocrine carcinomas.
- They differ in incidence, clinical and epidemiologic behavior, histology, and molecular characteristics.
- A shared neuroendocrine phenotype does not imply equivalent clinical aggressiveness.

Clinicopathologic interpretation

Neuroendocrine differentiation is a lineage feature; Malignant potential and grade require separate assessment.

Definition: Pulmonary carcinoid tumor

- A pulmonary carcinoid is a low-grade malignant epithelial neoplasm with neuroendocrine differentiation.
- It is subdivided into typical and atypical carcinoids.
- The word “malignant” recognizes the potential for local invasion and metastasis even when the course is indolent.



Frequency within lung neoplasms

- Carcinoids as 1%–5% of all lung tumors.
- They are less common than conventional bronchogenic carcinomas.
- The proportion is a descriptive textbook estimate, not a patient-level probability.

Clinicopathologic interpretation

Reported textbook frequency: 1%–5% of lung tumors. Denominator is all lung tumors; No registry year or method is specified.

Age and sex distribution

- Most affected patients are younger than 60 years.
- Incidence is approximately equal in both sexes in the Robbins description.
- Neither age nor sex establishes the diagnosis without morphology.

Clinicopathologic interpretation

Demographic trends contextualize a clinical presentation, but do not substitute for histologic classification.

Smoking exposure is not universal

- Approximately 20%–40% of patients in the cited source are nonsmokers.
- Pulmonary carcinoids therefore must not be dismissed solely because tobacco exposure is absent.
- The textbook passage does not define a smoking-related molecular pathway.

Clinicopathologic interpretation

History is supportive contextual information—not a prerequisite for identifying a carcinoid.

Two anatomic settings

- Carcinoids may arise in central conducting bronchi or more peripherally.
- Central lesions commonly project into the bronchial lumen.
- Peripheral lesions are more often solid nodules.

Location

Central or peripheral

Appearance

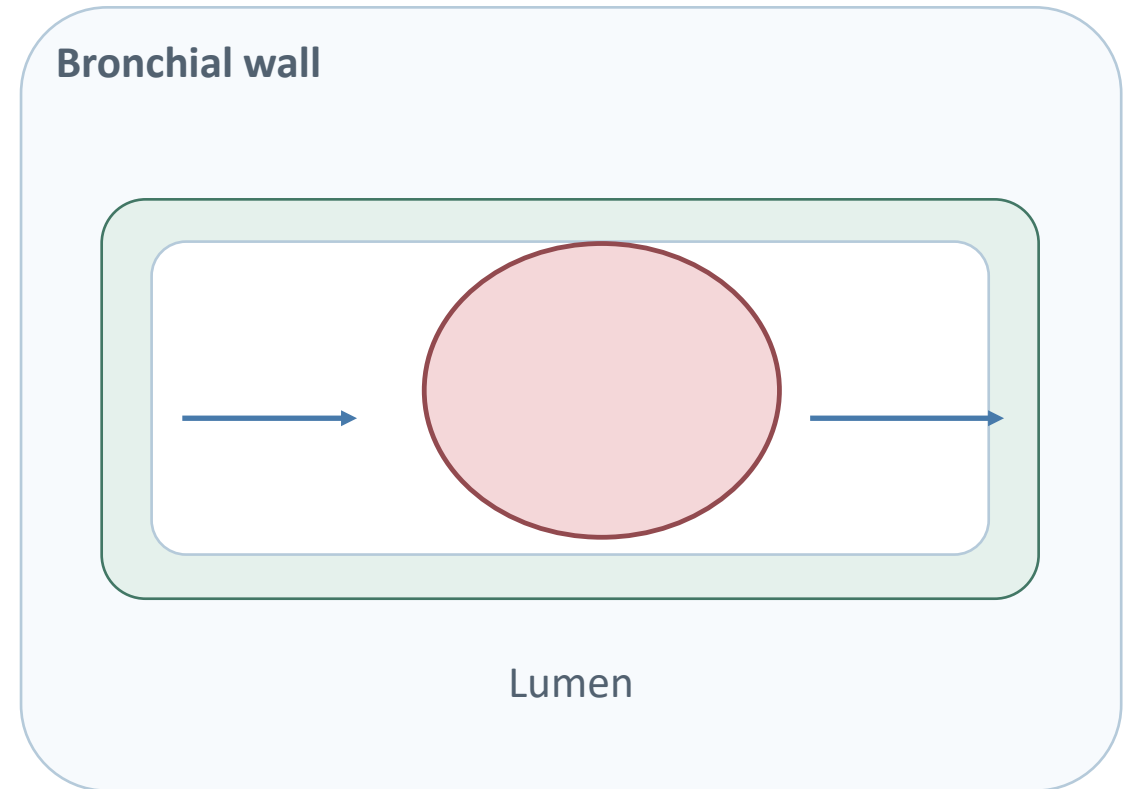
Polypoid or nodular

Consequence

Obstruction or incidental lesion

Central tumors: Polypoid growth

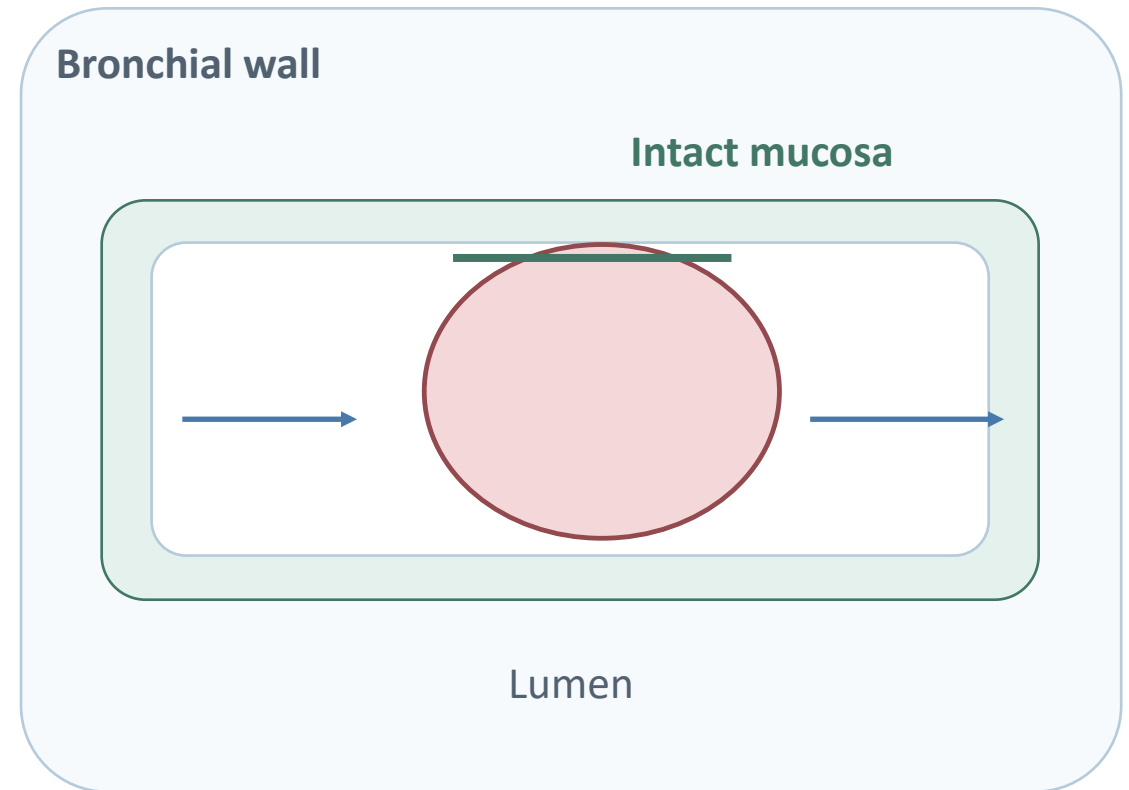
- Central bronchial carcinoids form finger-like or spherical polypoid masses.
- They project into the lumen and may narrow the airway.
- A gross description should capture the endobronchial component and any wall extension.



Schematic — conceptual, not a specimen

Why the overlying mucosa matters

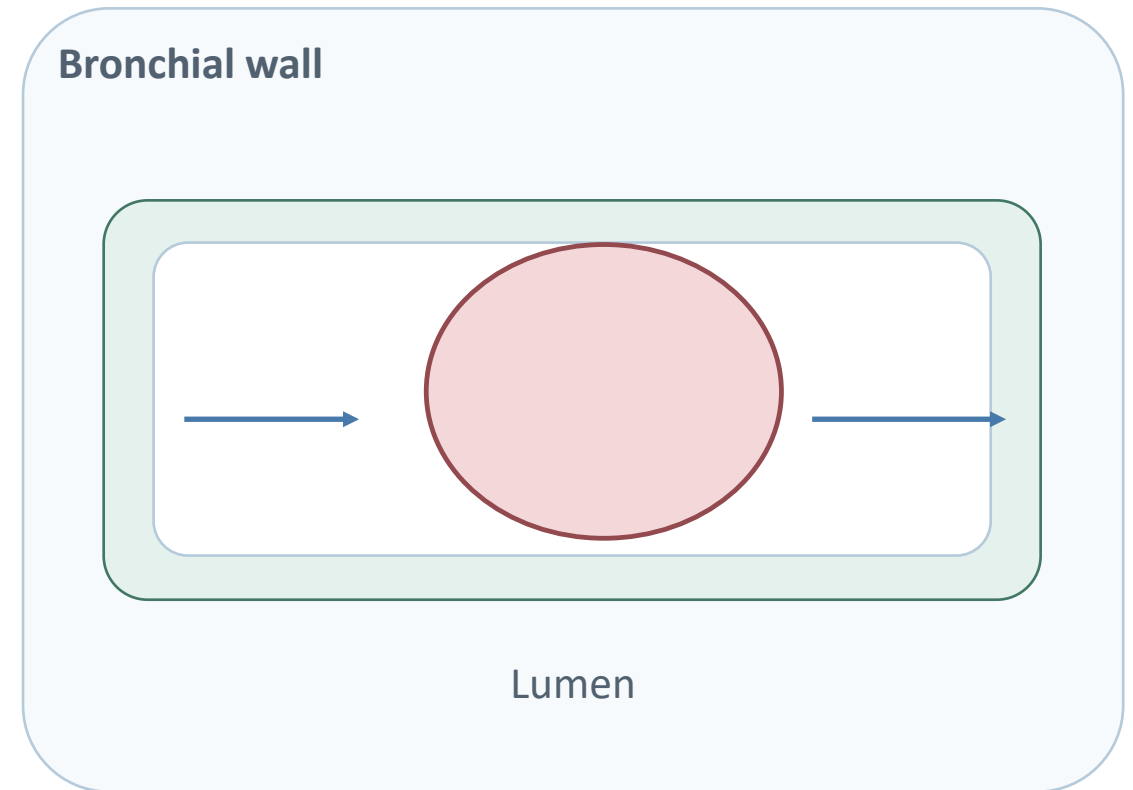
- The mucosal covering is commonly intact, despite the underlying tumor mass.
- A smooth surface does not exclude an epithelial neoplasm.
- This distinction is important when linking bronchoscopic appearance to histology.



Schematic — conceptual, not a specimen

Mainstem bronchial location

- Most centrally situated lesions are confined to mainstem bronchi.
- A centrally positioned mass is especially capable of obstructing a large airway.
- Record the relationship between the lesion and the bronchial lumen.



Schematic — conceptual, not a specimen

Gross size: A useful description

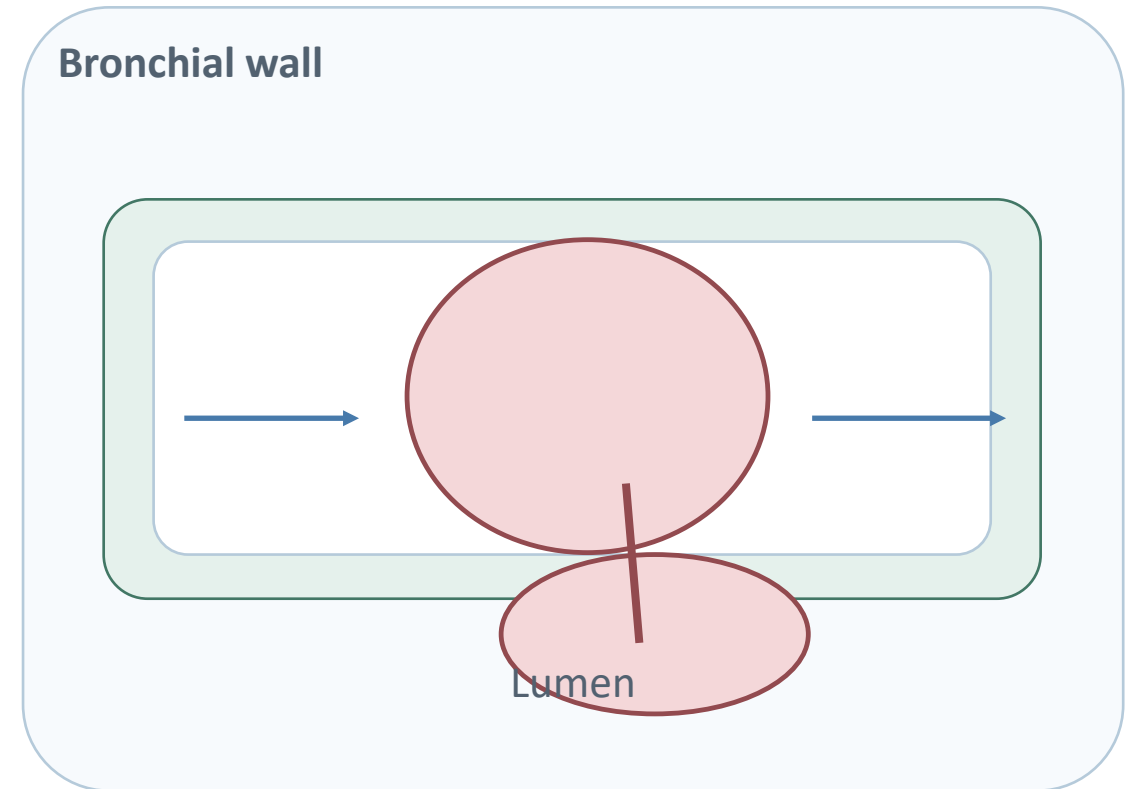
- Central carcinoids rarely exceed 3–4 cm in the Robbins description.
- Size describes the mass but does not by itself distinguish typical from atypical histology.
- Mitotic activity and necrosis remain the source-defined grading criteria.

Clinicopathologic interpretation

Do not convert this typical gross size into a diagnostic cutoff or an eligibility threshold.

Growth can cross the bronchial wall

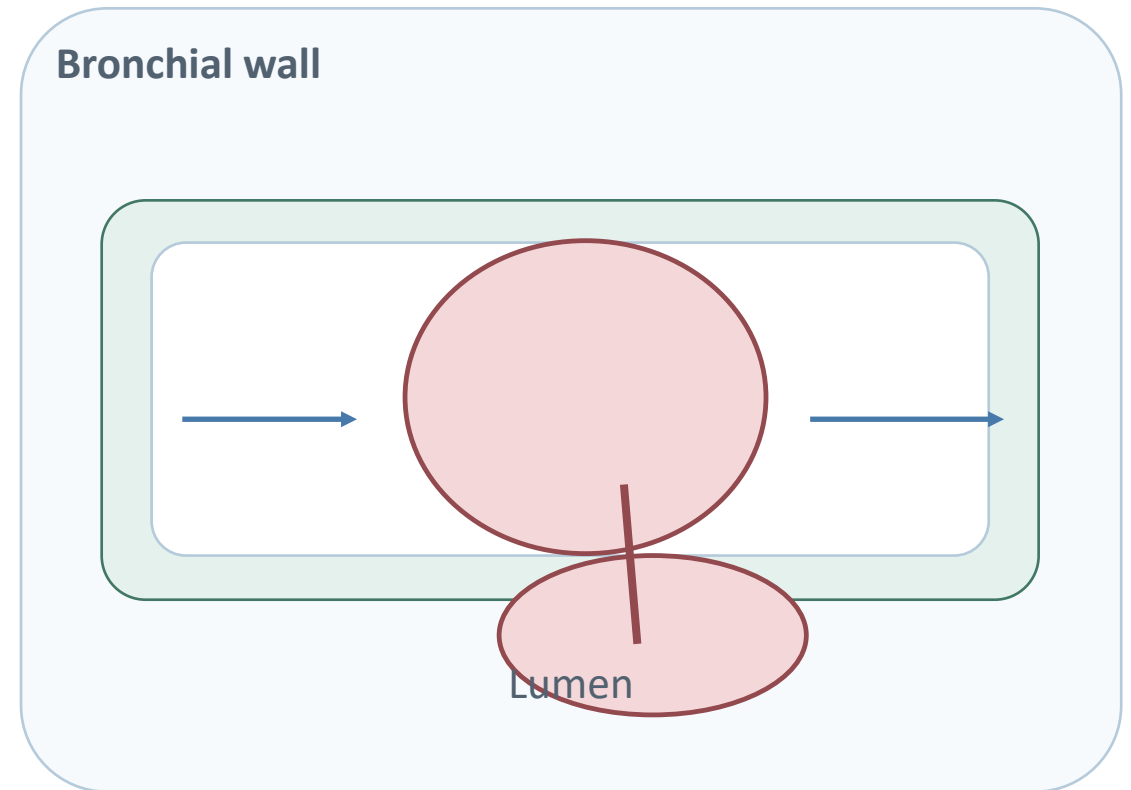
- Some lesions penetrate the bronchial wall into peribronchial tissue.
- The endobronchial and extrabronchial components may coexist.
- This explains why the full gross extent can exceed the lumen-facing polypoid portion.



Schematic — conceptual, not a specimen

Collar-button lesion

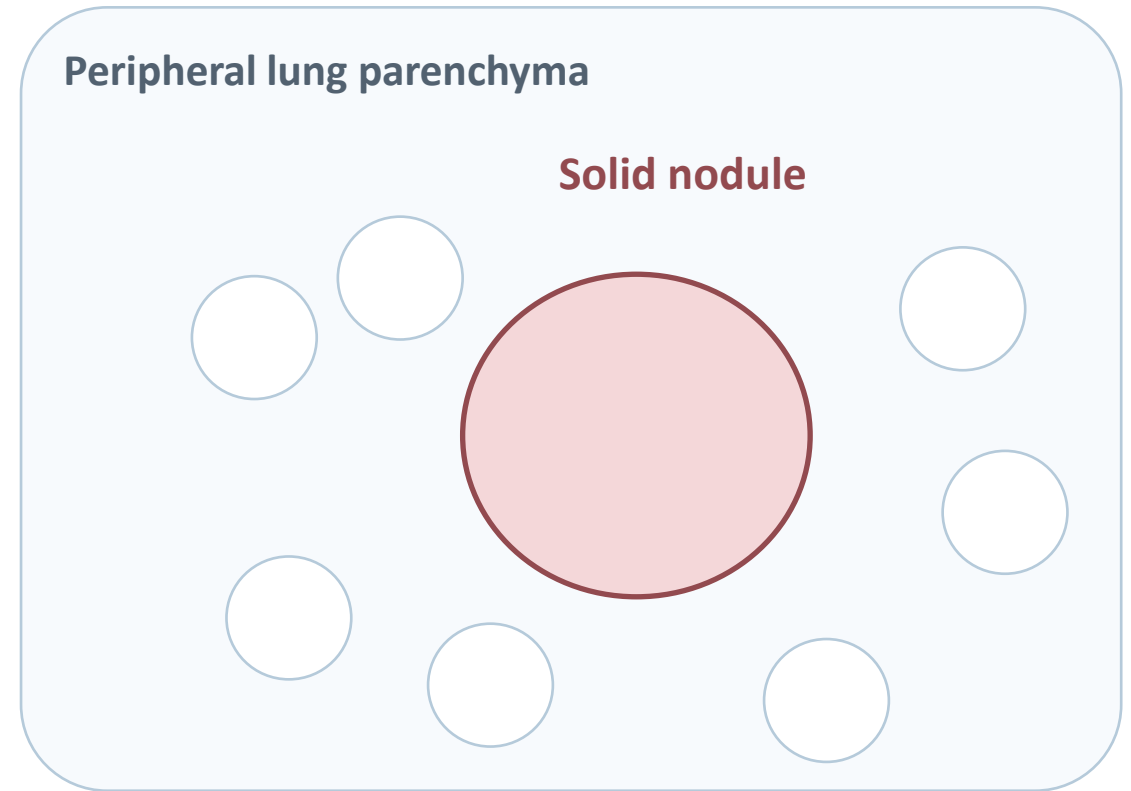
- Robbins calls a polypoid component with outward peribronchial spread a “collar-button” lesion.
- The name describes the gross shape and relationship to the bronchial wall.
- It is a configuration—not a separate carcinoid grade or molecular subtype.



Schematic — conceptual, not a specimen

Peripheral carcinoids

- Peripheral pulmonary carcinoids are described as solid, nodular masses.
- They lack the conspicuous lumen-projecting growth of central lesions.
- Central versus peripheral is an anatomic distinction, not a grading system.



Schematic — conceptual, not a specimen

Central and peripheral lesions: Gross comparison

Feature	Central bronchial lesion	Peripheral lesion
Predominant shape	Polypoid; Finger-like or spherical	Solid, nodular
Relationship to lumen	Often protrudes into a bronchus	May not be endobronchial
Typical mucosal finding	Often intact over the tumor	Not the defining feature
Functional consequence	Potential airway obstruction	Depends on location / extent

Gross assessment: What to document

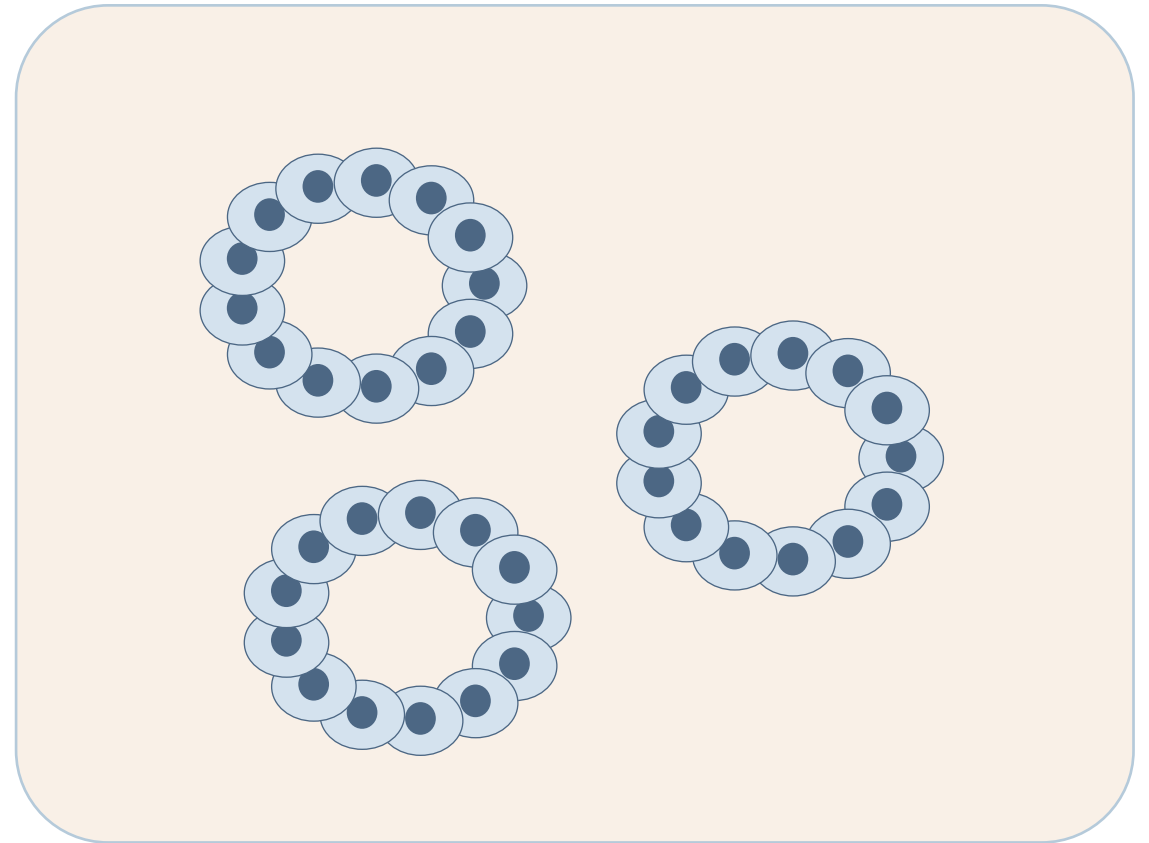
- Localize the mass as central or peripheral.
- Describe polypoid versus solid-nodular configuration.
- Record mucosal covering and extension through the bronchial wall.
- Do not assign typical/atypical status from gross appearance alone.

Clinicopathologic interpretation

Gross examination establishes location and extent; The typical–atypical distinction comes from microscopy.

Microscopy: A recognizable architecture

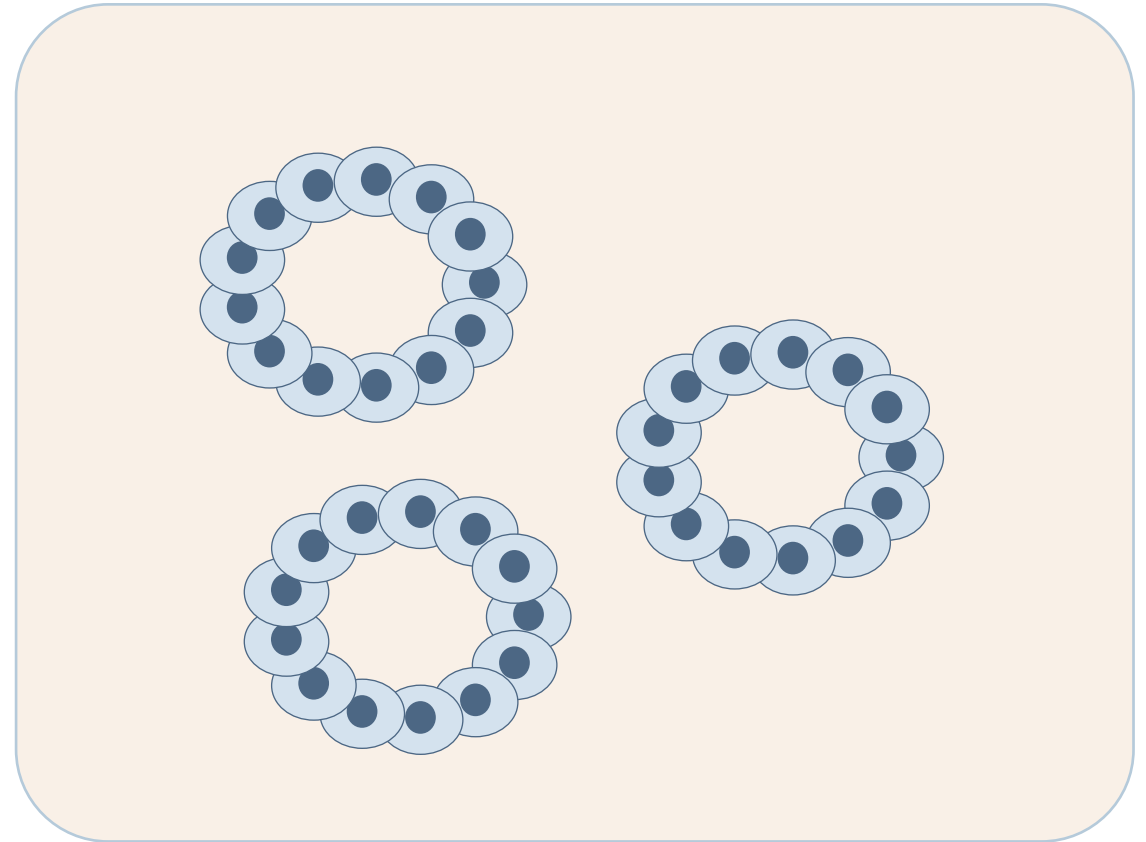
- Neoplastic cells form organoid nests, trabeculae, palisades, ribbons, and rosettes.
- These arrangements are separated by delicate fibrovascular stroma.
- A single tumor can show more than one neuroendocrine architectural pattern.



Schematic — conceptual, not a specimen

Organoid arrangement

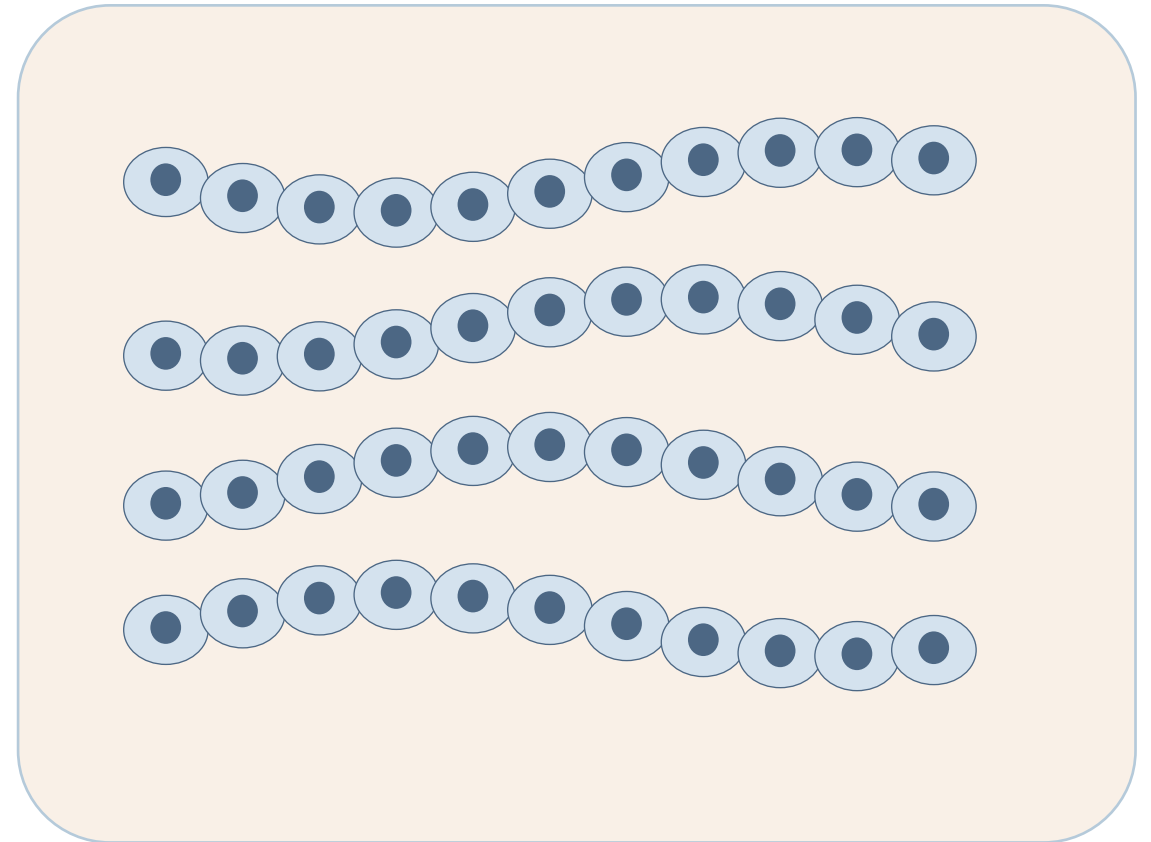
- Tumor cells are grouped in cohesive, organ-like nests.
- A fine supportive stromal network separates the nests.
- This pattern is one of several morphologies compatible with pulmonary carcinoid.



Schematic — conceptual, not a specimen

Trabecular architecture

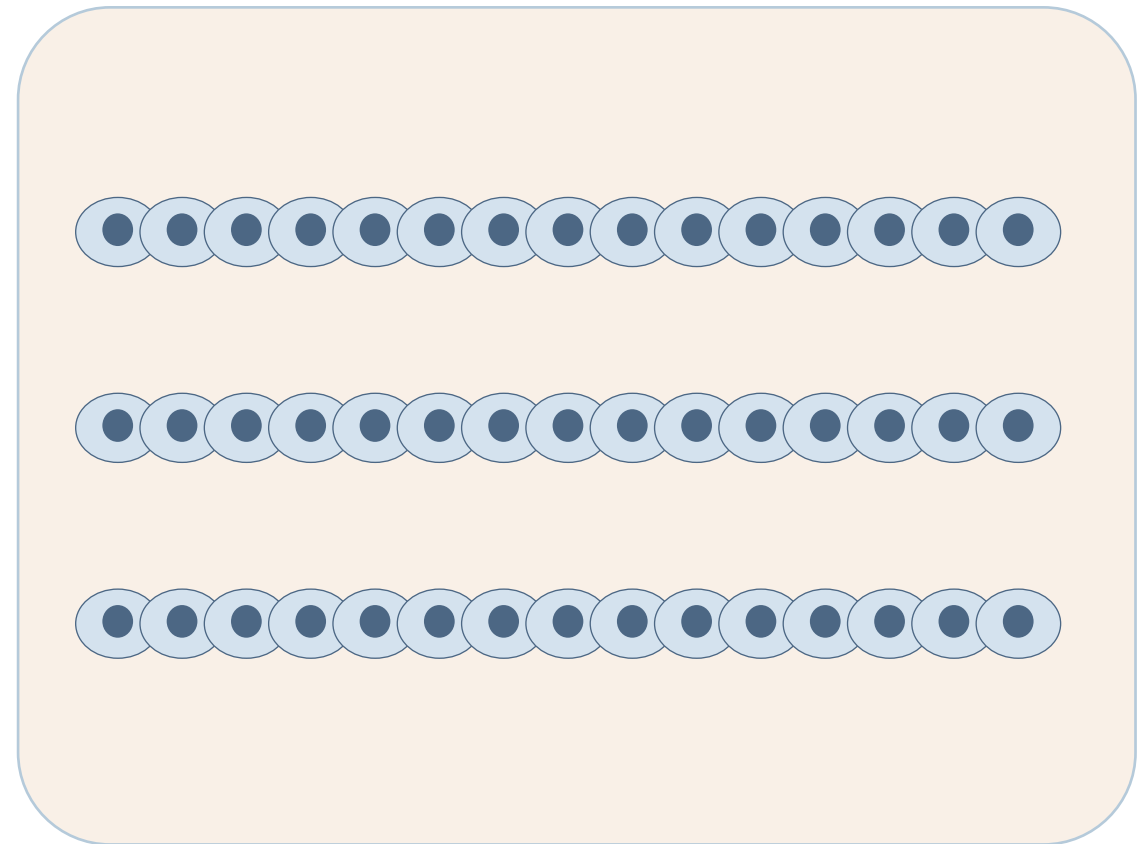
- Tumor cells may form elongated cords or trabeculae.
- Intervening fibrovascular tissue separates the cellular strands.
- Architecture suggests neuroendocrine differentiation but is not an independent grade criterion.



Schematic — conceptual, not a specimen

Palisading architecture

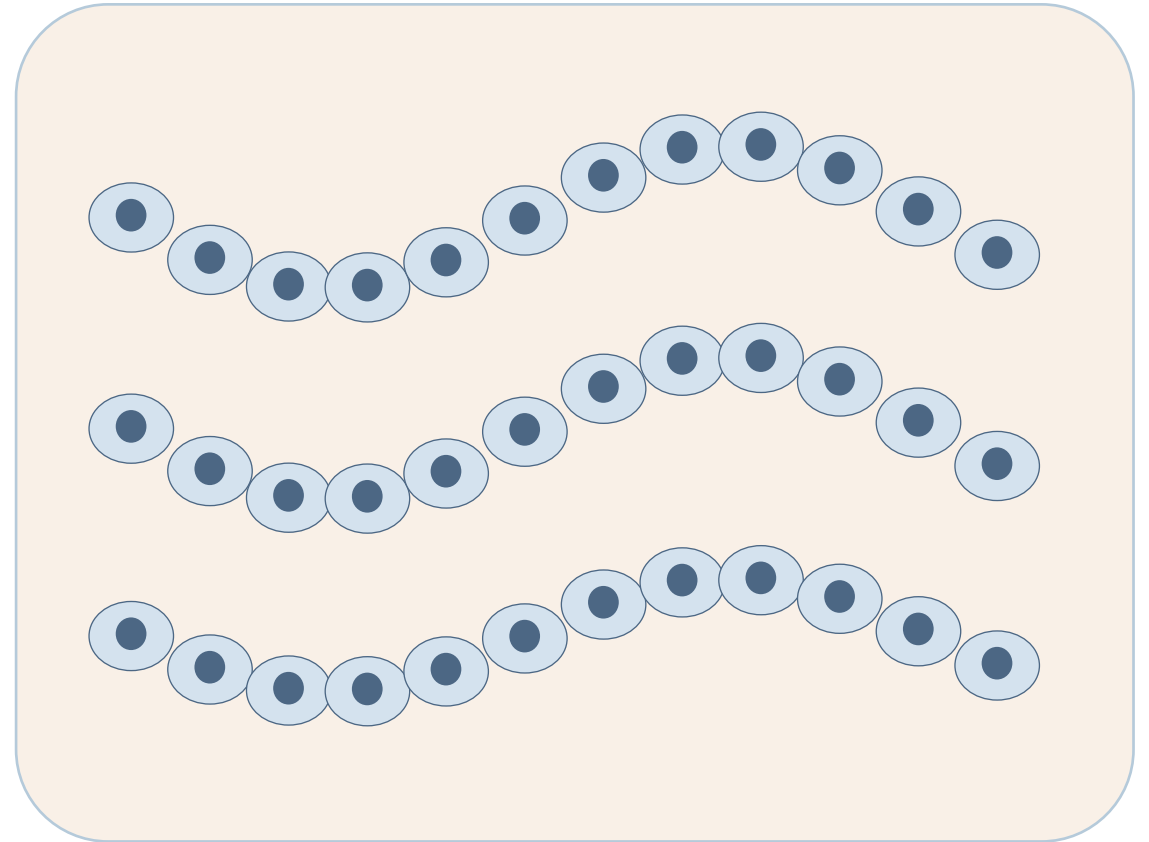
- Cells may align in palisading arrays.
- This directional organization belongs to the textbook architectural repertoire.
- Assess mitoses and necrosis independently of the attractive palisaded pattern.



Schematic — conceptual, not a specimen

Ribbon-like growth

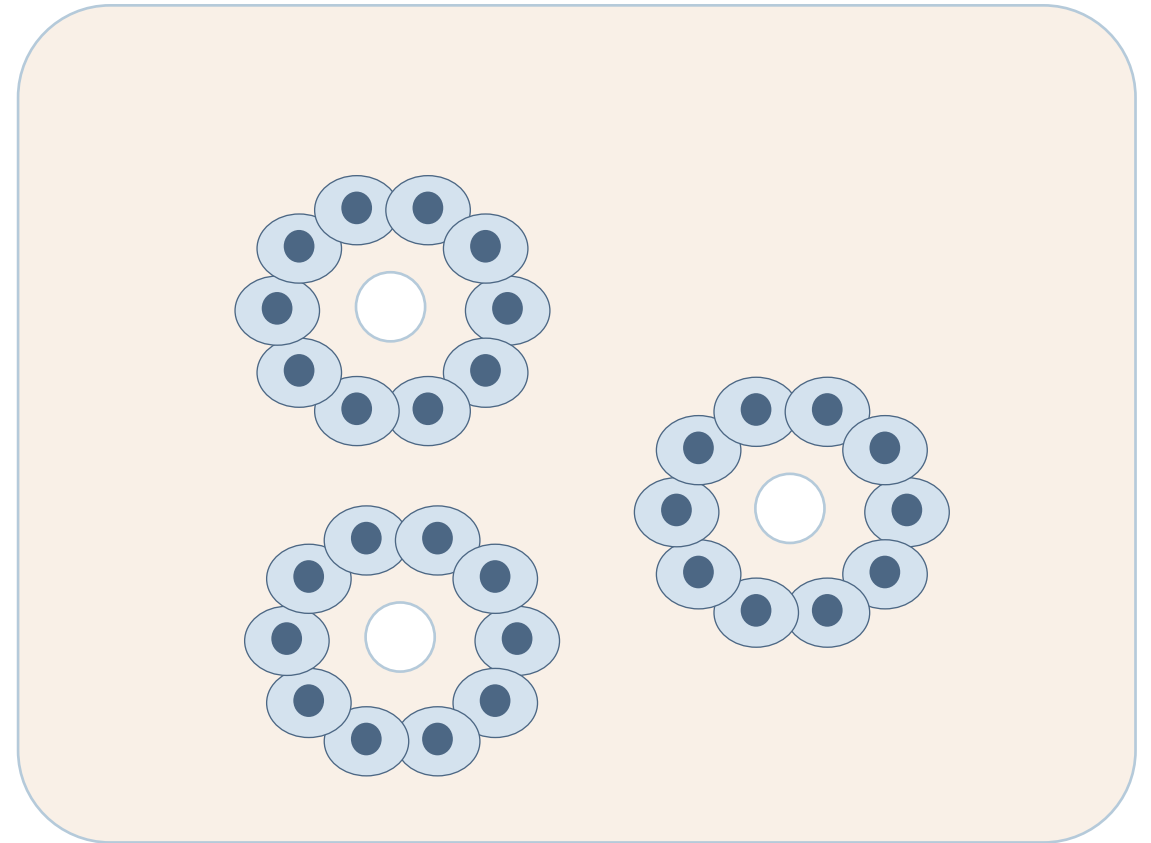
- Cells may form curved, elongated ribbons.
- Ribbon-like arrangements can coexist with organoid or trabecular structures.
- Recognition is useful when sampling is small and a classic nest is absent.



Schematic — conceptual, not a specimen

Rosette-like arrangements

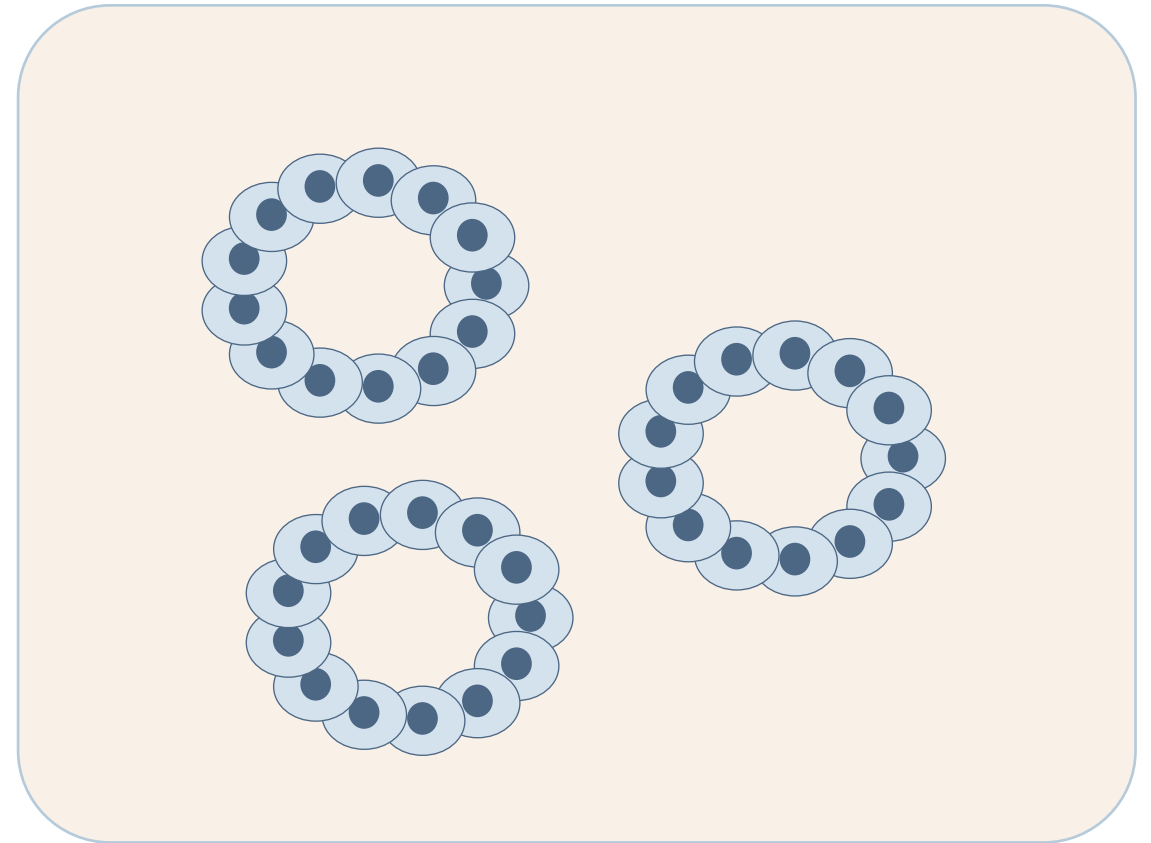
- Tumor cells can organize around small central spaces in a rosette-like configuration.
- This is another manifestation of neuroendocrine morphology.
- A rosette-like pattern alone does not establish the typical versus atypical category.



Schematic — conceptual, not a specimen

Delicate fibrovascular stroma

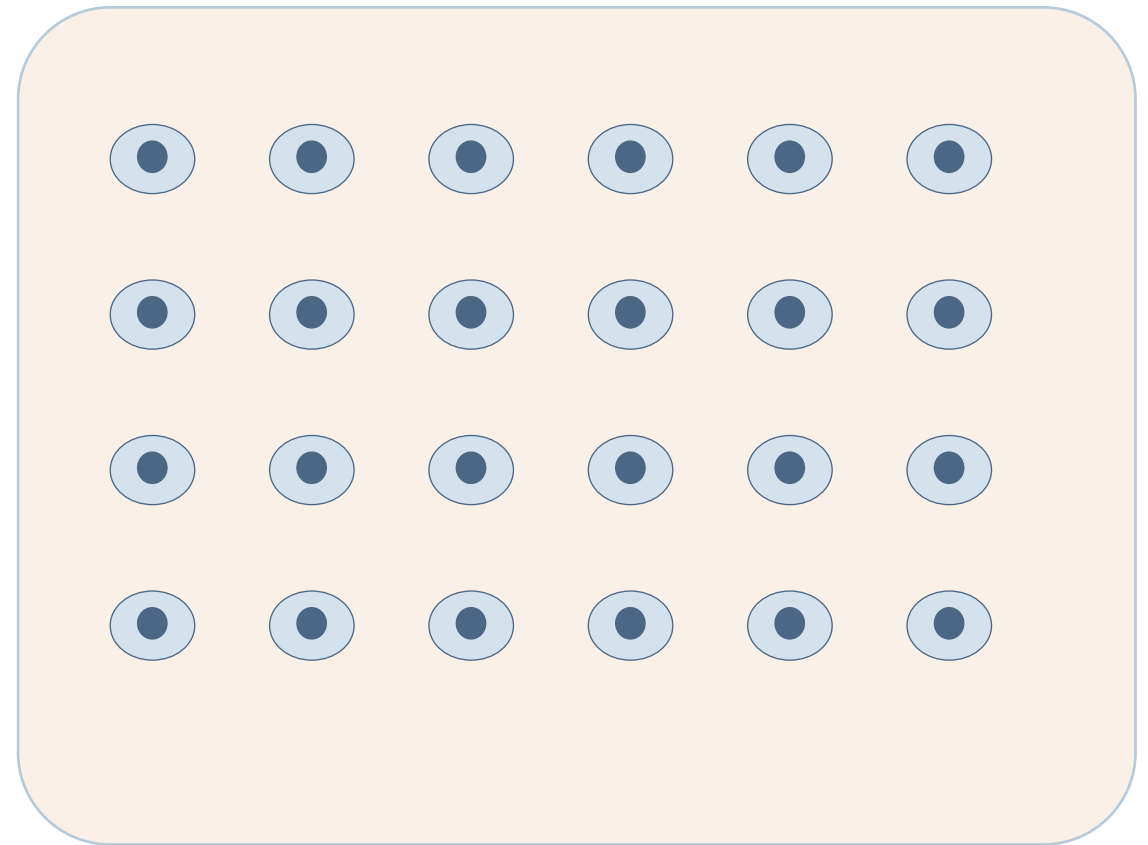
- A thin fibrovascular framework separates the tumor cell aggregates.
- This architecture differs from a single uniform solid sheet of cells.
- Observe the relationship between cellular nests, vascular spaces, and stromal septa.



Schematic — conceptual, not a specimen

Cytology: Relatively uniform cells

- The original figure description emphasizes small, rounded, uniform nuclei.
- Tumor cells have moderate cytoplasm.
- Cytologic uniformity fits a well-differentiated carcinoid pattern but does not replace formal grading.



Schematic — conceptual, not a specimen

An integrated microscopic reading

- First, recognize the neuroendocrine architectural pattern.
- Second, assess cytology, mitotic activity, and necrosis.
- Third, examine for disorganized growth and lymphatic invasion.
- The final typical/atypical category follows morphology, not a single visual impression.

Clinicopathologic interpretation

Architecture and grade provide different information: Pattern establishes character; Mitoses and necrosis help classify it.

Pulmonary carcinoid grading is morphologic

- Grading using histologic criteria.
- Typical and atypical categories correspond approximately to lower and intermediate neuroendocrine grades.
- Proliferation-marker measurement is not required in the source-defined lung system.

Clinicopathologic interpretation

Do not import a Ki-67-based grade from gastrointestinal or pancreatic neuroendocrine tumors.

Mitotic activity: The formal denominator

- The Robbins criteria are stated as mitoses per 10 high-power fields (HPF).
- Typical carcinoid: Fewer than 2 mitoses per 10 HPF.
- Atypical carcinoid: 2–10 mitoses per 10 HPF and/or necrosis.
- Use the specified field denominator when quoting this textbook.

Clinicopathologic interpretation

This lecture reports the 11th-edition textbook wording. Field area calibration and current reporting standards are not provided in the excerpt.

Necrosis changes the classification

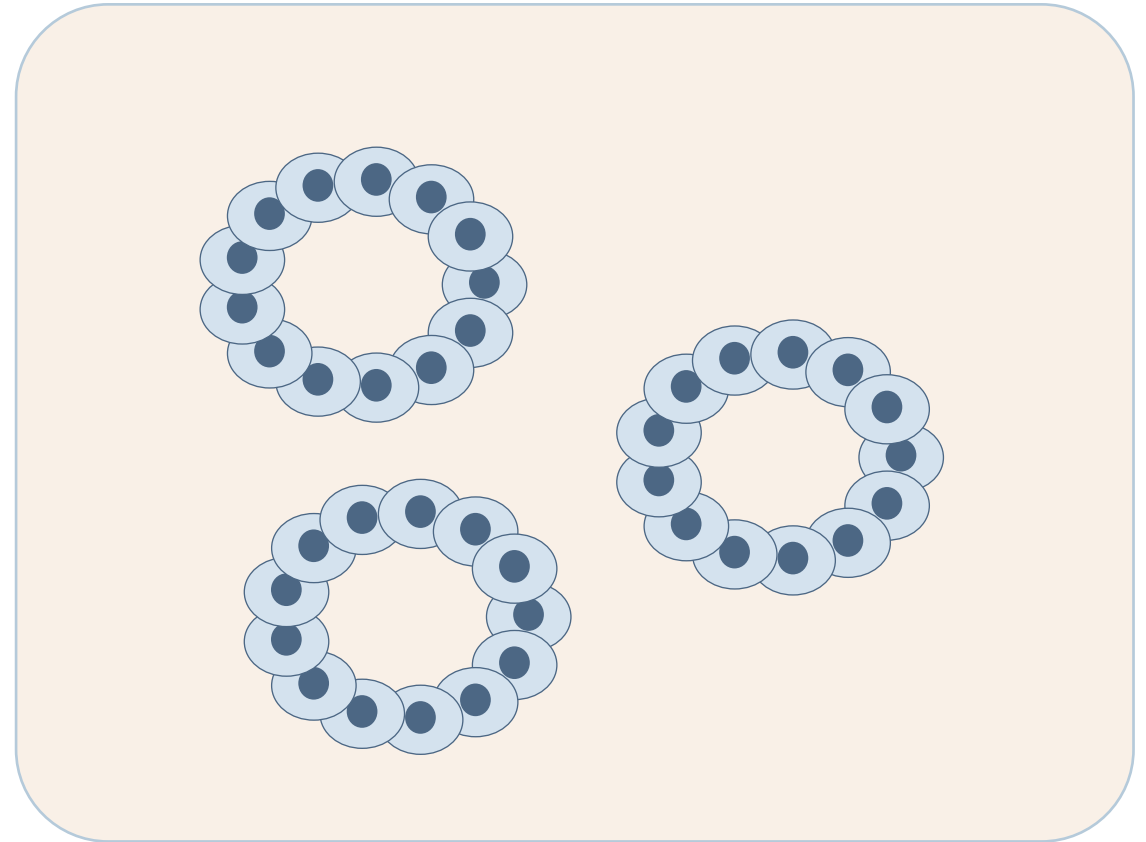
- Typical carcinoids lack necrosis.
- Foci of necrosis support the diagnosis of atypical carcinoid.
- Necrosis is a formal histologic discriminator, not merely a descriptive afterthought.

Clinicopathologic interpretation

A tumor with low mitotic activity but focal necrosis falls into the atypical category under the stated “and/or” criterion.

Typical carcinoid: Qualifying morphology

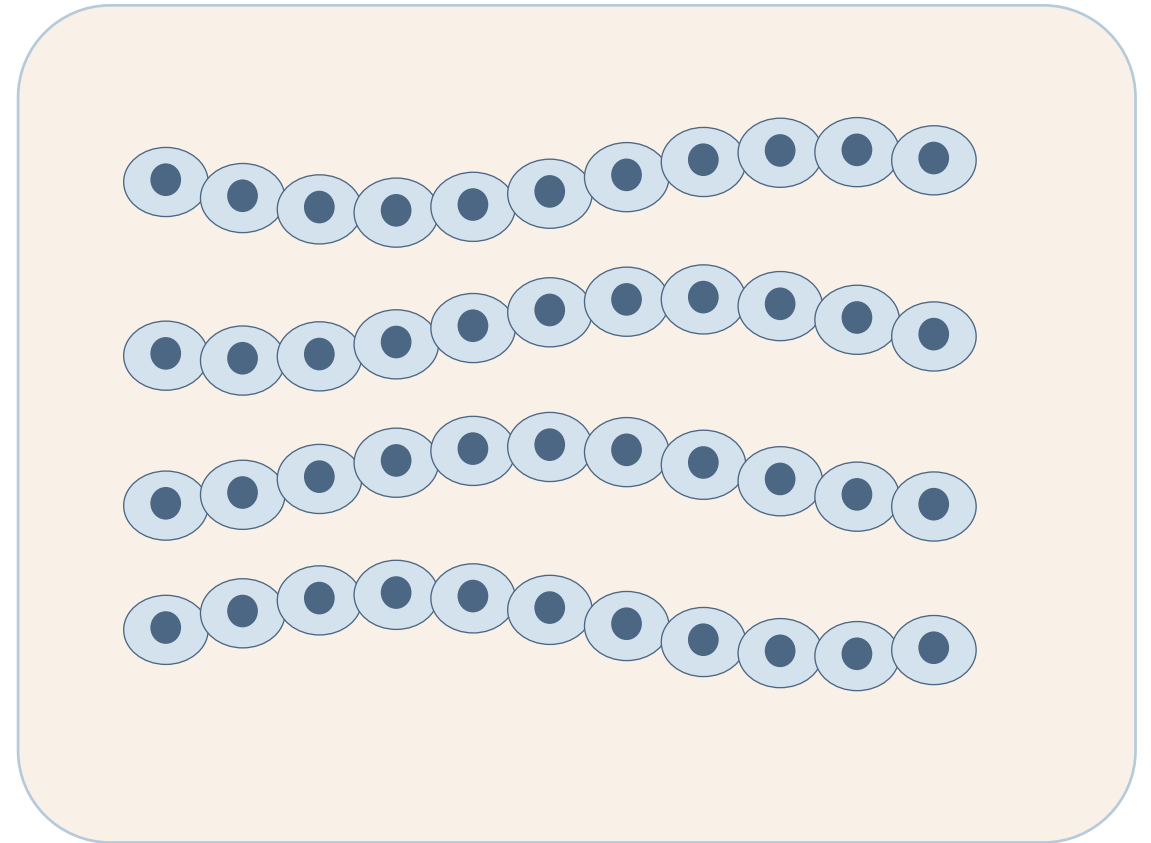
- Organized neuroendocrine architecture may be present.
- Mitotic rate is fewer than 2 per 10 HPF.
- Necrosis is absent.
- Clinical behavior is generally more favorable than that of atypical carcinoid.



Schematic — conceptual, not a specimen

Atypical carcinoid: Qualifying morphology

- Mitotic rate is 2–10 per 10 HPF and/or focal necrosis.
- Cytologic pleomorphism and nucleolar prominence may increase.
- Growth can be less organized, and lymphatic invasion is more likely.



Schematic — conceptual, not a specimen

Atypical cytology: Additional clues

- Atypical carcinoids may display increased pleomorphism.
- Nucleoli may be more prominent.
- These changes support the overall impression but the defined distinction still rests on mitoses and/or necrosis.

Clinicopathologic interpretation

Avoid assigning atypical grade on cytologic appearance alone if the defining information is missing.

Disorganized growth and lymphatic invasion

- Atypical carcinoids are more likely to show disordered architecture.
- Lymphatic invasion is more frequent in the atypical group.
- Invasion is a biologic warning; It should be separately documented from mitoses and necrosis.

Clinicopathologic interpretation

Lymphatic invasion indicates a route for dissemination but does not establish distant metastasis by itself.

Typical versus atypical carcinoids

Characteristic	Typical carcinoid	Atypical carcinoid
Mitoses / 10 HPF	< 2	2–10; Fewer if necrosis is present
Necrosis	Absent	Focal necrosis may occur
Cell pleomorphism	Generally less conspicuous	May be increased
Nucleoli	Usually less prominent	May be more prominent
Growth / invasion	Relatively organized	More disorganization; More lymphatic invasion
Reported 5-year survival	95%	70%

Ki-67: A system-specific distinction

- The lung carcinoid scheme is based on morphologic criteria.
- It does not currently require proliferation markers such as Ki-67.
- Other organ systems may use proliferation markers differently; Do not transfer those rules uncritically.

Clinicopathologic interpretation

“Not required for grading” does not mean a proliferation index could never be measured for a separate clinical purpose.

Ultrastructure: Dense-core granules

- On electron microscopy, carcinoid cells contain dense-core neurosecretory granules.
- The granules support neuroendocrine differentiation.
- They are not identified by H&E pattern alone.

Clinicopathologic interpretation

The electron-microscopy finding is reported in the source; The slide uses no synthetic EM image.

Immunohistochemical evidence of secretion

- Immunohistochemical detection of serotonin and other products.
- Listed examples include neuron-specific enolase, bombesin, and calcitonin.
- Different tumors can express different substances; One peptide does not define every carcinoid.

Clinicopathologic interpretation

These are examples in the supplied Robbins passage, not an exhaustive modern immunohistochemical panel.

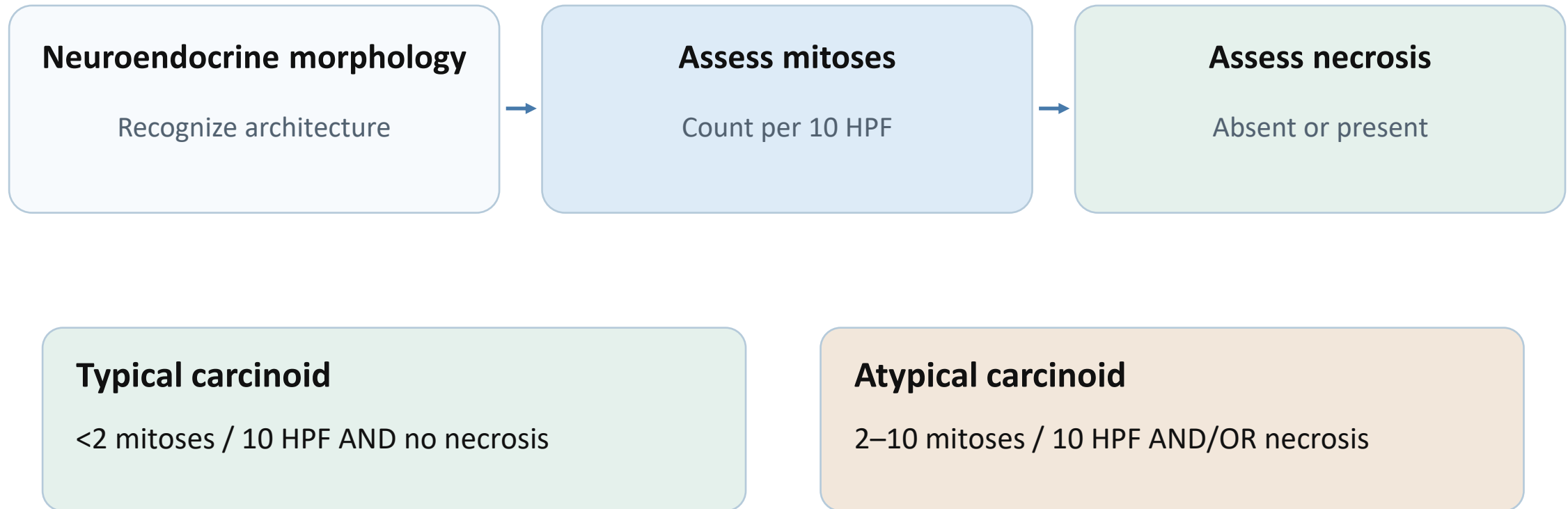
Marker role must be interpreted correctly

- Evidence of neuroendocrine differentiation helps characterize the tumor lineage.
- Histologic mitoses and necrosis, not any listed secretory peptide, define typical versus atypical in this source.
- The ability to produce a peptide does not guarantee a clinical secretory syndrome.

Clinicopathologic interpretation

Keep lineage markers, grading criteria, and functional secretion as separate diagnostic questions.

Morphologic grading: A decision framework



Apply this distinction only after establishing pulmonary carcinoid morphology.

Three mechanisms of clinical disease

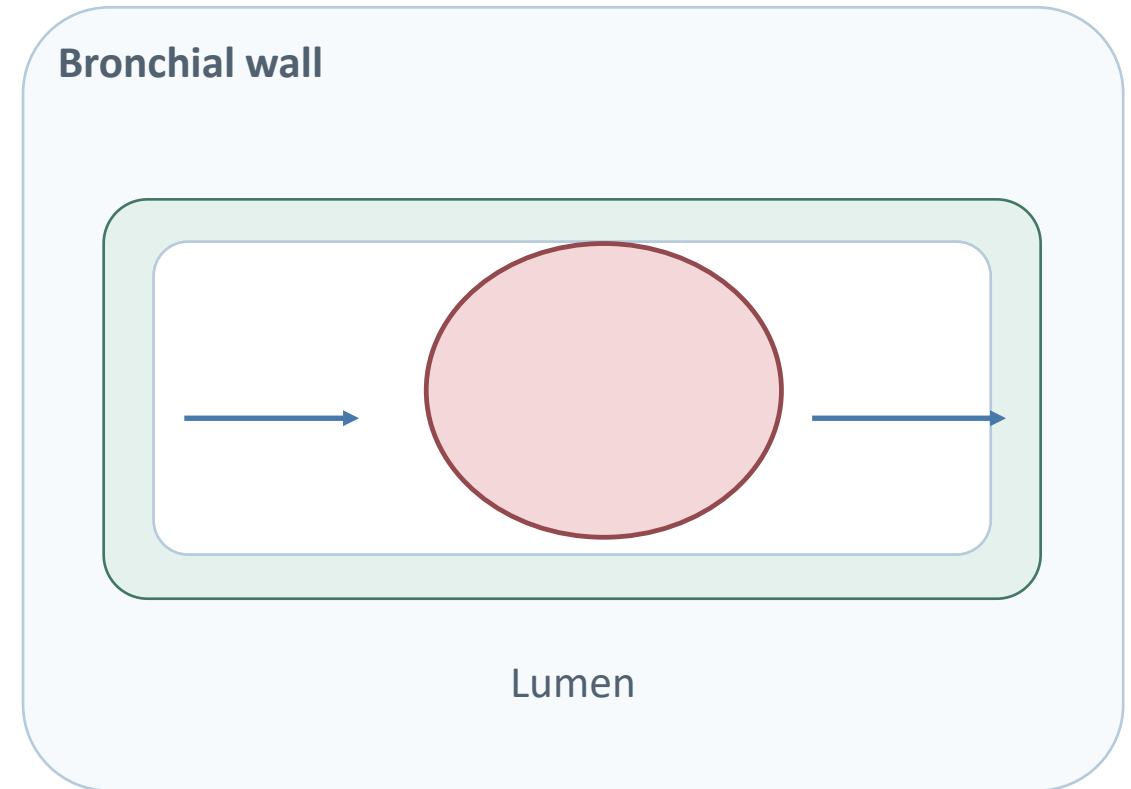
- Intraluminal growth can impair airway patency and drainage.
- Some tumors can metastasize.
- A minority can produce vasoactive amines and a systemic syndrome.
- The mechanisms must be evaluated separately in individual patients.

Clinicopathologic interpretation

Mechanical obstruction, dissemination, and hormone-mediated symptoms are distinct clinical pathways.

Persistent cough: Local airway effects

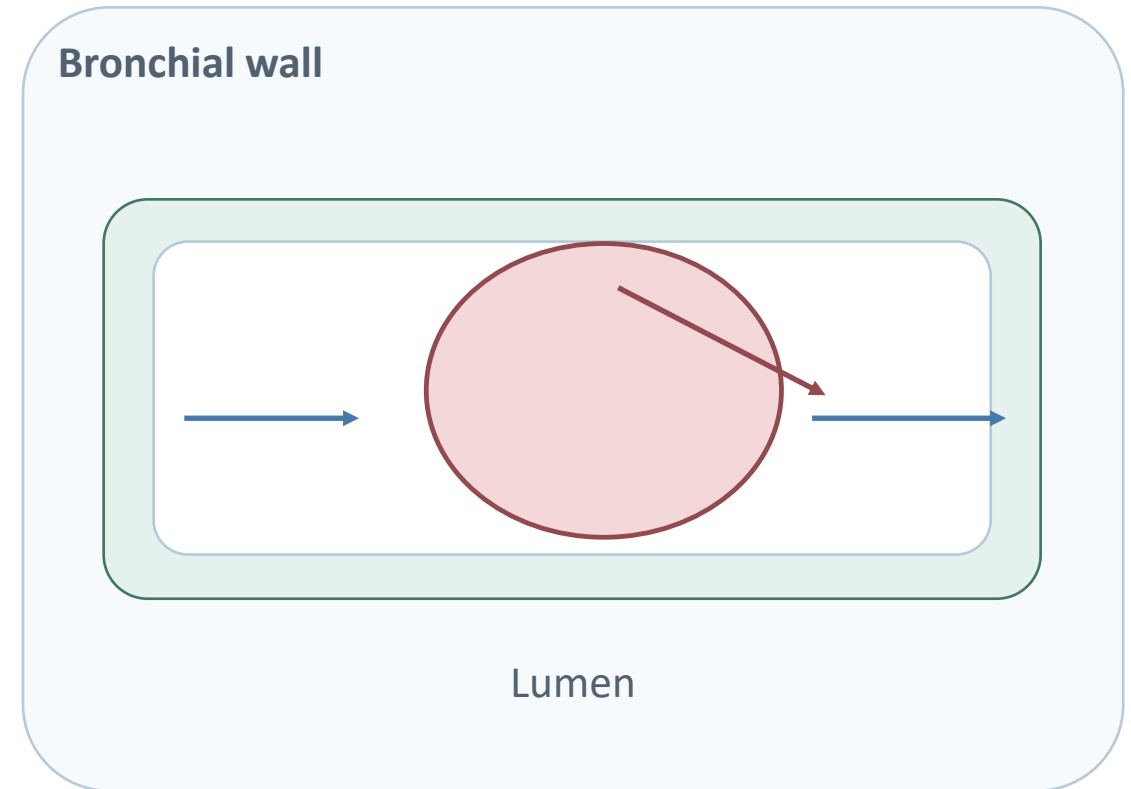
- Cough is one manifestation of intraluminal bronchial growth.
- A central mass can alter the airway lumen without a large external lung lesion.
- Correlate cough with the bronchial location, not with endocrine secretion by default.



Schematic — conceptual, not a specimen

Hemoptysis: Another local manifestation

- Hemoptysis appears among the source-described symptoms of bronchial carcinoids.
- A lesion projecting into the bronchial lumen may present with visible airway bleeding.
- The symptom does not by itself distinguish typical from atypical carcinoid.



Schematic — conceptual, not a specimen

Impaired drainage causes secondary infection

- A lumen-occupying tumor can compromise distal airway drainage.
- Retained secretions can be associated with infection beyond the obstruction.
- In such presentations, the apparent infectious problem may coexist with an underlying tumor.

Clinicopathologic interpretation

A localized infection pattern should prompt consideration of the bronchial obstruction mechanism when supported by imaging or bronchoscopy.

Bronchiectasis downstream of obstruction

- Bronchiectasis among consequences of bronchial carcinoid obstruction.
- The associated airway change may reflect prolonged impairment of drainage and recurrent injury.
- Describe bronchiectasis as a secondary manifestation, not as the histologic grade.

Clinicopathologic interpretation

Mechanistic explanation of prolonged drainage impairment is inferential; The association itself is source stated.

Emphysema may accompany an obstructing lesion

- Emphysema is among the reported complications of intraluminal carcinoid growth.
- Airway narrowing may produce regional abnormalities in ventilation.
- The source does not specify an imaging pattern or quantify the risk.

Clinicopathologic interpretation

Do not claim a particular radiologic subtype of emphysema solely from this textbook list.

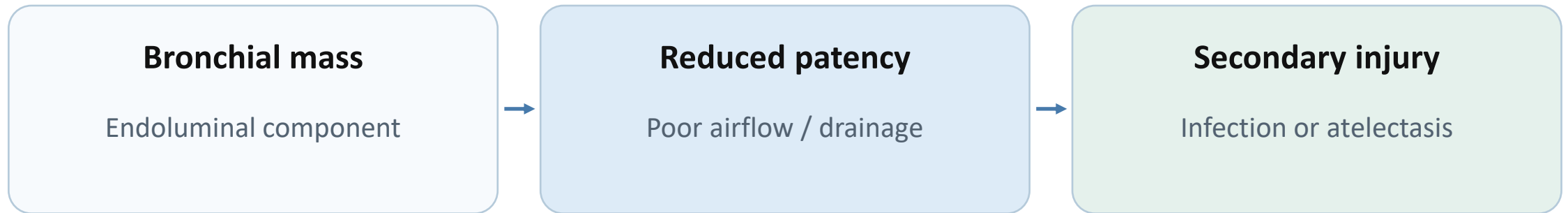
Atelectasis: A consequence of blocked airflow

- Atelectasis is listed among the complications of bronchial luminal obstruction.
- Loss of airway patency can be associated with distal loss of aeration.
- Intraluminal tumor growth can therefore have effects larger than the mass itself.

Clinicopathologic interpretation

Local anatomic disturbance and distal functional effect should be interpreted together.

Mechanical obstruction: Clinicopathologic cascade



Other associated effects: Cough, hemoptysis, bronchiectasis, and emphysema.

Metastatic potential must not be forgotten

- Although usually low-grade, pulmonary carcinoids have malignant potential.
- Clinical manifestations can result from their capacity to metastasize.
- A relatively indolent course does not make staging or follow-up irrelevant.

Clinicopathologic interpretation

Atypical carcinoids show more lymphatic invasion in the source, supporting greater concern for dissemination.

Functional tumors: Endocrine activity

- Some carcinoids contain functional cells capable of elaborating vasoactive amines.
- Secretory activity can produce symptoms remote from a mass in the bronchus.
- Most bronchial carcinoids are not functionally secretory description.

Clinicopathologic interpretation

Tumor presence and clinical secretory activity are different properties.

Vasoactive mediators in carcinoid syndrome

- Serotonin and bradykinin are associated with carcinoid syndrome in the adjacent Robbins paraneoplastic section.
- Amines or related mediators can generate systemic vasomotor and intestinal symptoms.
- Do not infer a specific analyte concentration or laboratory threshold from this excerpt.

Clinicopathologic interpretation

The source names mediators but provides no biochemical diagnostic algorithm.

Carcinoid syndrome: Clinical manifestations

- Classic pulmonary carcinoid syndrome can produce intermittent diarrhea.
- Episodic flushing is another characteristic manifestation.
- Cyanosis is also included in the Robbins triad.
- The syndrome is a functional phenomenon rather than a measure of tumor grade.

Clinicopathologic interpretation

In the Robbins source: Intermittent diarrhea + flushing + cyanosis.

How often is the syndrome reported?

- Approximately 10% of bronchial carcinoids produce carcinoid syndrome.
- Therefore, the syndrome is not present in the large majority of cases.
- Absence of flushing or diarrhea does not exclude the tumor.

Clinicopathologic interpretation

The 10% figure is the book-reported estimate; It is not a diagnostic sensitivity estimate.

Avoid conflating local and systemic symptoms

- Cough, hemoptysis, and postobstructive infection chiefly reflect local bronchial growth.
- Diarrhea, flushing, and cyanosis indicate a potential mediator-driven syndrome.
- Metastatic disease represents a third pathway with separate consequences.

Clinicopathologic interpretation

One patient may have overlapping mechanisms; Classify symptoms by the underlying process.

Clinical course is often indolent

- Most bronchial carcinoids neither secrete clinically significant products nor metastasize distantly.
- Many follow a relatively benign course over prolonged periods.
- The course is nonetheless heterogeneous: Histologic subclassification matters.

Clinicopathologic interpretation

“Relatively benign course” must not be rewritten as a universal absence of malignant risk.

Surgical resection and disease extent

- Because many pulmonary carcinoids remain localized, they are often amenable to resection.
- Intraluminal location and wall extension are relevant to operative assessment.
- The source does not provide a regimen-specific treatment algorithm.

Clinicopathologic interpretation

The textbook supports the general resectability statement—not particular operative techniques or guideline-based treatment thresholds.

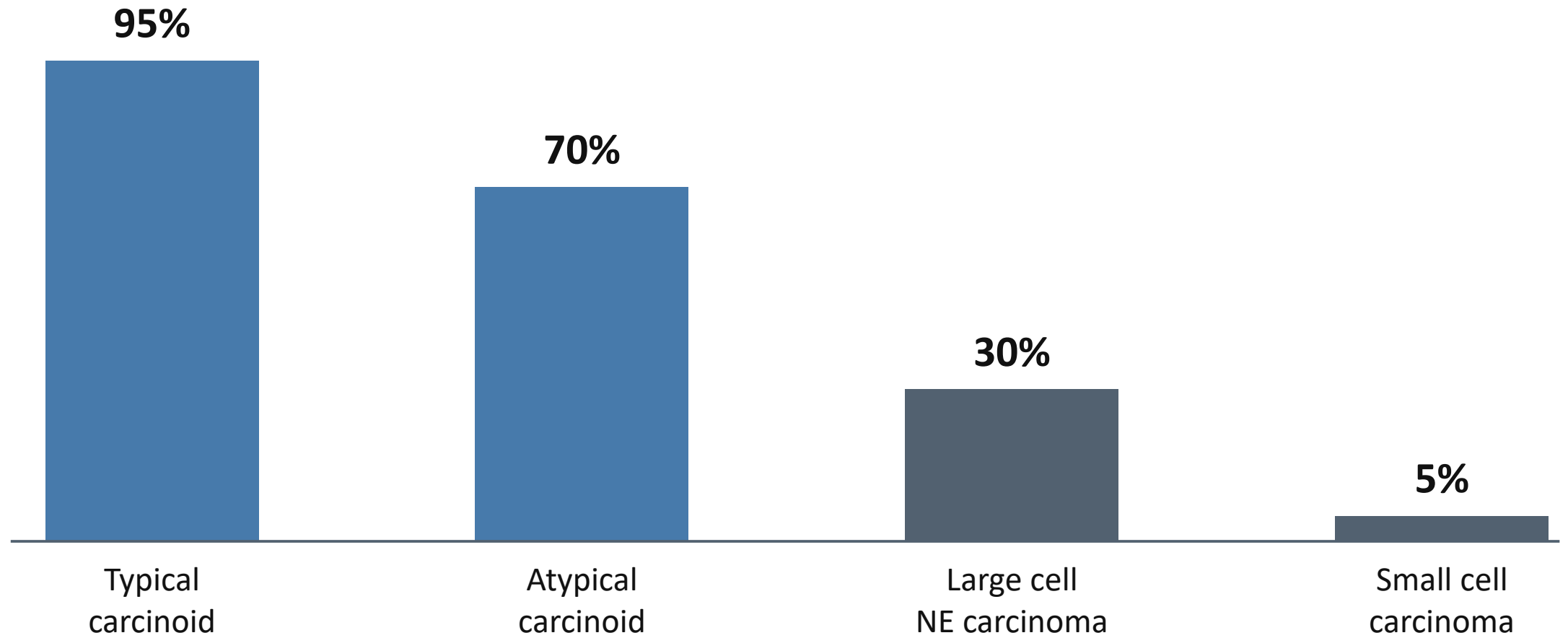
Reported survival differs by carcinoid subtype

- Robbins quotes 95% five-year survival for typical carcinoids.
- The corresponding reported value for atypical carcinoids is 70%.
- These are descriptive textbook rates and not individual patient predictions.

Clinicopathologic interpretation

The excerpt does not specify stage distribution, treatment, study population, or confidence intervals.

Context: Survival across pulmonary neuroendocrine tumors



Robbins-reported five-year survival

What the prognostic contrast demonstrates

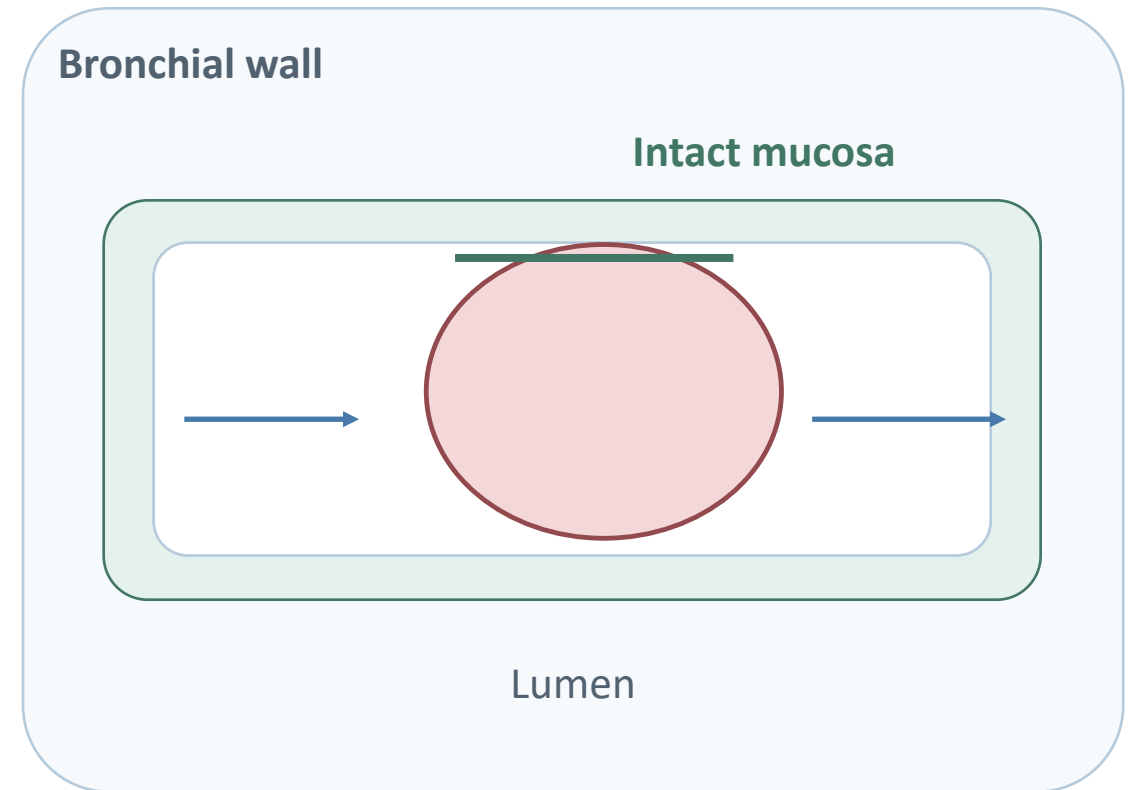
- Typical and atypical carcinoids have substantially better reported outcomes than neuroendocrine carcinomas.
- Typical carcinoid has the more favorable course of the two carcinoid grades.
- A survival percentage summarizes groups; It cannot substitute for individual staging and clinical context.

Clinicopathologic interpretation

The four percentage values come from one Robbins comparison; Avoid claiming a causal effect of any particular therapy.

Application case: A central endobronchial mass

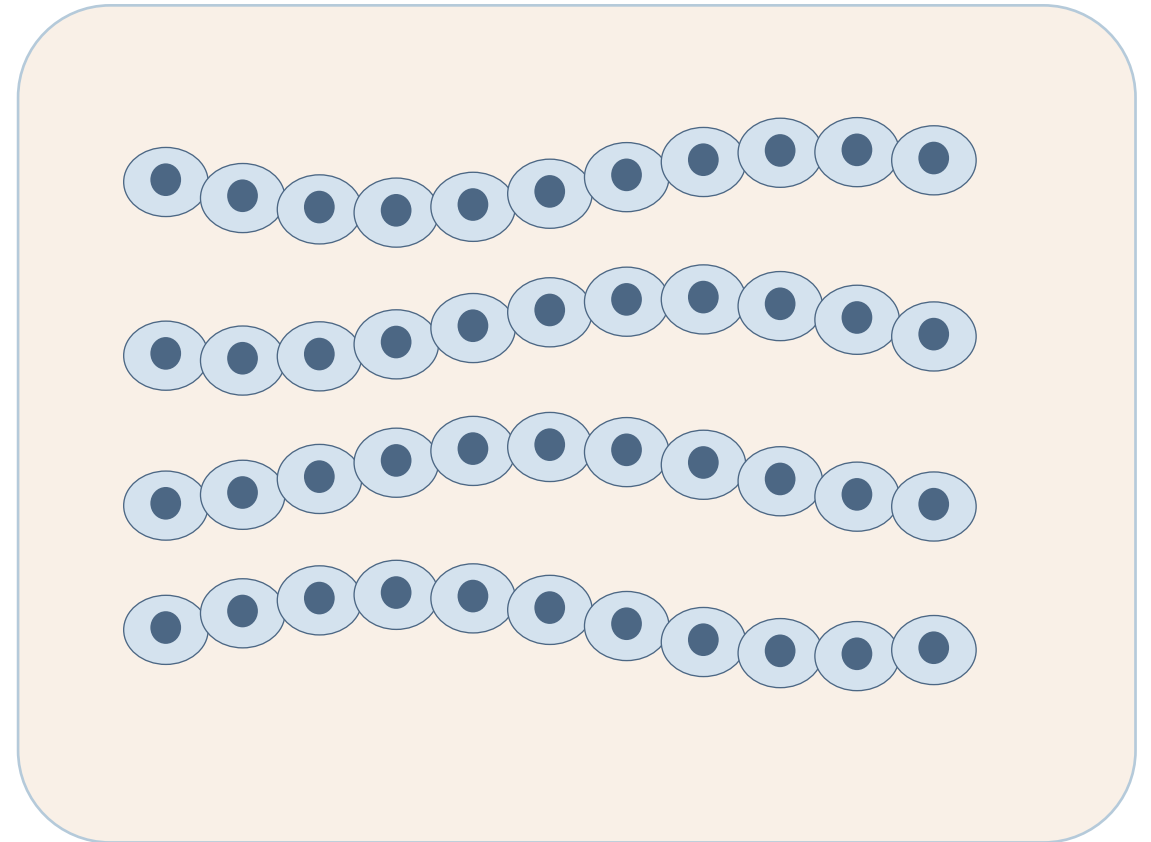
- Hypothetical scenario: Persistent cough, intermittent hemoptysis, and a smooth polypoid bronchial lesion.
- Question: Which gross characteristics favor pulmonary carcinoid as a diagnostic consideration?
- Reason through lumen projection, mucosal covering, and potential obstruction.



Schematic — conceptual, not a specimen

Application case: Interpret histologic grading

- Hypothetical tumor:
Organoid/trabecular growth, 1 mitosis per 10 HPF, and no necrosis.
- What carcinoid category follows morphologic criteria?
- Which measured findings carry grading weight, and which are architectural clues?



Schematic — conceptual, not a specimen

Application case: Low mitoses with focal necrosis

- Hypothetical tumor: A carcinoid pattern with 1 mitosis per 10 HPF but focal necrosis.
- Question: Does the low mitotic count alone justify “typical” carcinoid?
- Apply the source’s “and/or” formulation for the atypical category.

Clinicopathologic interpretation

The focal necrosis means the case should not be labeled typical using the provided criteria.

Application case: Intermittent systemic symptoms

- Hypothetical patient: An endobronchial carcinoid with episodic flushing and diarrhea.
- Question: Which clinical mechanism differs from simple airway obstruction?
- Explain why the absence of this syndrome in another patient would not refute carcinoid.

Clinicopathologic interpretation

The hormonal syndrome is uncommon (~10%) and mechanism-distinct from bronchial obstruction.

Common classification errors to avoid

- Do not use an intact bronchial mucosa to declare the mass benign.
- Do not grade a pulmonary carcinoid solely with Ki-67.
- Do not equate a rosette-like pattern with typical carcinoid.
- Do not overlook focal necrosis when mitoses are low.
- Do not assume that every carcinoid causes carcinoid syndrome.

Integrated diagnostic summary

- Recognize a pulmonary neuroendocrine lesion through site, architecture, and cytology.
- Assign typical or atypical using mitoses and necrosis as.
- Assess local obstruction, dissemination, and functional secretion as separate clinical axes.
- Relate subtype to the broadly different textbook-reported outcomes.

Source and interpretive limits

- Primary text: Robbins, Cotran & Kumar, Pathologic Basis of Disease, 11th ed. (2026), “The Lung,” pp. 658–659.
- Parent context: “Neuroendocrine Proliferations and Tumors,” p. 658; mediator list: “Paraneoplastic Syndromes,” p. 657.
- Diagrams illustrate gross and cellular organization; they are schematics rather than actual histologic specimens.
- The typical/atypical distinction is morphologic; site and clinical presentation supply complementary information.