Repiratory block
SECOND PRACTICAL

1. TUBERCULOSIS

2. CANCER OF THE LUNG

TUBERCULOSIS

Tuberculosis is a chronic inflammation caused by *Mycobacterium tuberculosis*

The most affected organ by tuberculosis is the lung.

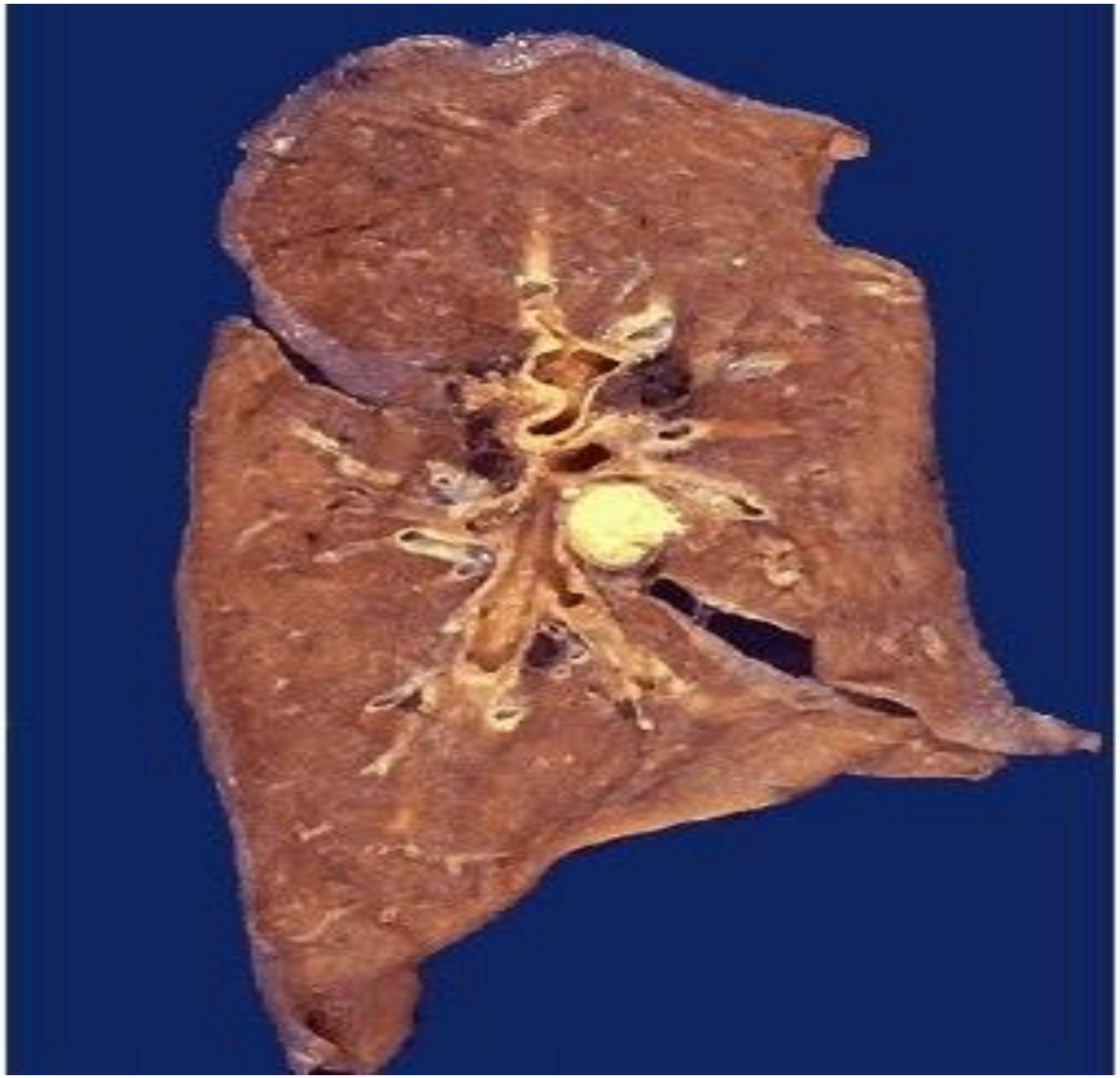
Pulmonary tuberculosis is classified in primary and secondary.

Characterized histologicaly by Central caseous necrosis, epithelioid cells, multinucleated giant cells, Ghon's complex.

Complications of TB are:

- Amyloidosis ,
- Tuberculous pneumonia
- Miliary tuberculosis
- Tuberculous meningitis
- Addison disease .

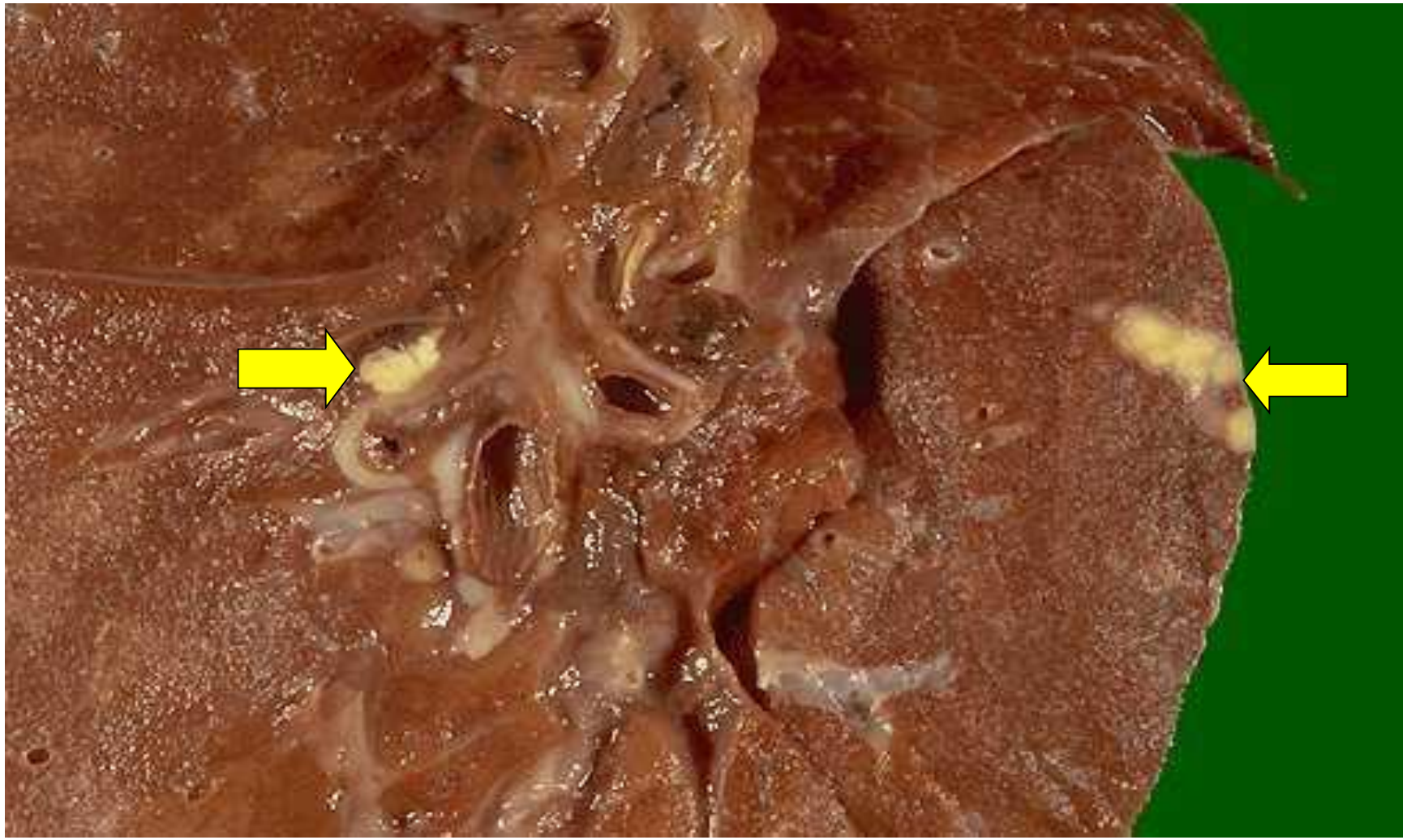
Pulmonary TB – Caseous Necrosis – Gross



Primary TB:

- Primary tuberculosis is the pattern seen with initial infection with tuberculosis in children.
- Reactivation, or secondary tuberculosis, is more typically seen in adults.
- This is a gross appearance of caseous necrosis in a hilar lymphnode
- The nodule have a cheesy tan to white appearance
- Caseous necrosis is a combination of coagulation and liqufactive necrosis

Pulmonary TB - Ghon's Complex – Gross Pathology

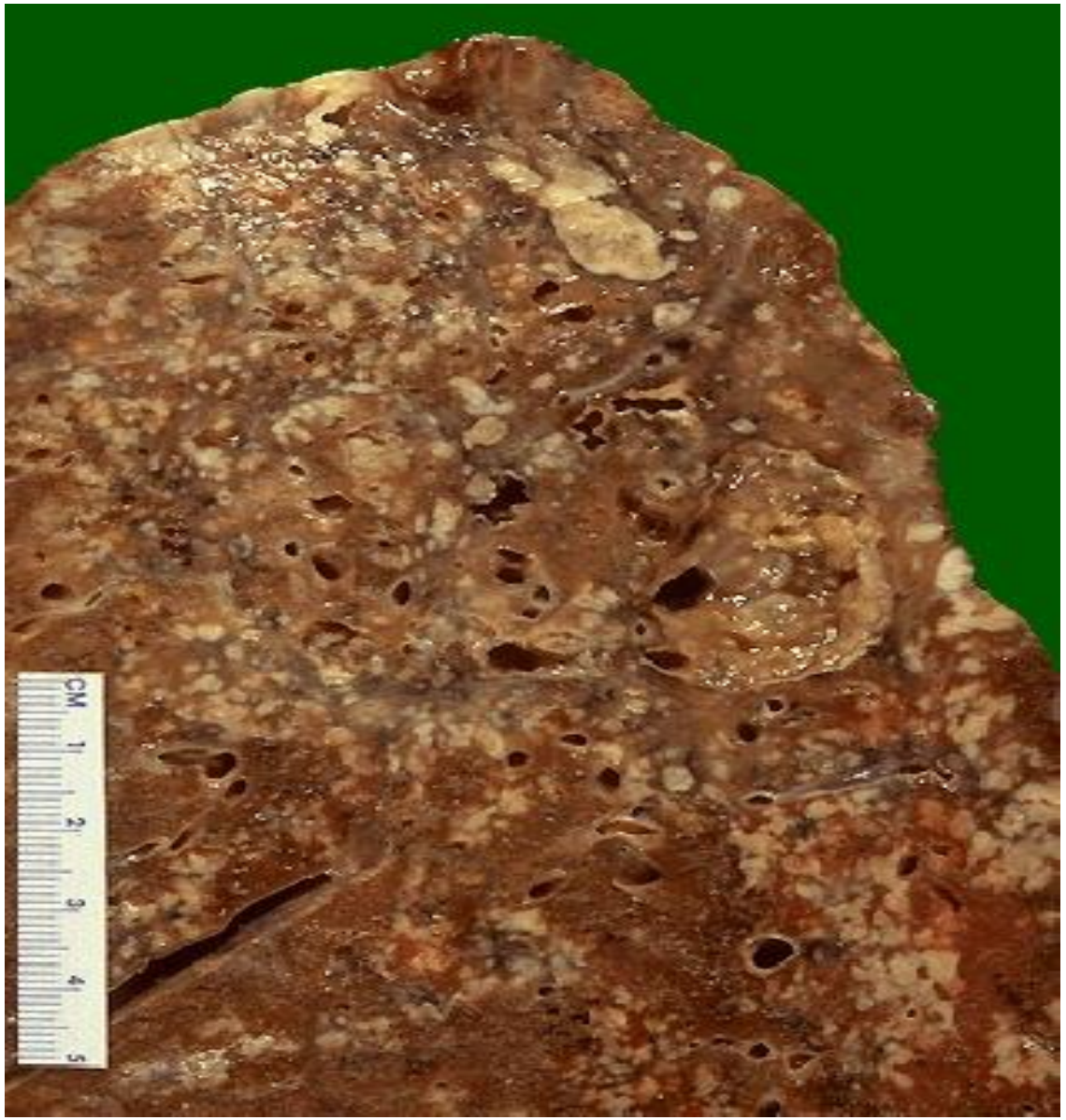


The Ghon's focus is a sub pleural location of caseous necrosis
The Ghon's complex is a combination of Ghon's focus and hilar lymph node involvement

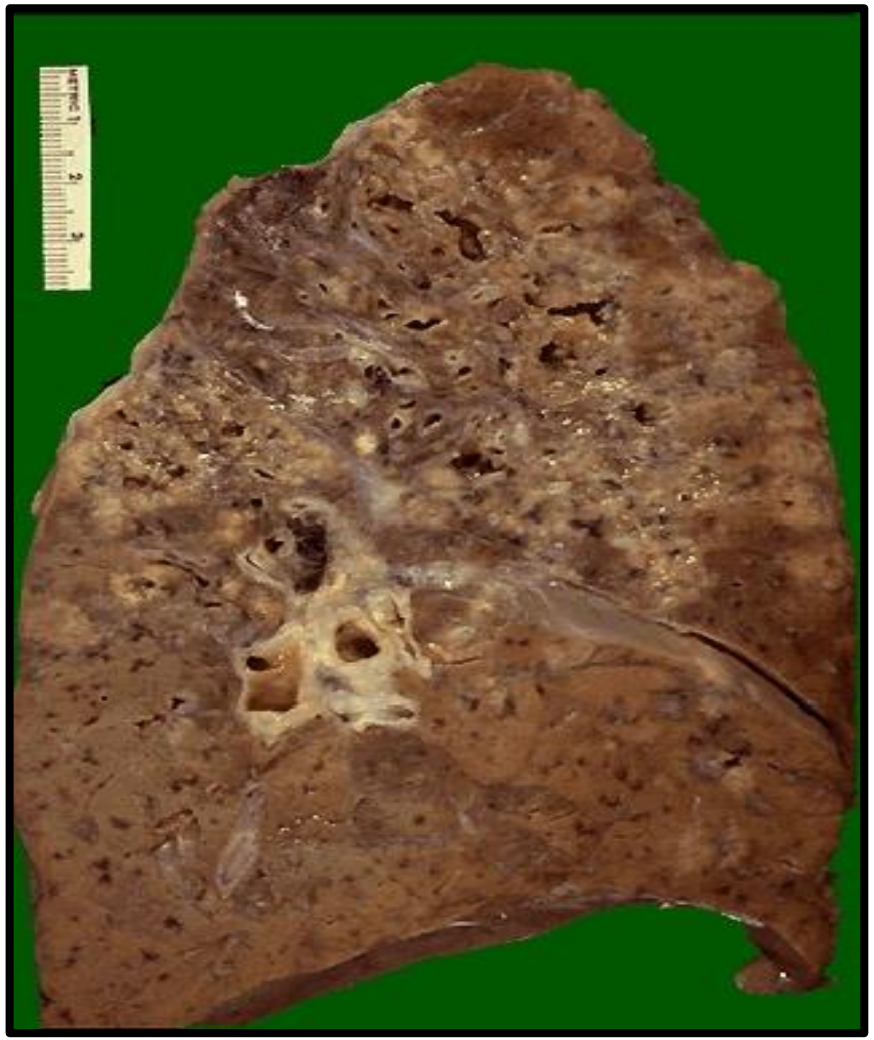
Pulmonary TB – Caseous Necrosis – Gross

Secondary TB

- occur by the reactivation of the latent primary infection, the other cases resulting from reinfection with *Mycobacterium tuberculosis.*
- *The granulomatous inflammation is much florid and widespread*
- *Typically , the upper lobes are most affected*
- *Tissue destruction and Cavitation can occur*



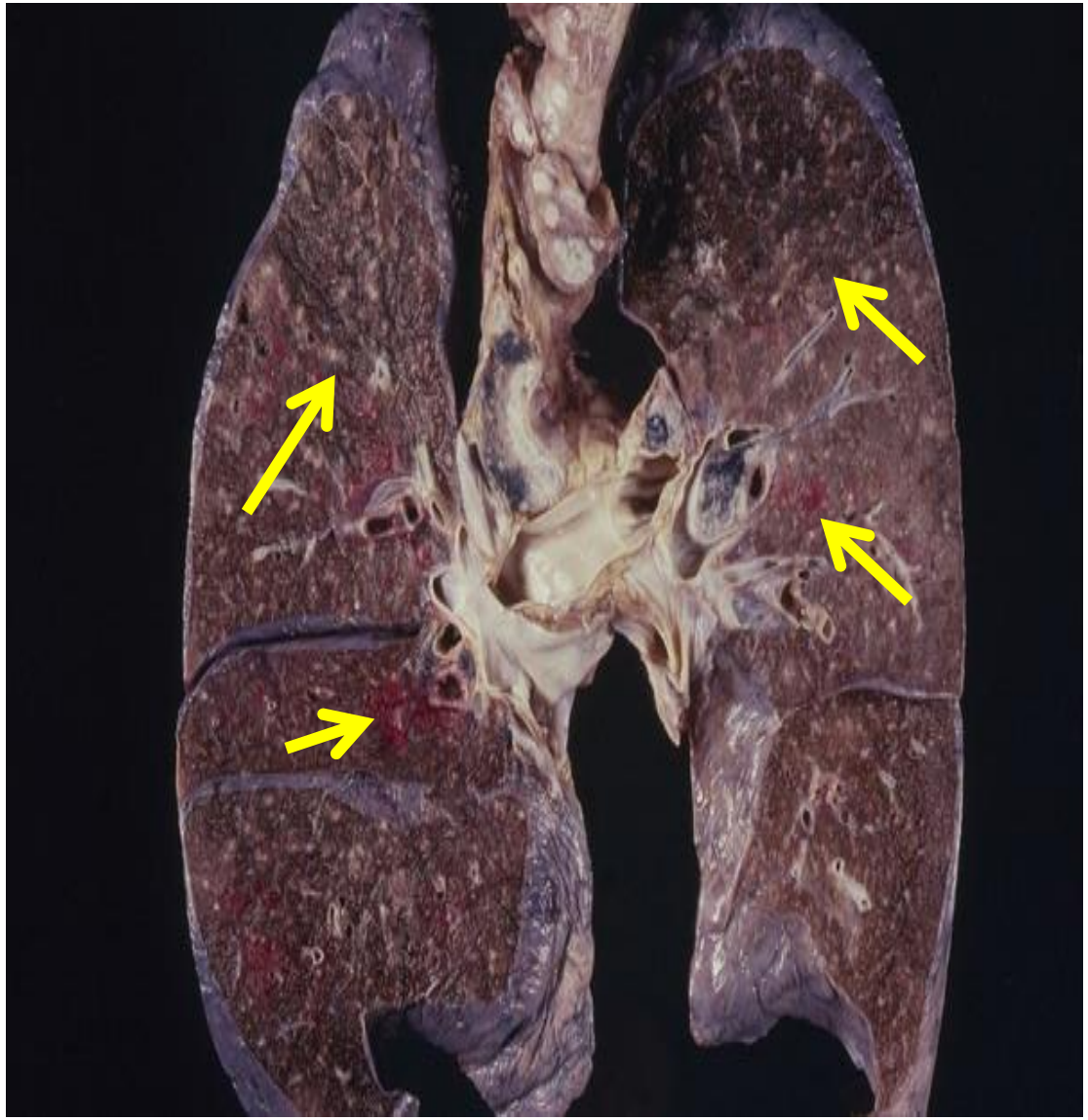
Pulmonary TB – Caseous Necrosis – Gross



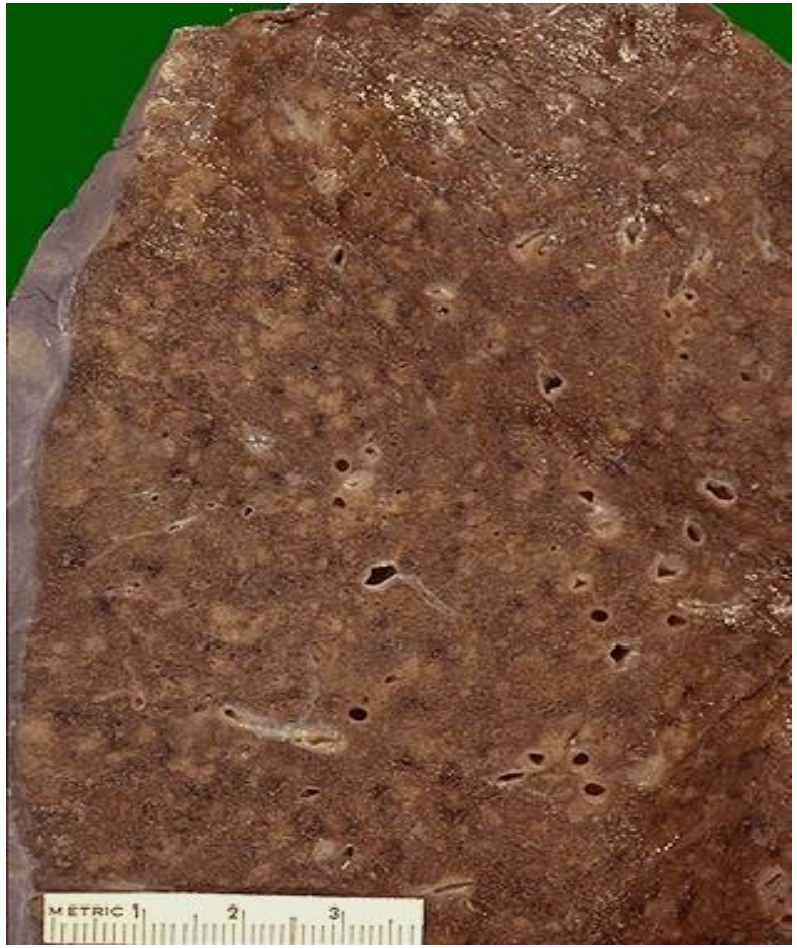
Extensive caseation and the granulomas involve a larger bronchus causing soft, necrotic center to drain out and leave behind a cavity. Cavitation is typical for large granulomas with TB. Cavitation is more common in the upper lobes.

Miliary TB of the Lungs

- *Miliary TB can occur when TB lung lesions erode pulmonary veins or when extrapulmonary TB lesions erode systemic veins.*
- *This results in hematogenous dissemination of tubercle bacilli producing myriads of 1-2 mm. lesions throughout the body in susceptible hosts.*
- *Miliary spread limited to the lungs can occur following erosion of pulmonary arteries by TB lung lesions.*



Miliary TB of the Lungs – Cut section



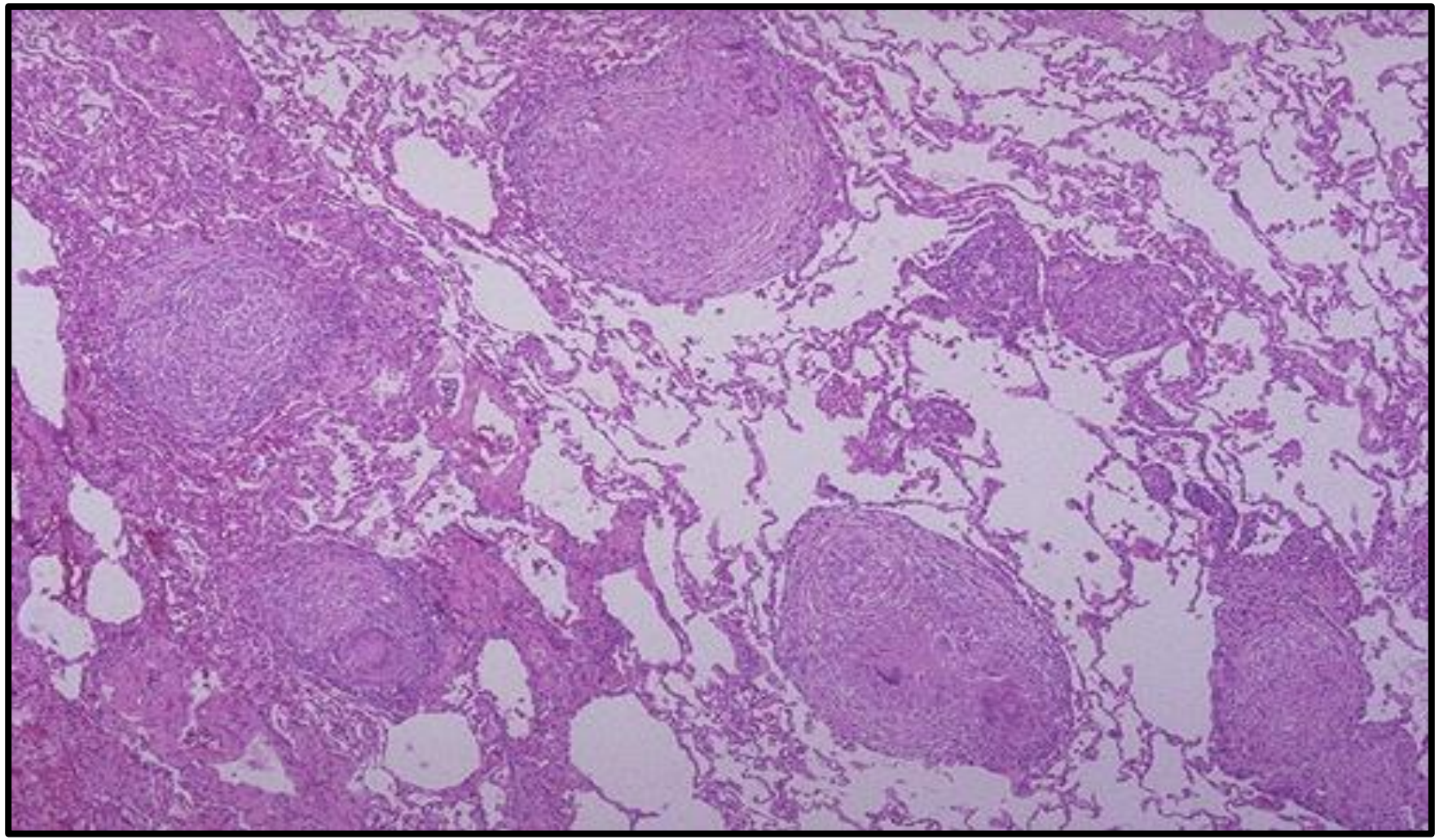
This is a "miliary" pattern of granulomas because there are a multitude of small tan granulomas, about 2 to 4 mm in size, scattered throughout the lung parenchyma. The miliary pattern gets its name from the resemblence of the granulomas to millet seeds.

Miliary TB of the Lungs – X-Ray

This chest x-ray shows a patient with miliary TB.

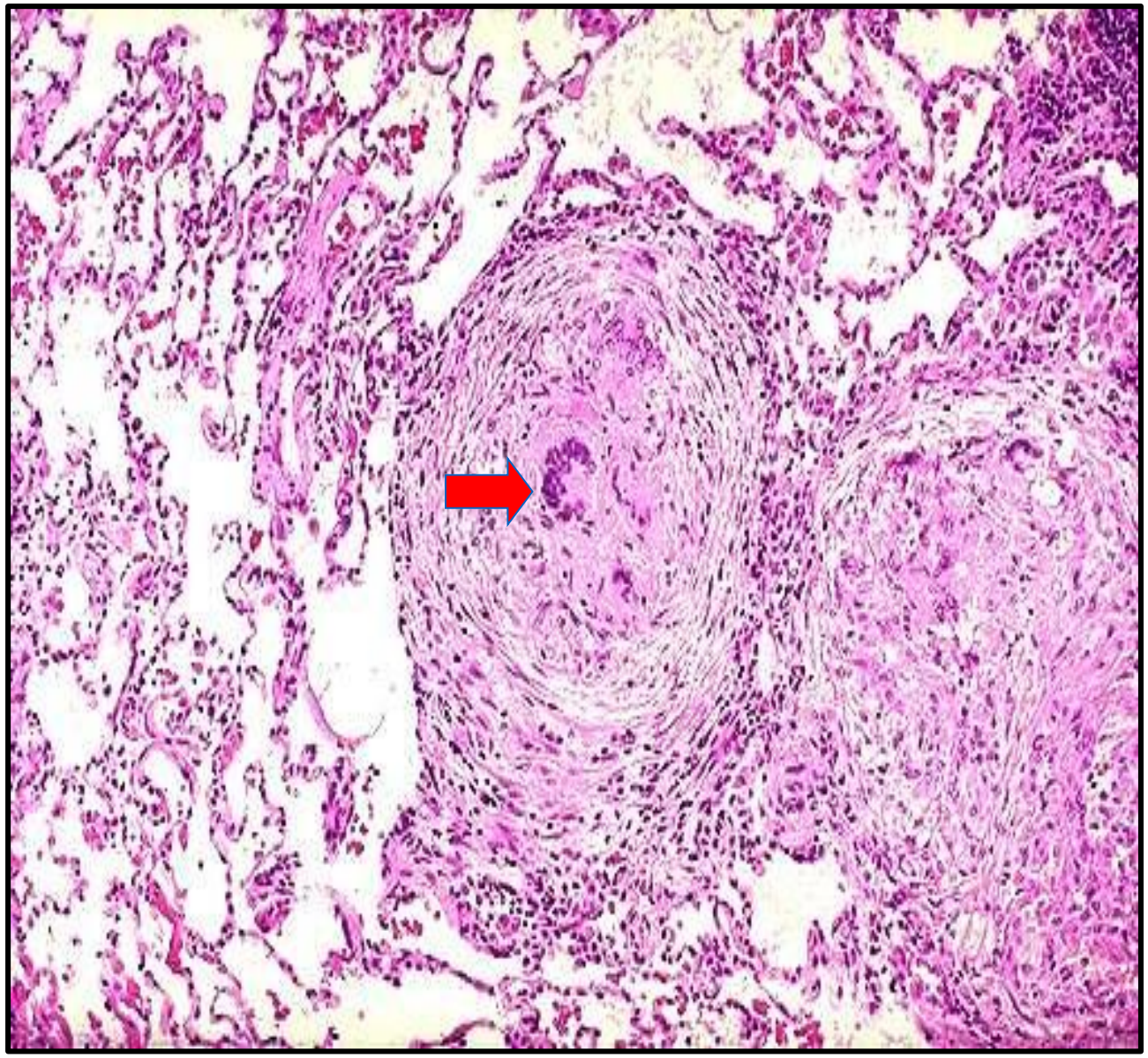
Miliary nodules appear as 1-3 mm diameter, which are uniform in size and uniformly distributed.

Tuberculous Granulomas - LPF



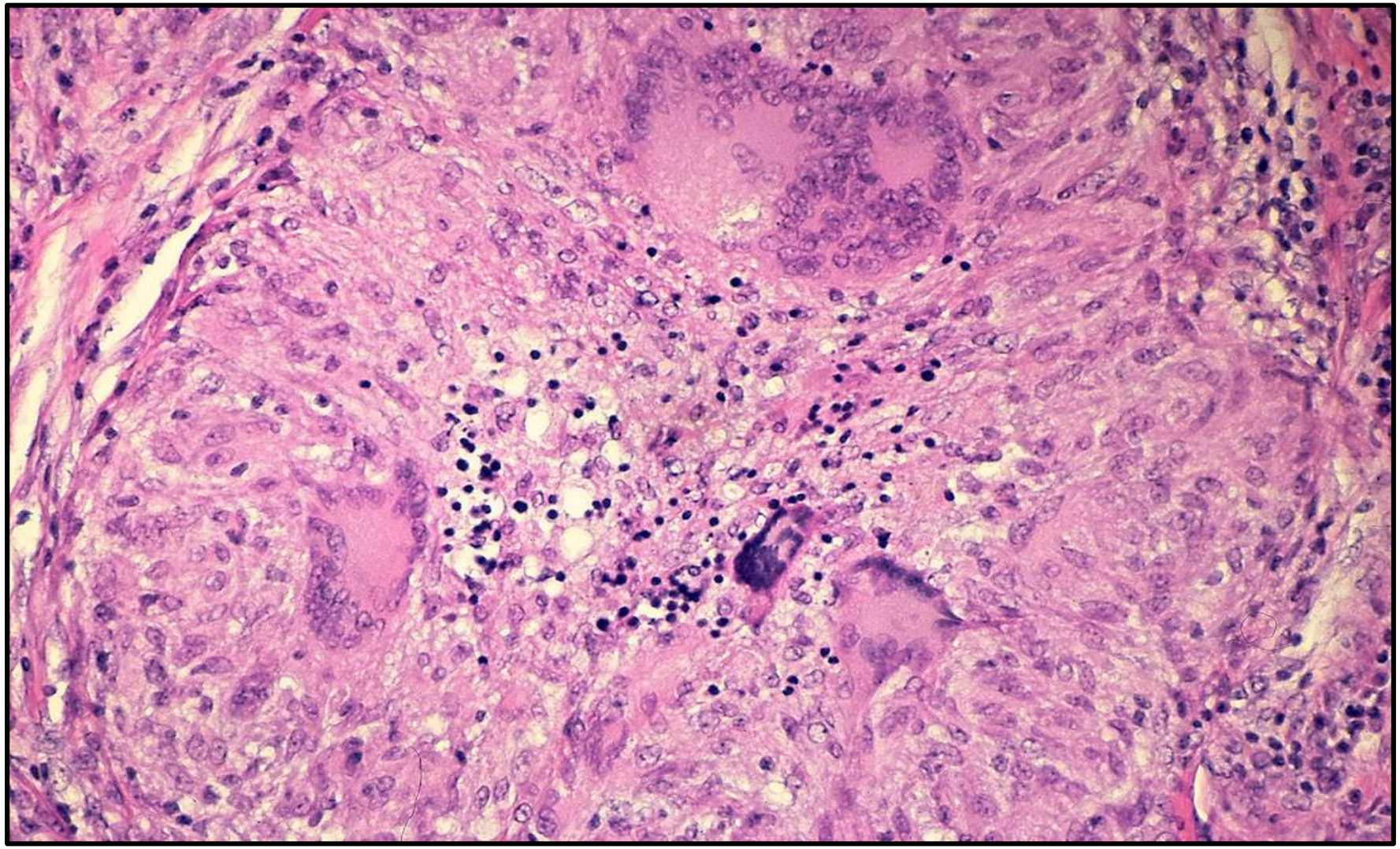
At low magnification, this micrograph reveals multiple granulomas. Granulomatous disease by chest radiograph appear as reticulonodular densities.

Tuberculous Granulomas - HPF



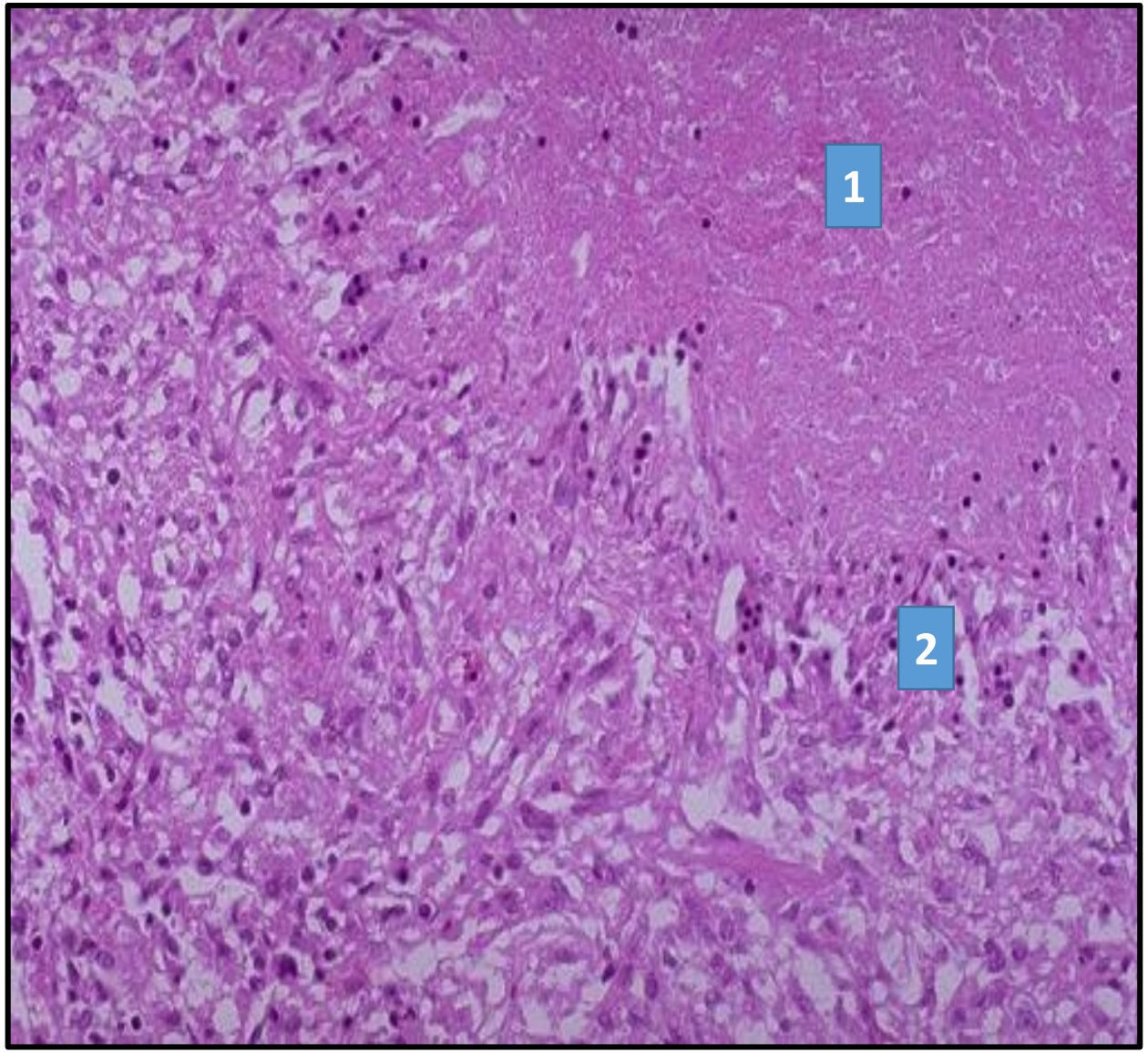
- *Well-defined granulomas are seen here.*
- *They have rounded outlines.*
- *contains several Langhan's giant cells.*
- *Granulomas are composed of transformed macrophages called epithelioid cells along with lymphocytes, occasional PMN's, plasma cells, and fibroblasts*

Pulmonary TB - Granuloma with central early necrosis



The pyknotic nuclei of epithelioid cells in the center of the granuloma (apoptotic bodies) are a precursor of necrosis.

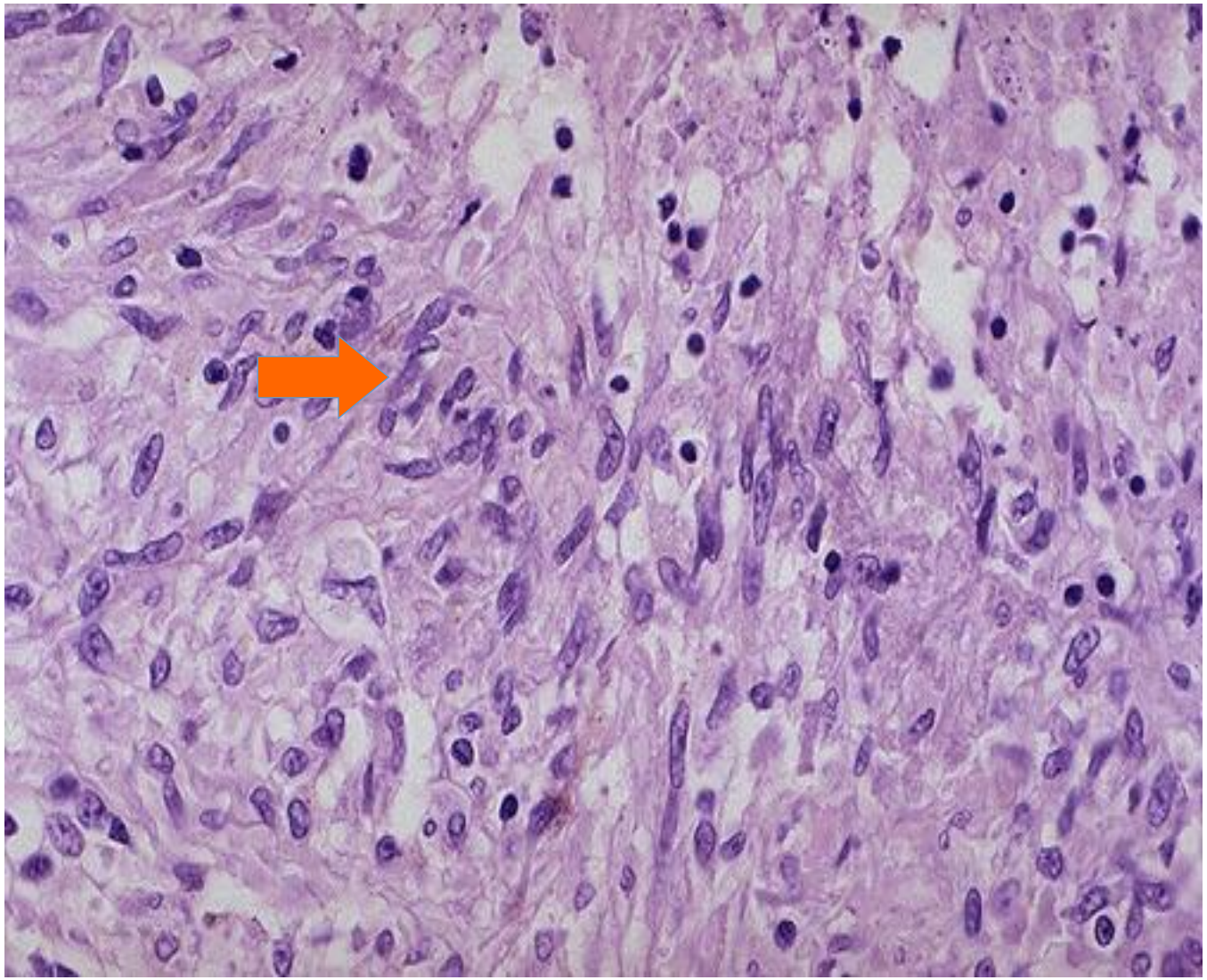
Tuberculous *Granulomas - HPF*



[1] The edge of a granuloma is shown here at high magnification. At the upper is amorphous pink caseous material composed of the necrotic elements of the granuloma as well as the infectious organisms.

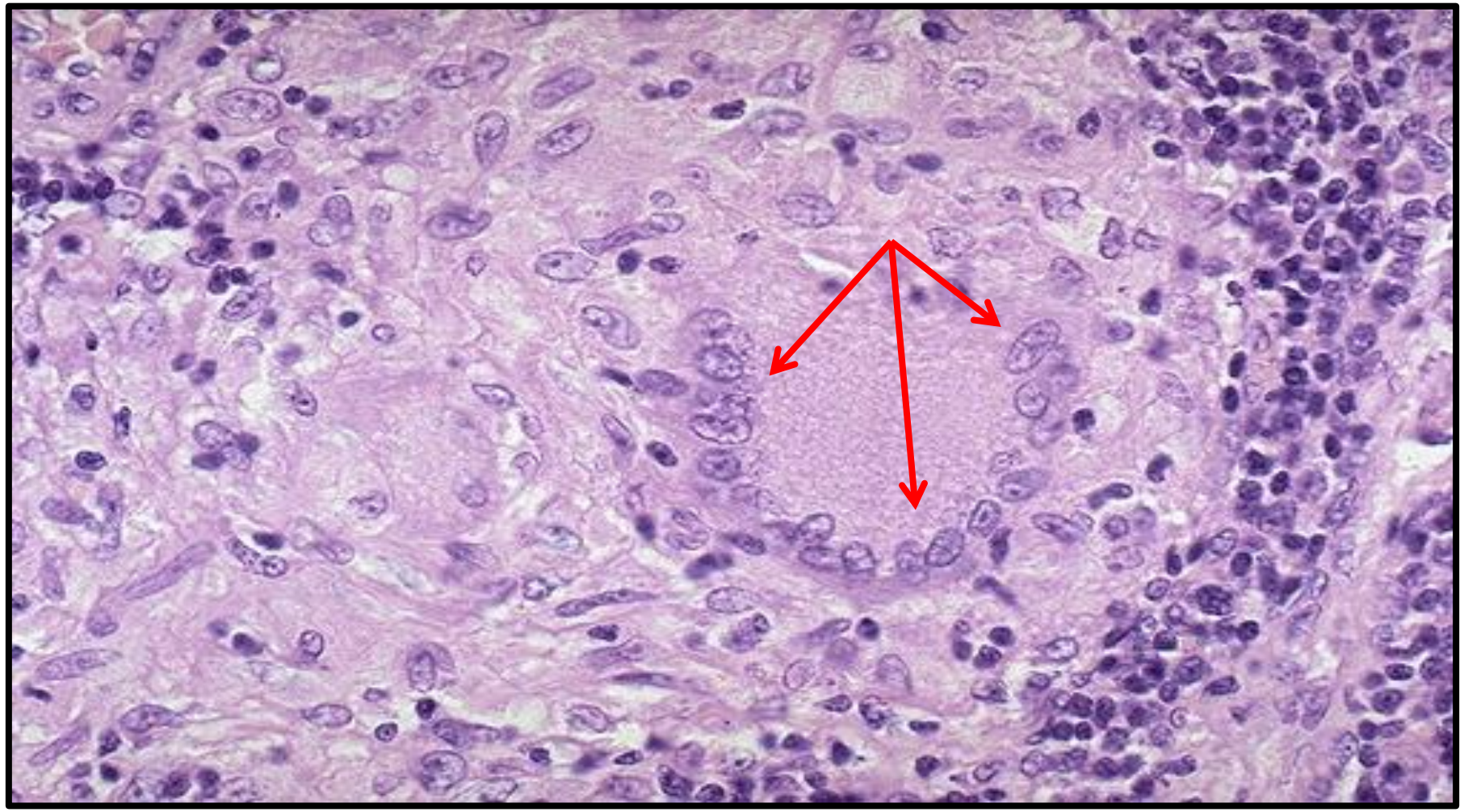
[2] This area is ringed by the inflammatory component with epithelioid cells, lymphocytes, and fibroblasts.

Epithelioid cell in *Tuberculosis - HPF*



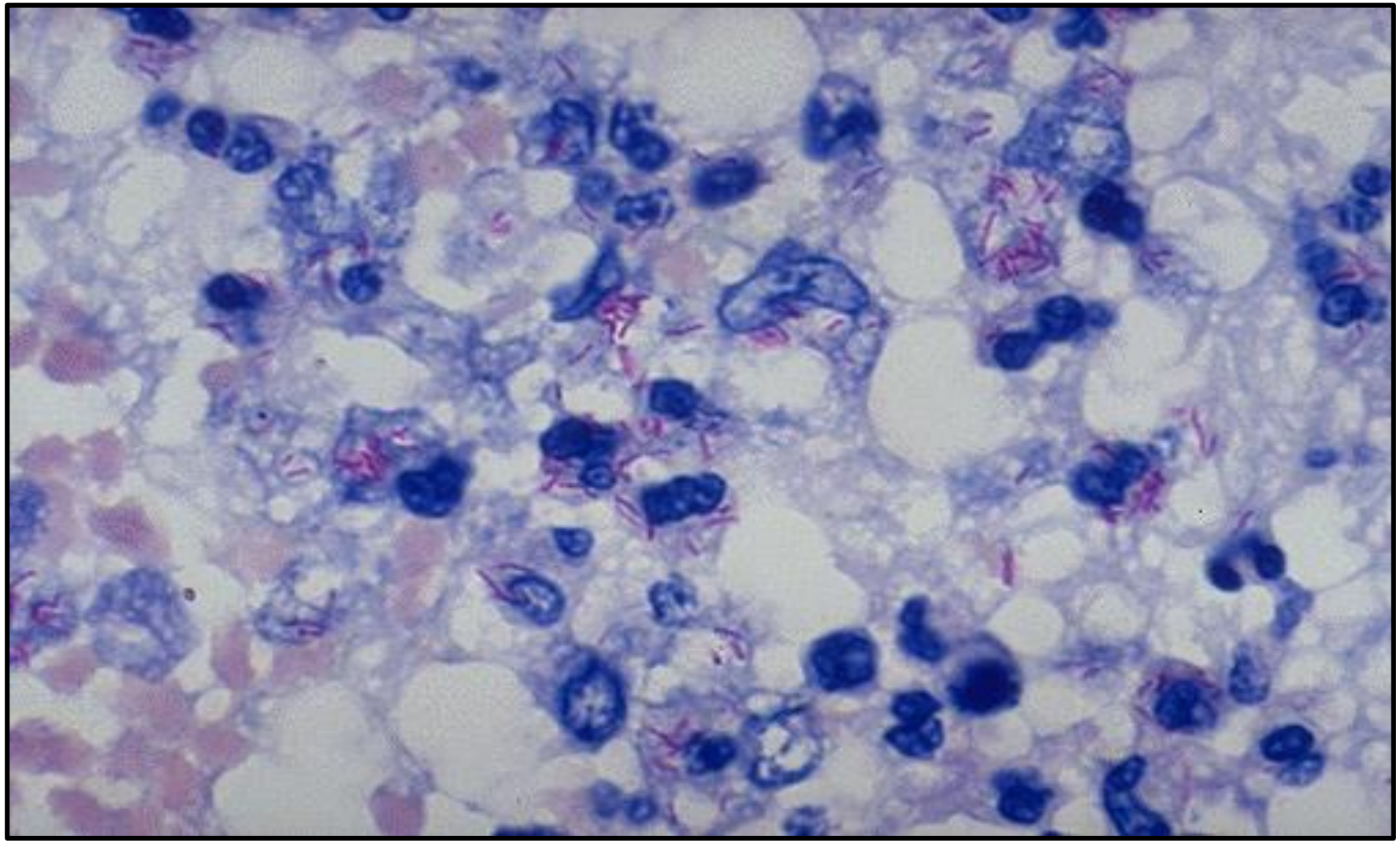
- These are epitheloid cells around the cener of a granuloma
- They are activated macrophages
- With elongated, finely granular pale eosinophilic cytoplasm
- They get their name from the fact that they have lots of pink cytoplasm similar to squamous epithelial cells
- Their nuclei tend to be long

Epithelioid & Giant cell Granulomas in *Tuberculosis*



At high magnification, the granuloma demonstrates that the epithelioid macrophages are elongated with long, pale nuclei and pink cytoplasm. The macrophages organize into committees called giant cells. The typical giant cell for infectious granulomas is called a Langhan's giant cell and has the nuclei lined up along one edge of the cell

Acid Fast bacilli of Mycobacterium TB in the Lung



A stain for Acid Fast Bacilli is done (AFB stain) to find the mycobacteria .
The mycobacteria stain as red rods, as seen here at high magnification.

LUNG CARCINOMA

MAJOR CATIGORIES OF LUNG CARCINOMA

- **NON-SMALL CELL CARCINOMA**
  1. SQUAMOUS CELL CARCINOMA
  2. ADENOCARCINOMA
  3. LARGE CELL CARCINOMA
- **SMALL CELL CARCINOMA**

The NON-small cell cancers behave and are treated similarly, the SMALL cell carcinomas are WORSE than the non-small cell carcinomas, but respond better to chemotherapy, often drastically!

1. Squamous Cell Carcinoma of the lung

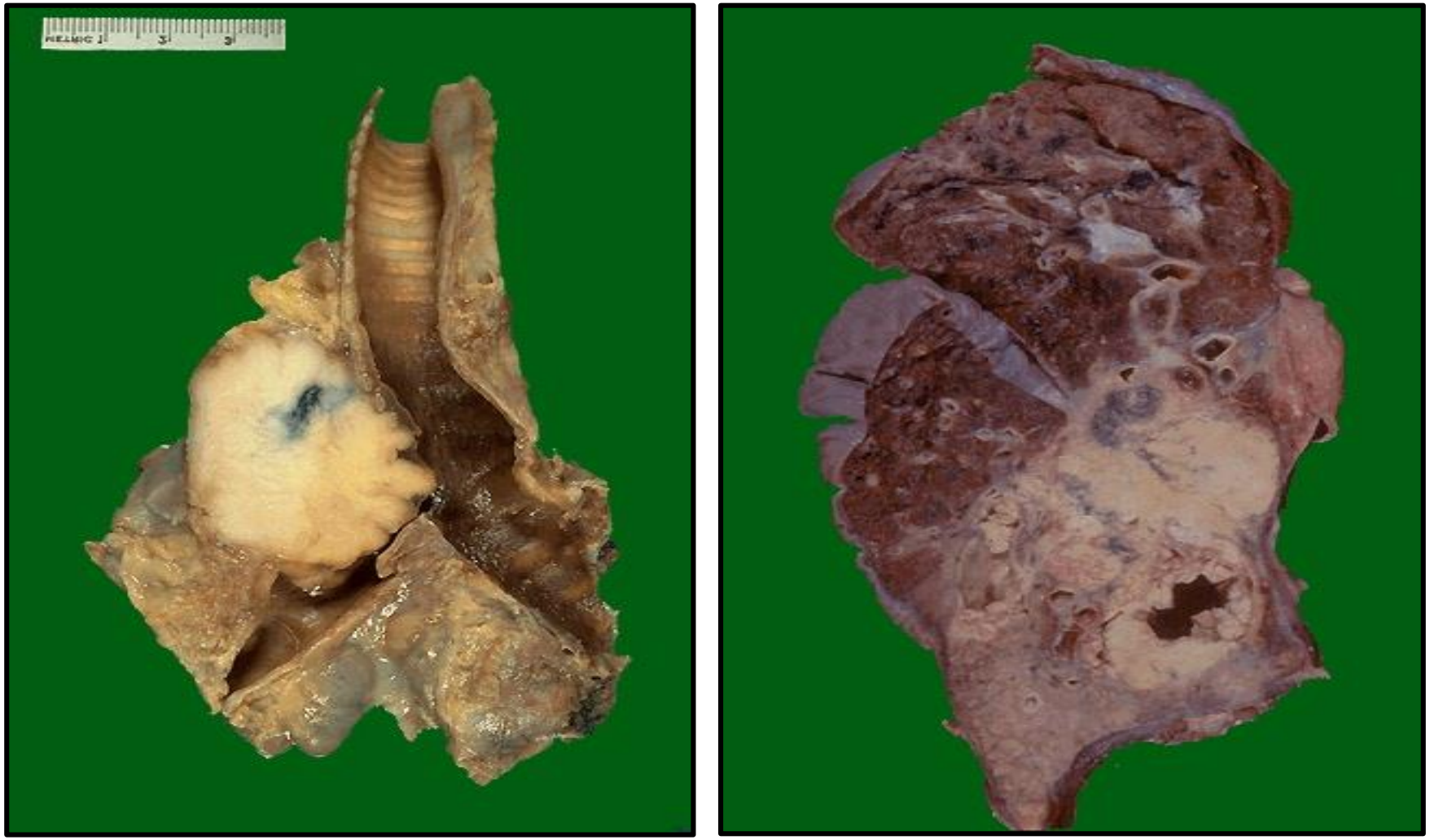
- Most commonly found in men
- correlated with smoking.
- Other etiology: industrial hazards, air pollution and genetic alterations
- SCC are often preceded for years by squamous metaplasia or dysplasia in the bronchial epithelium which then Transforms to carcinoma in situ
- Grading is based on the amount of keratin cytoplasm

١. well-differentiated with keratin whorls,
٢. moderately differentiated
٣. poorly differentiated tumors

Squamous Cell Carcinoma of the Lung - Gross

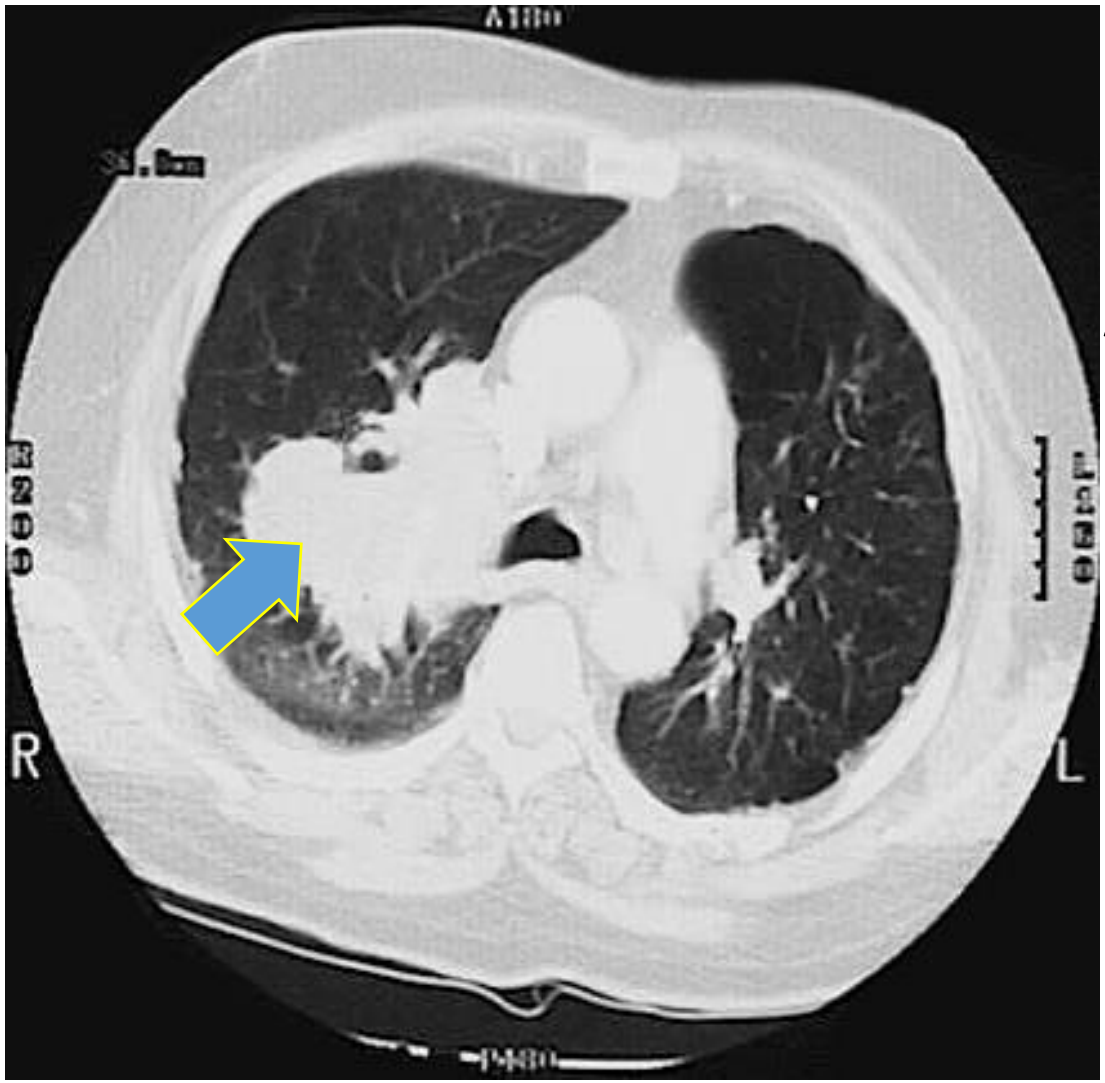
This is a squamous cell carcinoma of the lung that is arising centrally in the lung (as most squamous cell carcinomas do). It is obstructing the right main bronchus. The neoplasm is very firm and has a pale white to tan cut surface.

Squamous Cell Carcinoma of the Lung - Gross



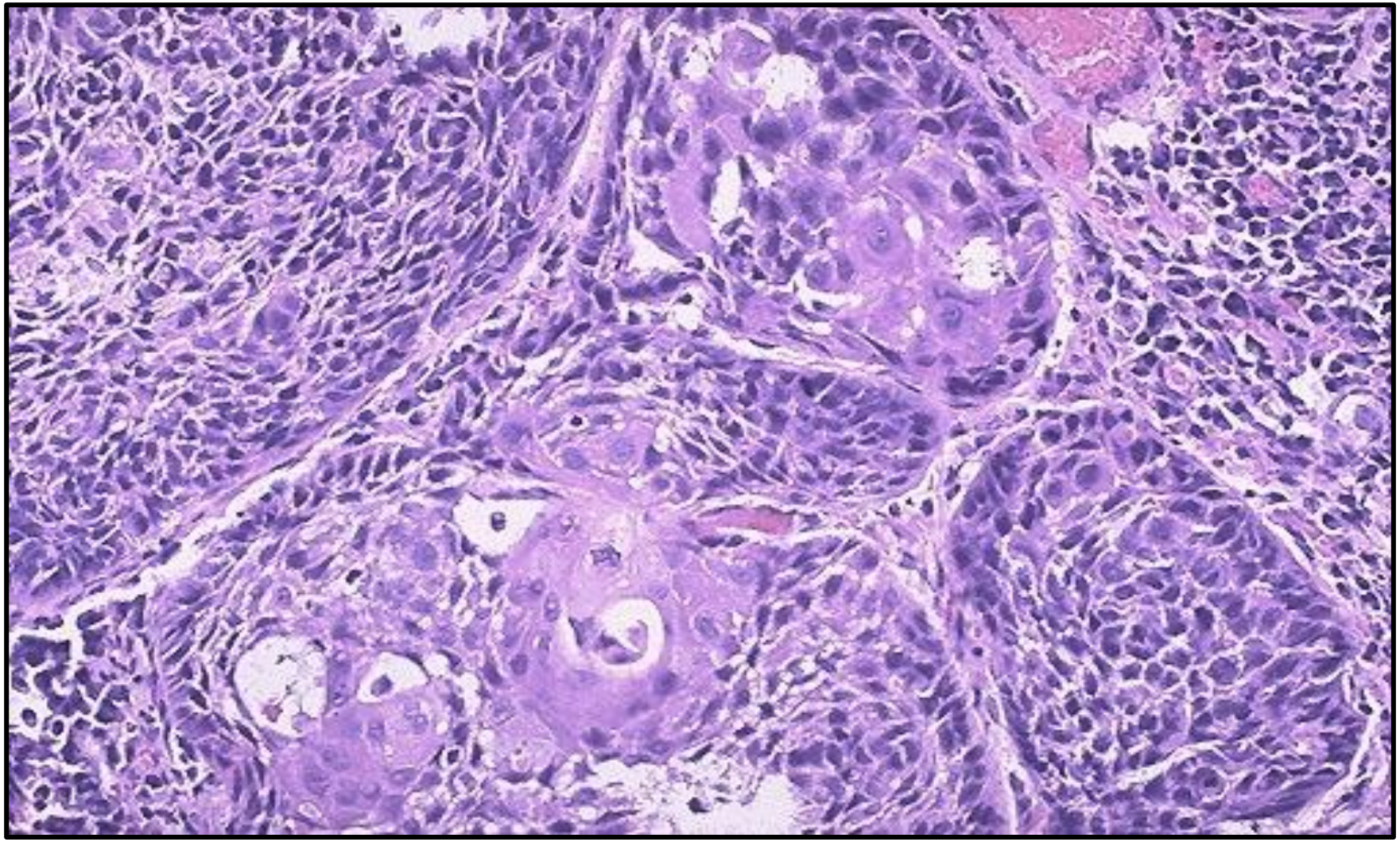
This is a larger squamous cell carcinoma in which a portion of the tumor demonstrates central cavitation, probably because the tumor outgrew its blood supply and undergo central necrosis

Squamous Cell Carcinoma of the Lung – CT scan



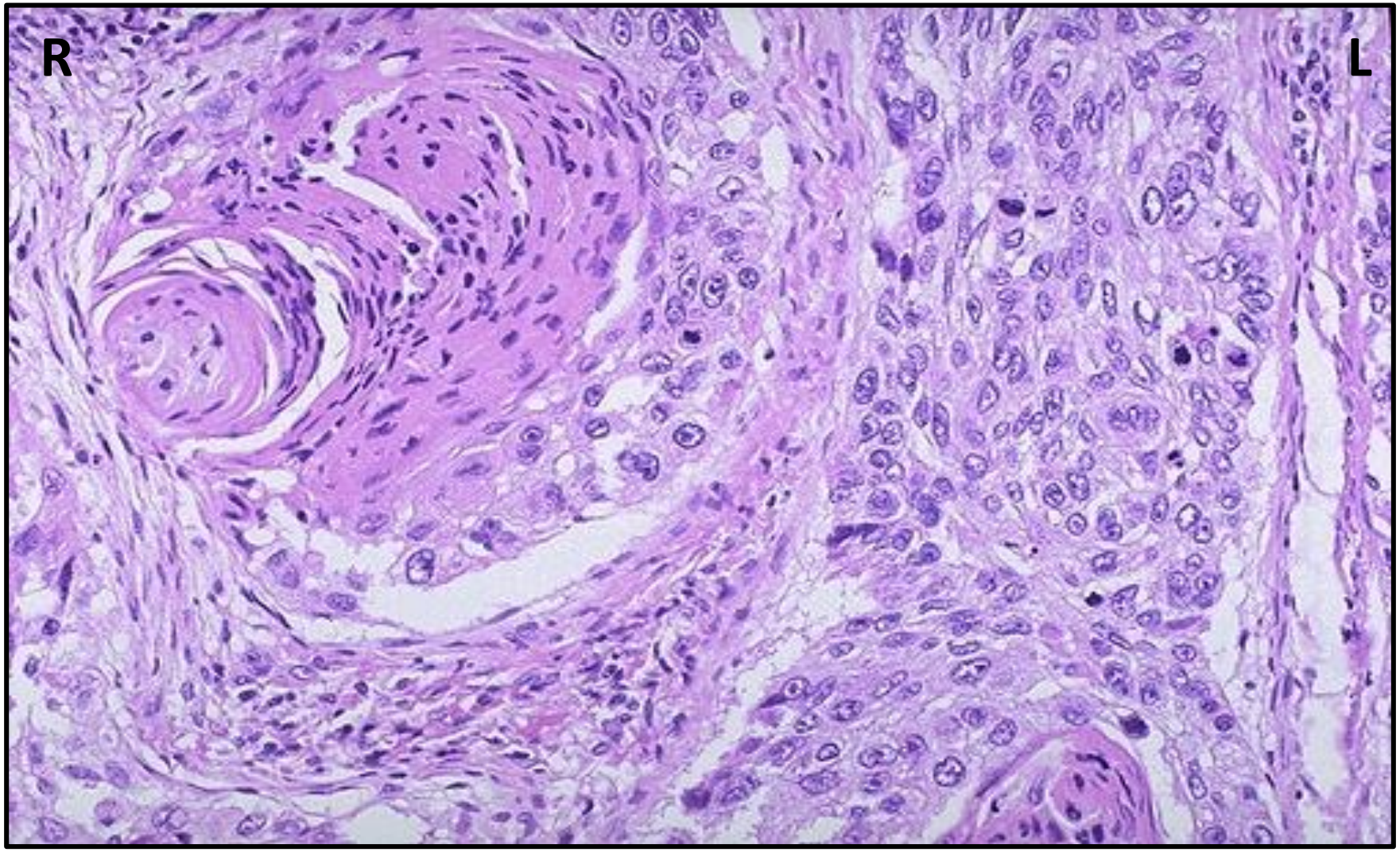
This chest CT scan view demonstrates a large squamous cell carcinoma of the right upper lobe that extends around the right main bronchus and also invades into the mediastinum and involves hilar lymph nodes.

Squamous Cell Carcinoma of the Lung - HPF



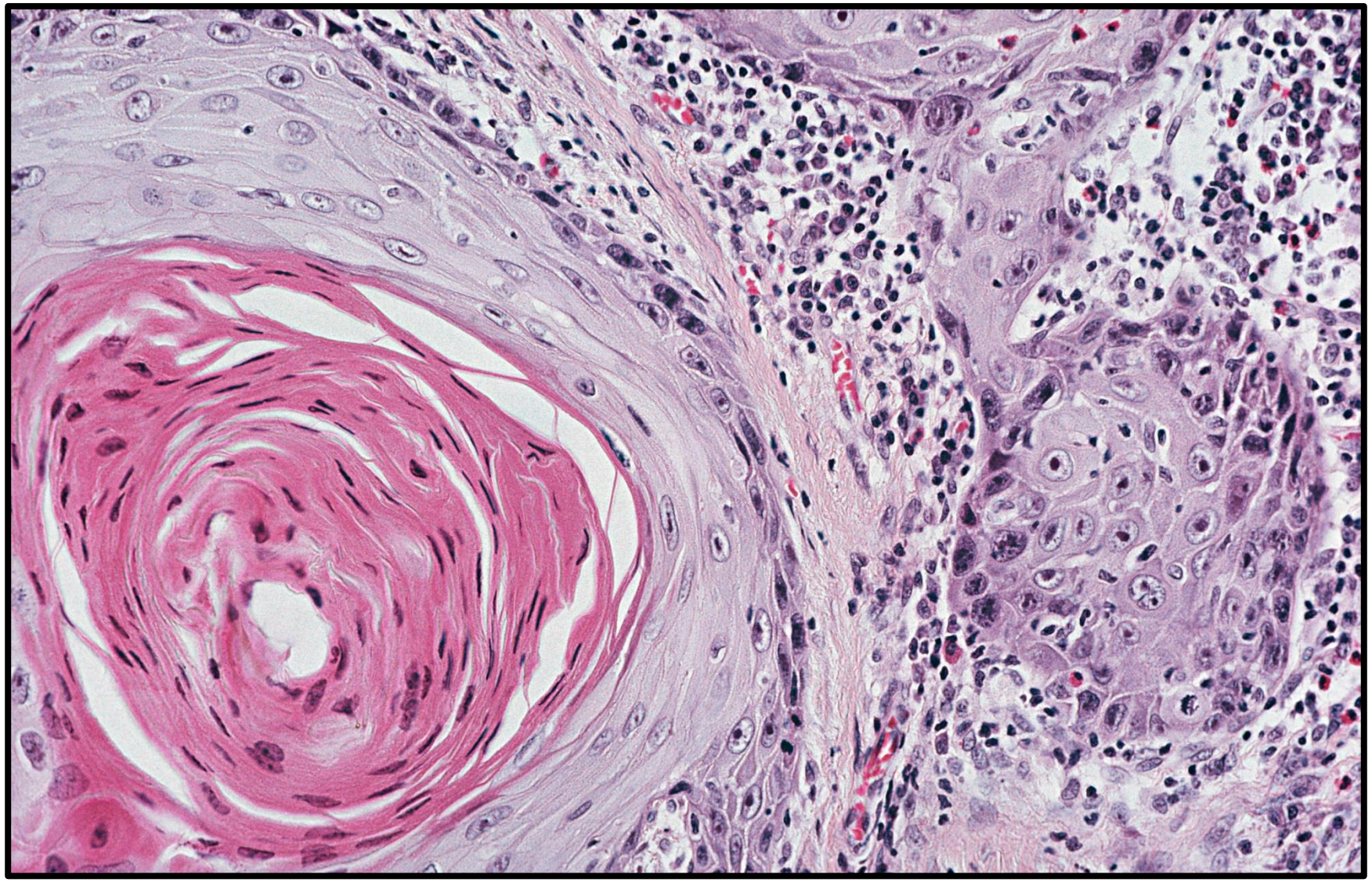
Microscopic appearance of squamous cell carcinoma with nests of polygonal cells with pink cytoplasm and distinct cell borders. The nuclei are hyperchromatic and angular.

Squamous Cell Carcinoma of the Lung - HPF



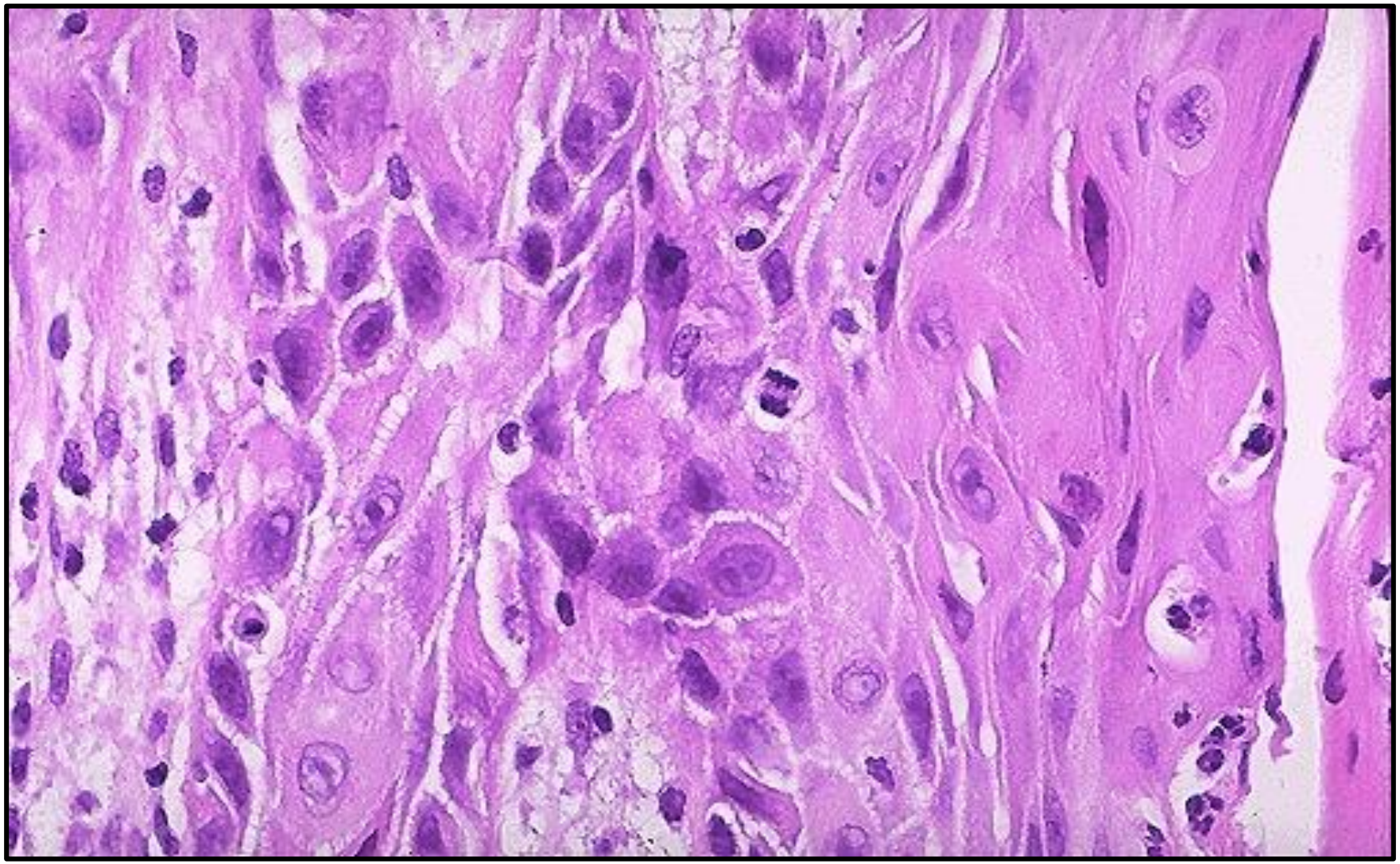
In this squamous cell carcinoma at the upper right is a squamous eddy with a keratin pearl. At the left, the tumor is less differentiated and several dark mitotic figures are seen

Squamous Cell Carcinoma of the Lung - HPF



Neoplastic squamous cells show pleomorphism, hyperchromatism, individual cell keratinization, mitoses and areas of necrosis.

Squamous Cell Carcinoma of the Lung - HPF

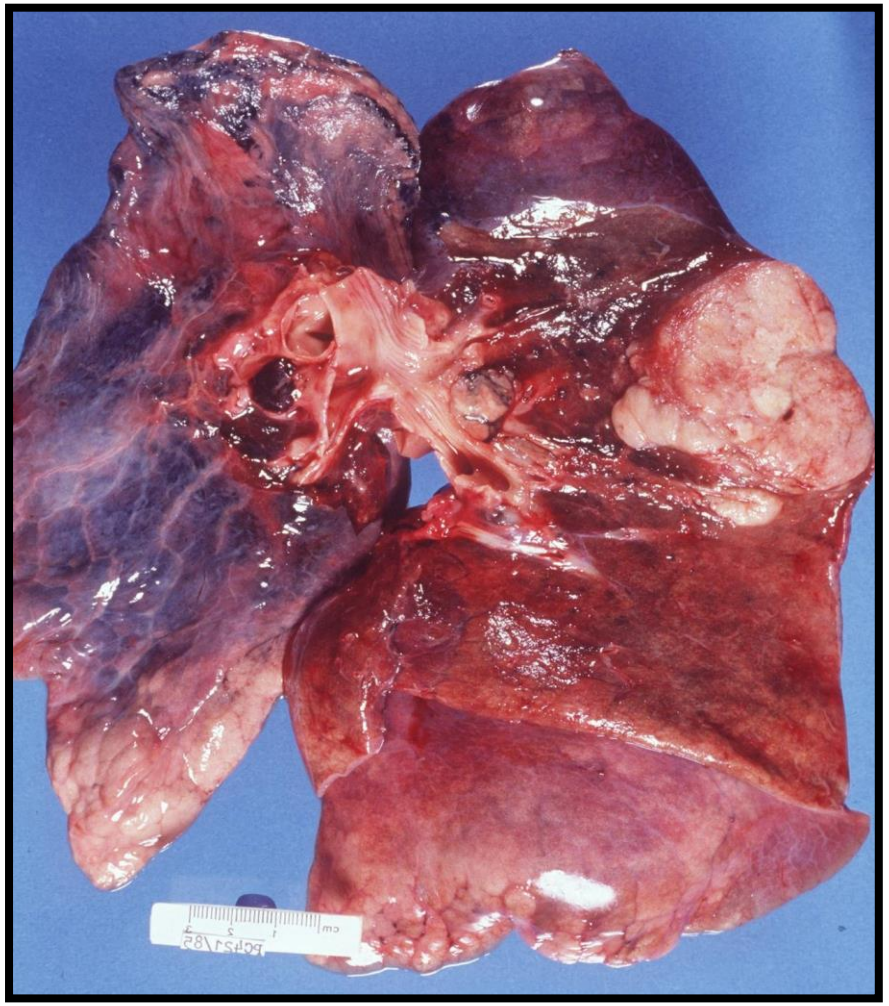


The pink cytoplasm with distinct cell borders and intercellular bridges characteristic for a squamous cell carcinoma of the lung

2. Adenocarcinoma of the lung

- The most common type of lung cancer, making up 30-40% of all cases.
- Glandular differentiation by tumor cells and 80% of those cells produce mucin.
- Not as strongly associated with a smoking history as compared to Squamous or Small Cell Carcinomas
- Adenocarcinoma in situ - called bronchoalveolar carcinoma
- Early and distant metastases
- Adenocarcinoma grow in various patterns, including lepidic , acinar, papillary , micropapillary and solid

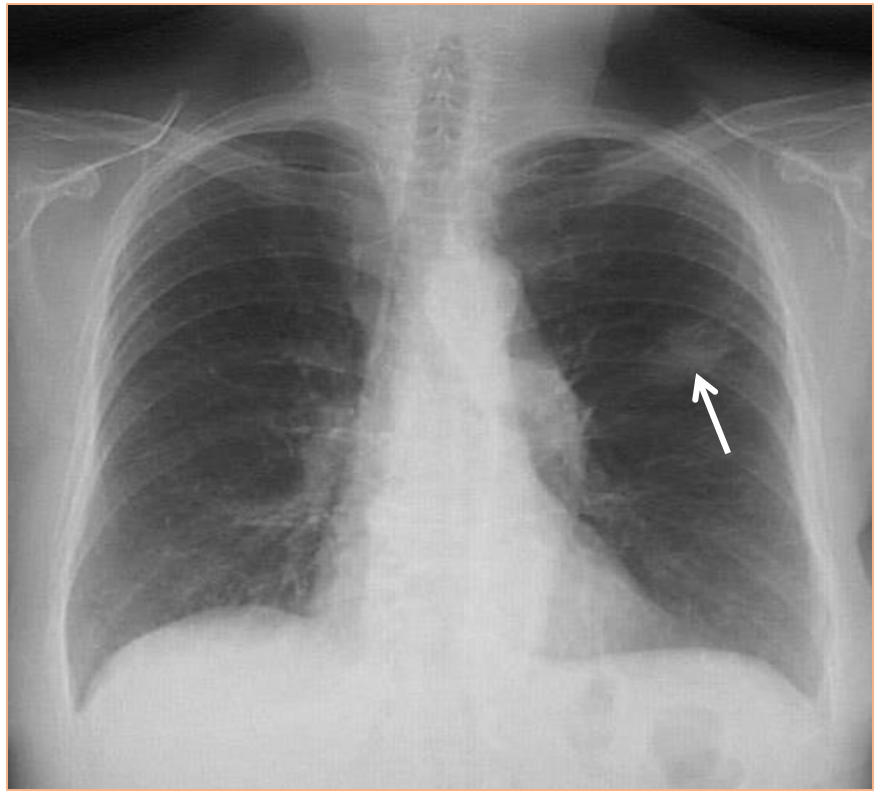
Adenocarcinoma of the Lung – Gross



A peripheral adenocarcinoma of the lung. Adenocarcinomas tend to occur more peripherally in lung. Adenocarcinoma is the one cell type of primary lung tumor that occurs more often in non-smokers and in smokers who have quit.
Grossly: white-tan solitary nodule and peripherally located

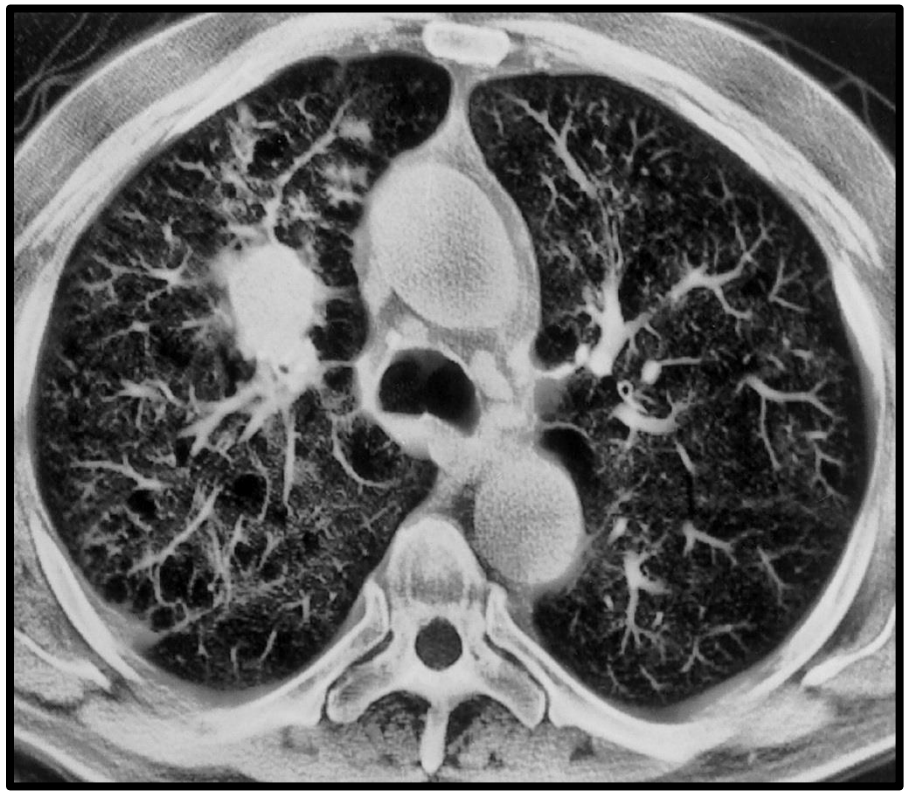
Adenocarcinoma of the Lung

X-Ray



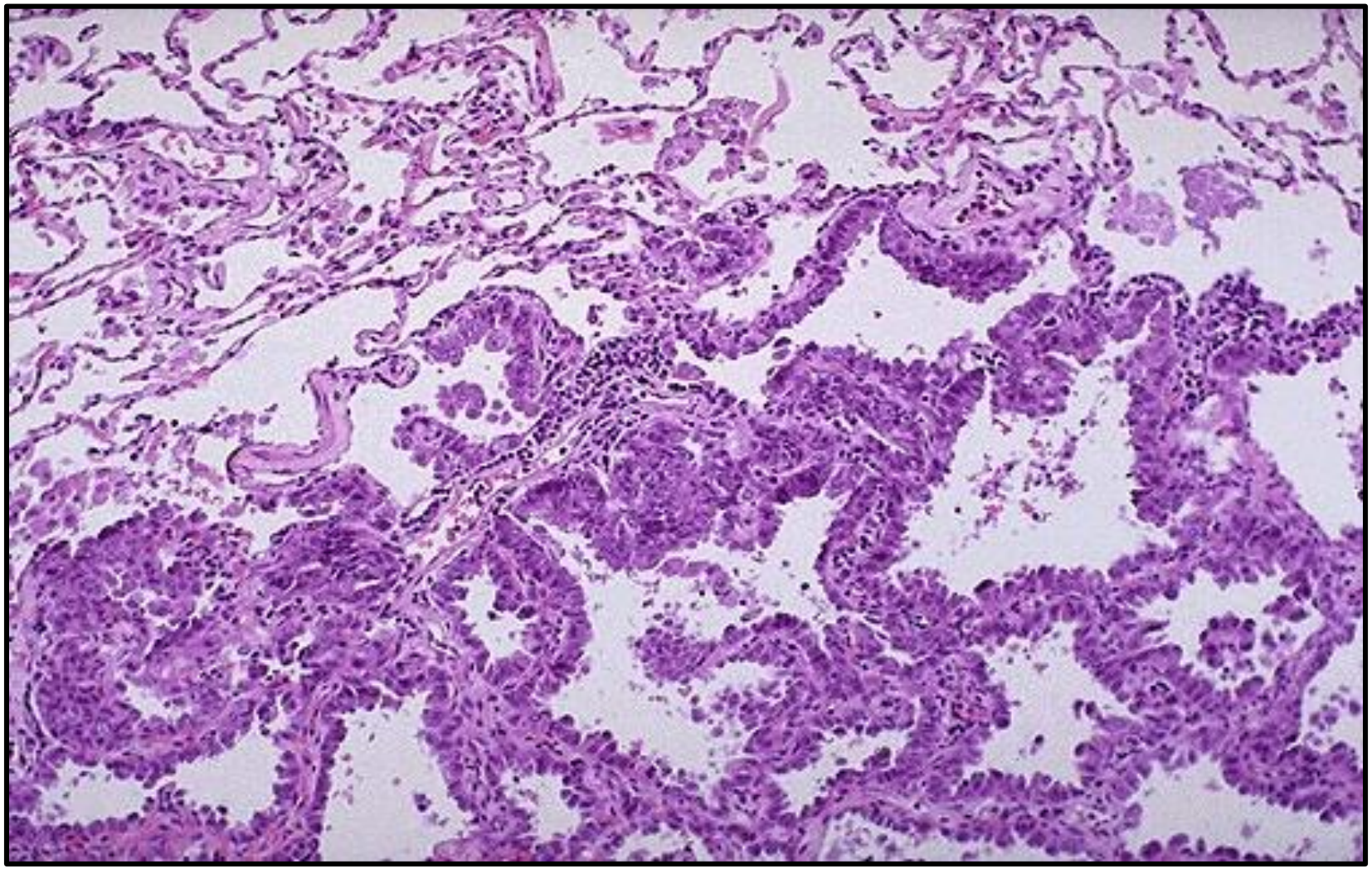
A peripheral adenocarcinoma of the lung appears in this chest radiograph of an elderly non-smoker woman.

CTscan



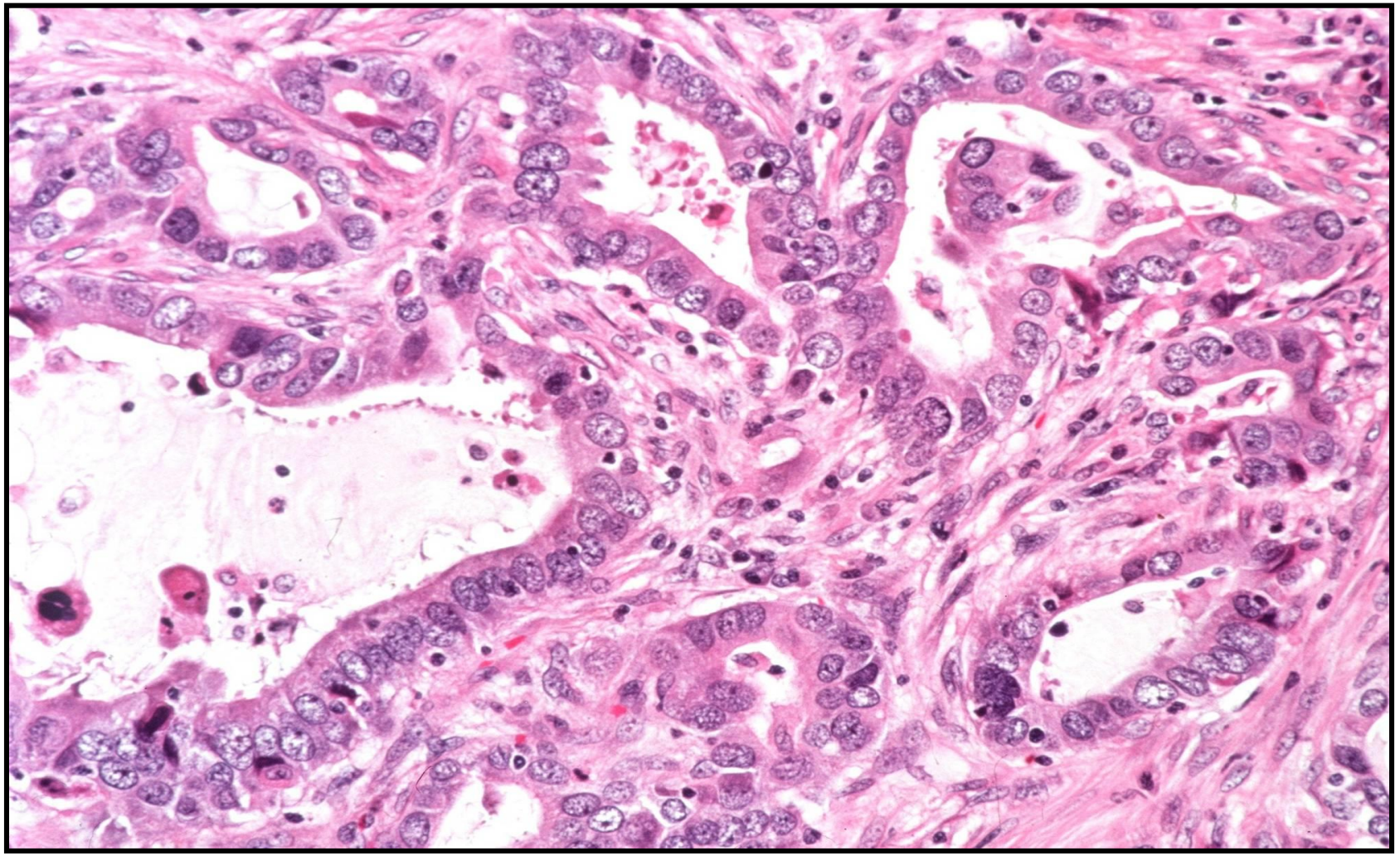
CT scans in a 61-year-old man with adenocarcinoma of the lung

Adenocarcinoma of the Lung – LPF



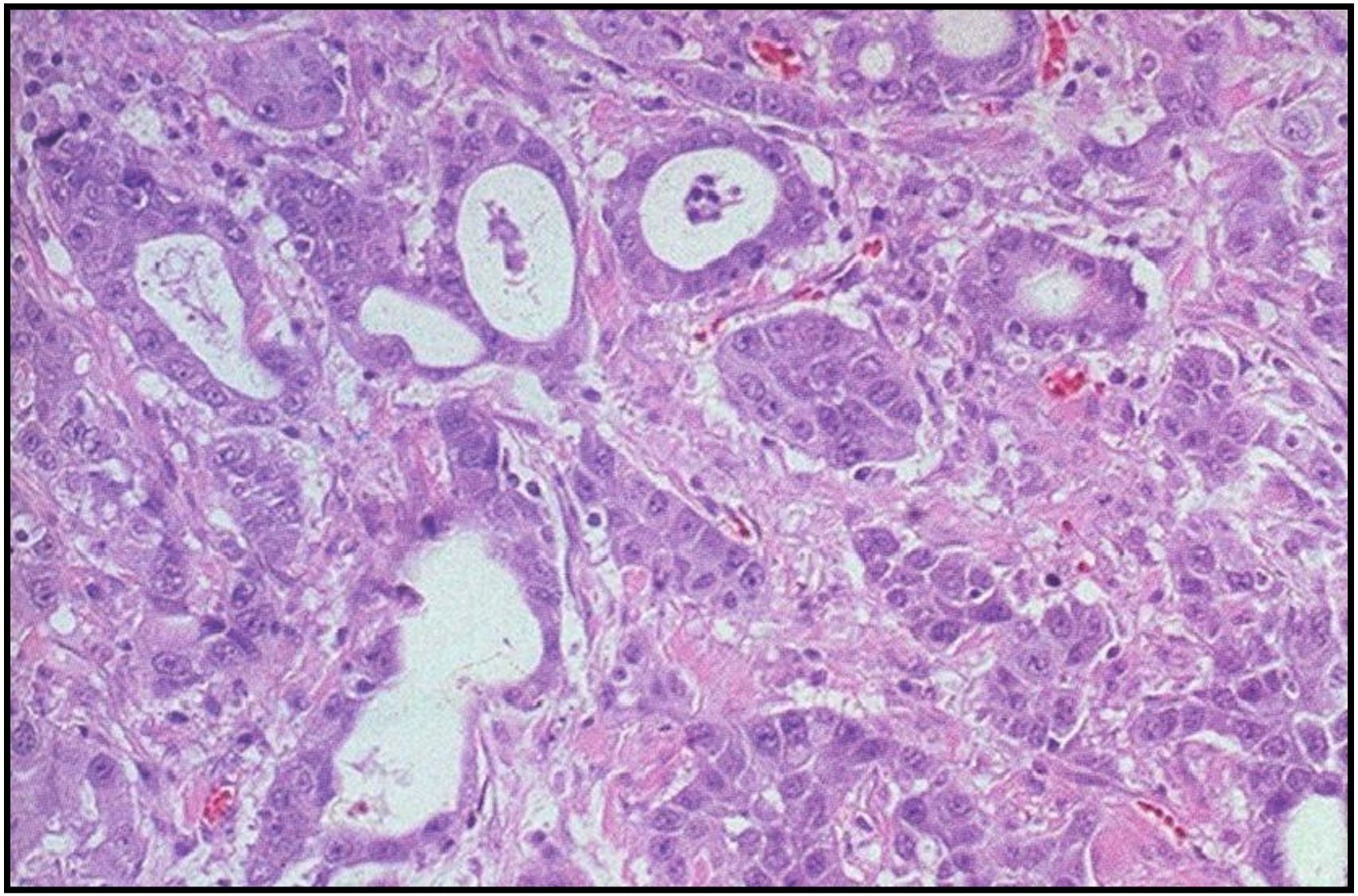
Microscopically, the Adenocarcinoma in Situ (Previously named Bronchioloalveolar Carcinoma) is composed of columnar cells that proliferate along the framework of alveolar septae. The cells are well-differentiated. No evidence of stromal, vascular, or pleural invasion.

Adenocarcinoma of the Lung – HPF



Section of the tumor shows moderately differentiated malignant glands lined by pleomorphic and hyperchromatic malignant cells showing conspicuous nucleoli . Note the presence of tissue desmoplasia around the neoplastic glands .

Adenocarcinoma of the Lung – HPF



Differentiated malignant glands lined by pleomorphic and hyperchromatic malignant cells showing conspicuous nucleoli

3. Large Cell Carcinoma of the lung

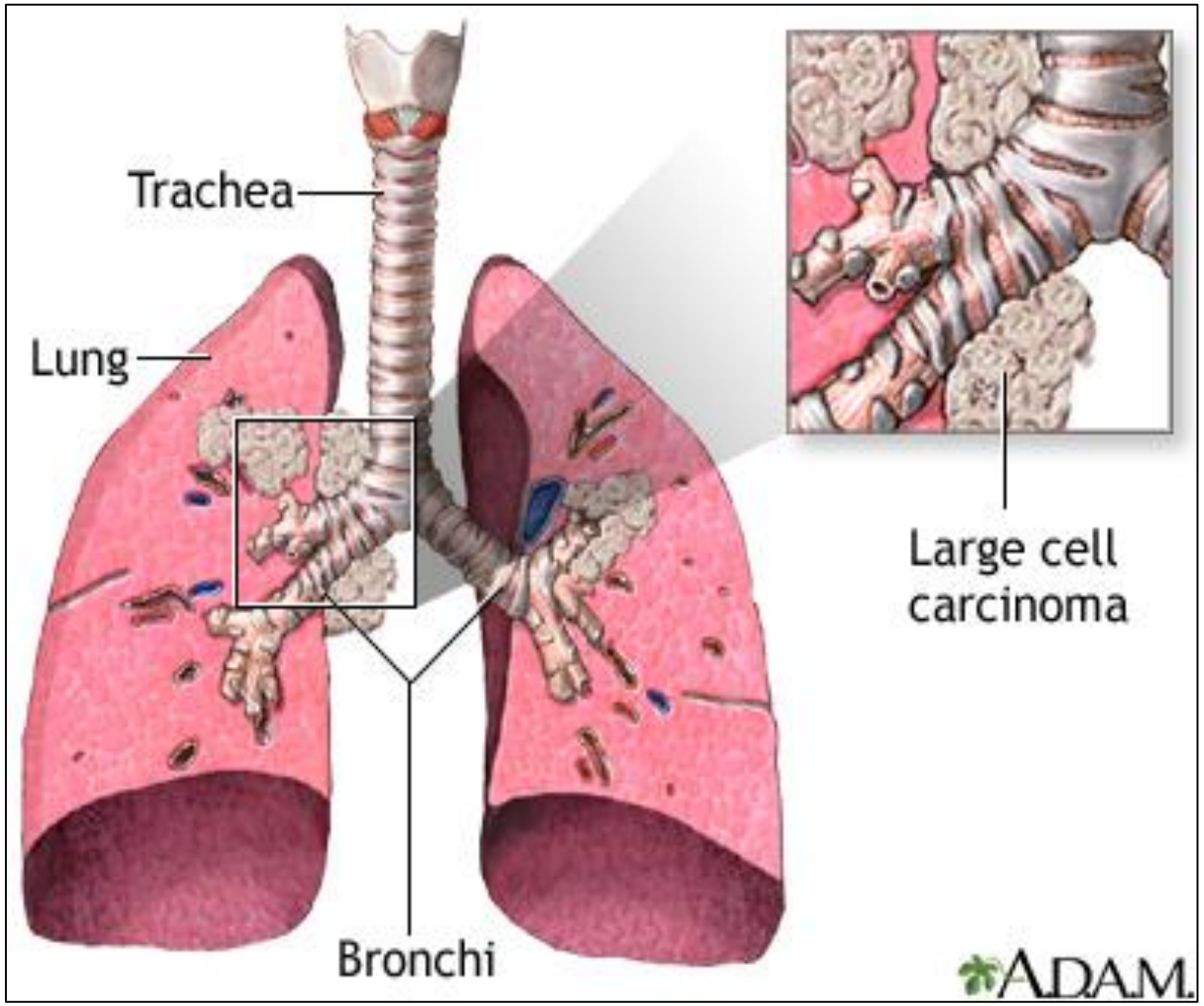
- This is an undifferentiated malignant epithelial tumor that lacks the cytological features of small-cell carcinoma and glandular or squamous differentiation

- They probably represent SCC and ADC
- Other variant of LCC is Large cell neuroendocrine carcinoma

- Pathology:
  1. Large cells, variant in size and shape.
  2. Large nuclei with prominent nucleoli.
  3. Moderate amount of cytoplasm.

- Early and distant metastases, sometimes cavitating.

Large Cell Carcinoma of the Lung – Gross



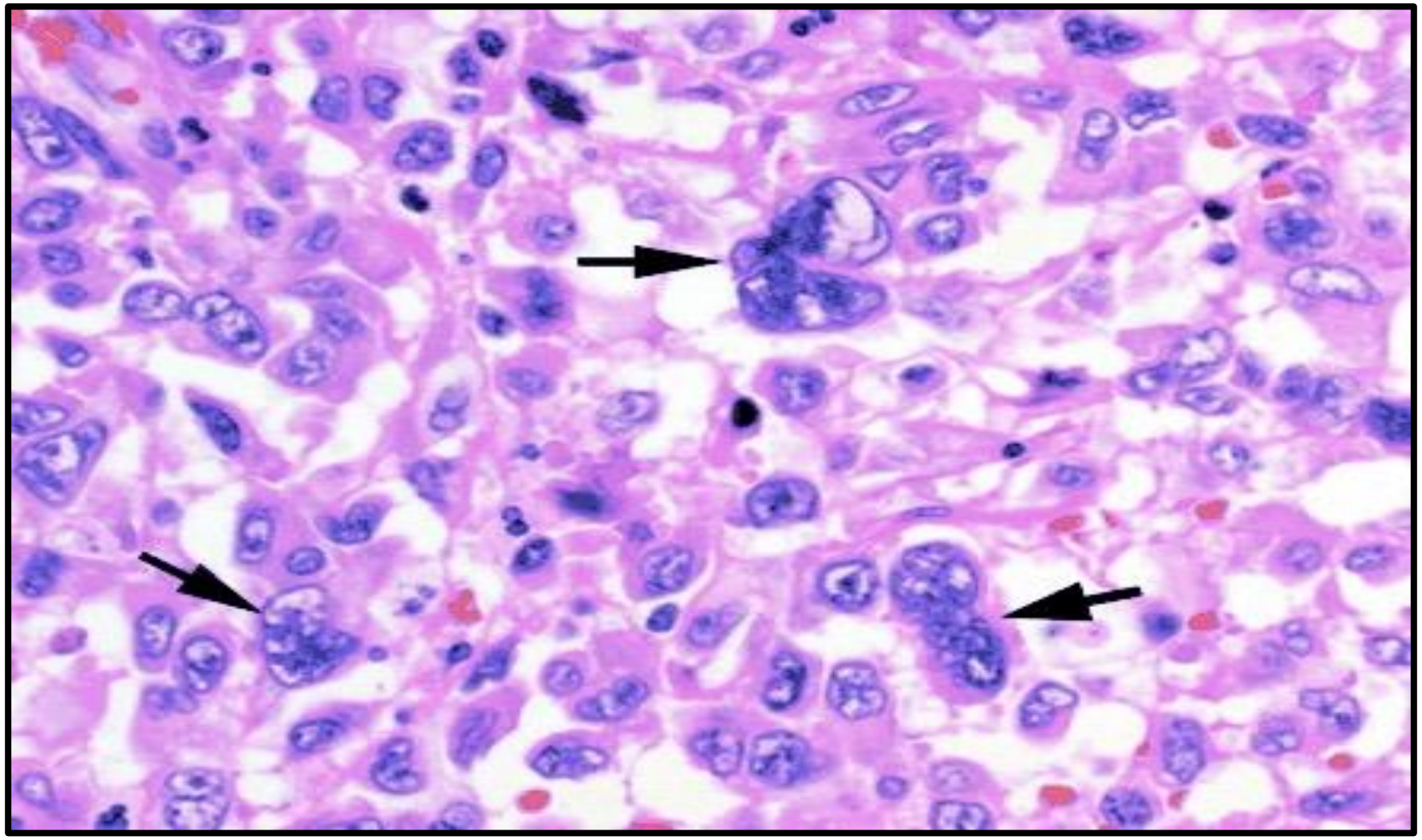
- **Large cell cancer makes up 10% of all cases**
- **LCC tends to grow rapidly and spread more quickly than other type of non small cell of lung cancer**

Undifferentiated Large Cell Carcinoma of the Lung – Gross

This large cell carcinoma at autopsy shows a large multilobulated tumor adjacent to the hilum.

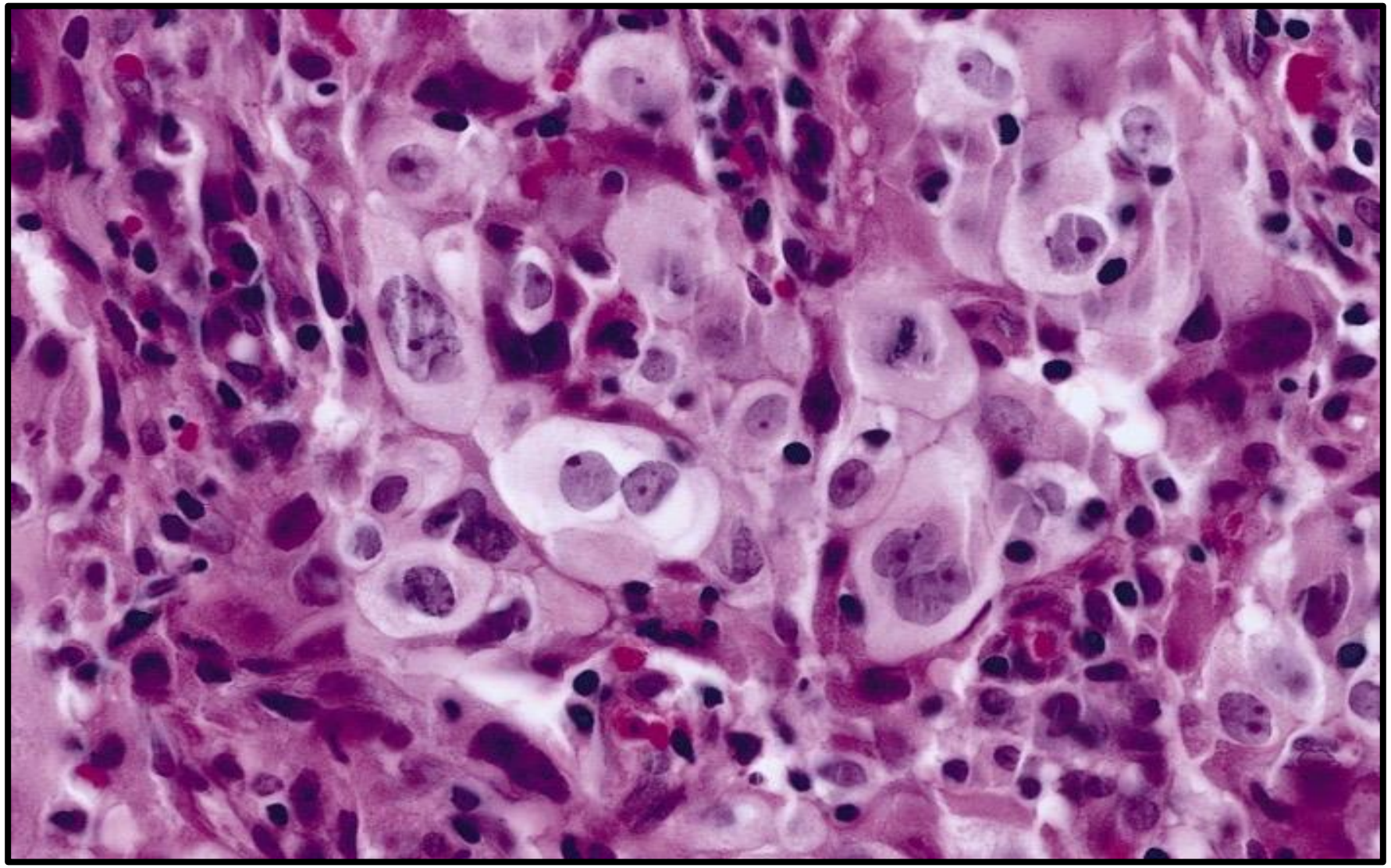
A metastatically involved lymph node is present next to the bronchus.

Large Cell Carcinoma of the Lung – HPF



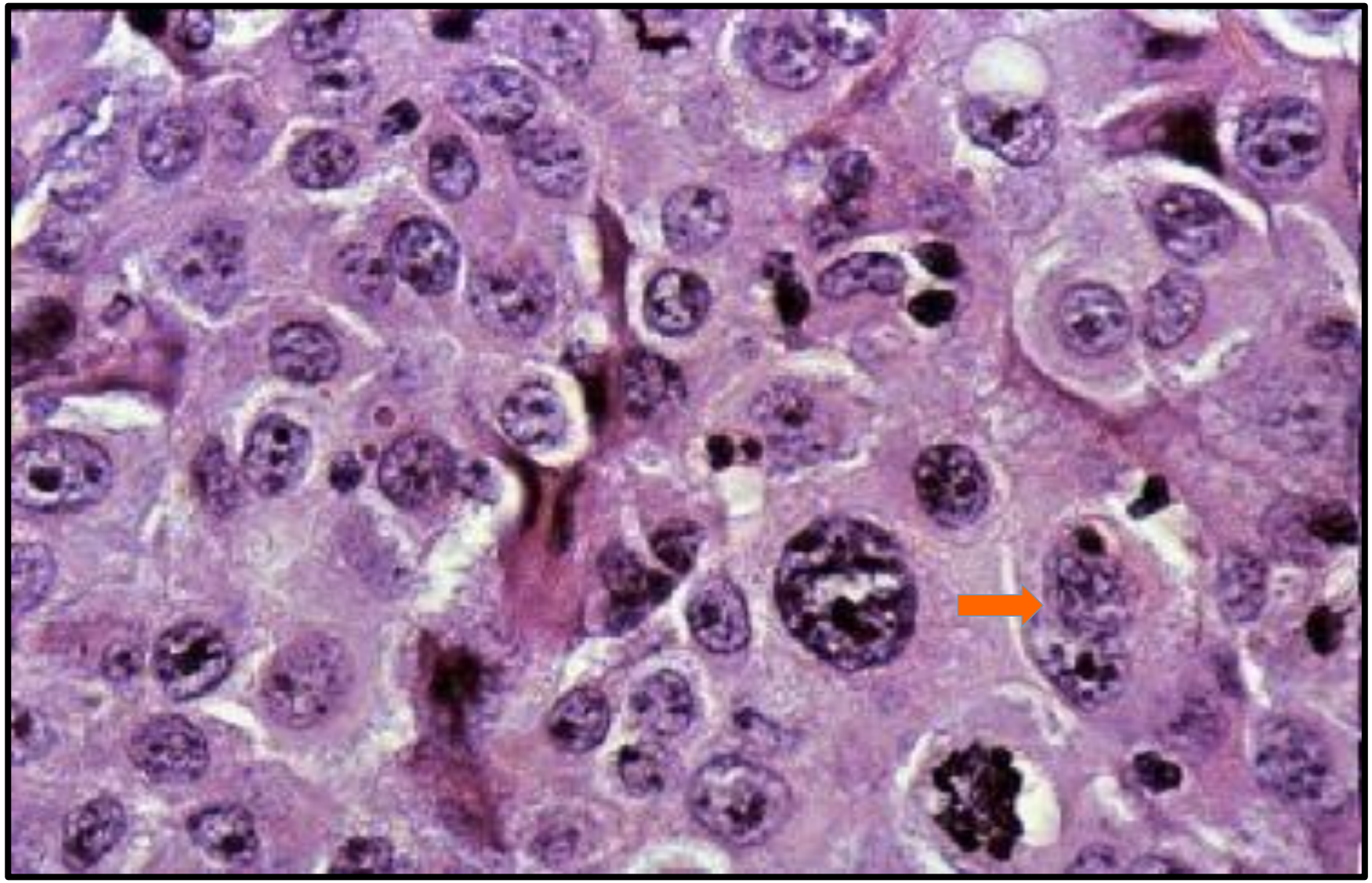
Pleomorphic carcinoma of lung (large cell and giant cell subtype). It shows mixed composition of large cell carcinoma and pleomorphic multinucleated giant cells (arrows). (H and E, ×200)

Large Cell Carcinoma of the Lung – HPF



This section from lower respiratory tract shows neoplastic cells with abundant pale eosinophilic cytoplasm and a surrounding infiltrate of inflammatory cells

Large Cell Carcinoma of the Lung – HPF



This section shows neoplastic cells with abundant pale eosinophilic cytoplasm and pleomorphic multinucleated giant cells

Small cell carcinoma of the lung

- Highly Malignant Tumor with distinctive cell type
- Cells are small, with scant cytoplasm, ill-defined borders, finely granular chromatin (salt & pepper pattern) and absent or inconspicious nucleoli.
- High mitotic count and often extensive necrosis.
- Typically not graded as all SCLC are considered High Grade.
- Very strong relationship with smoking.
- Often lead to paraneoplastic syndromes??

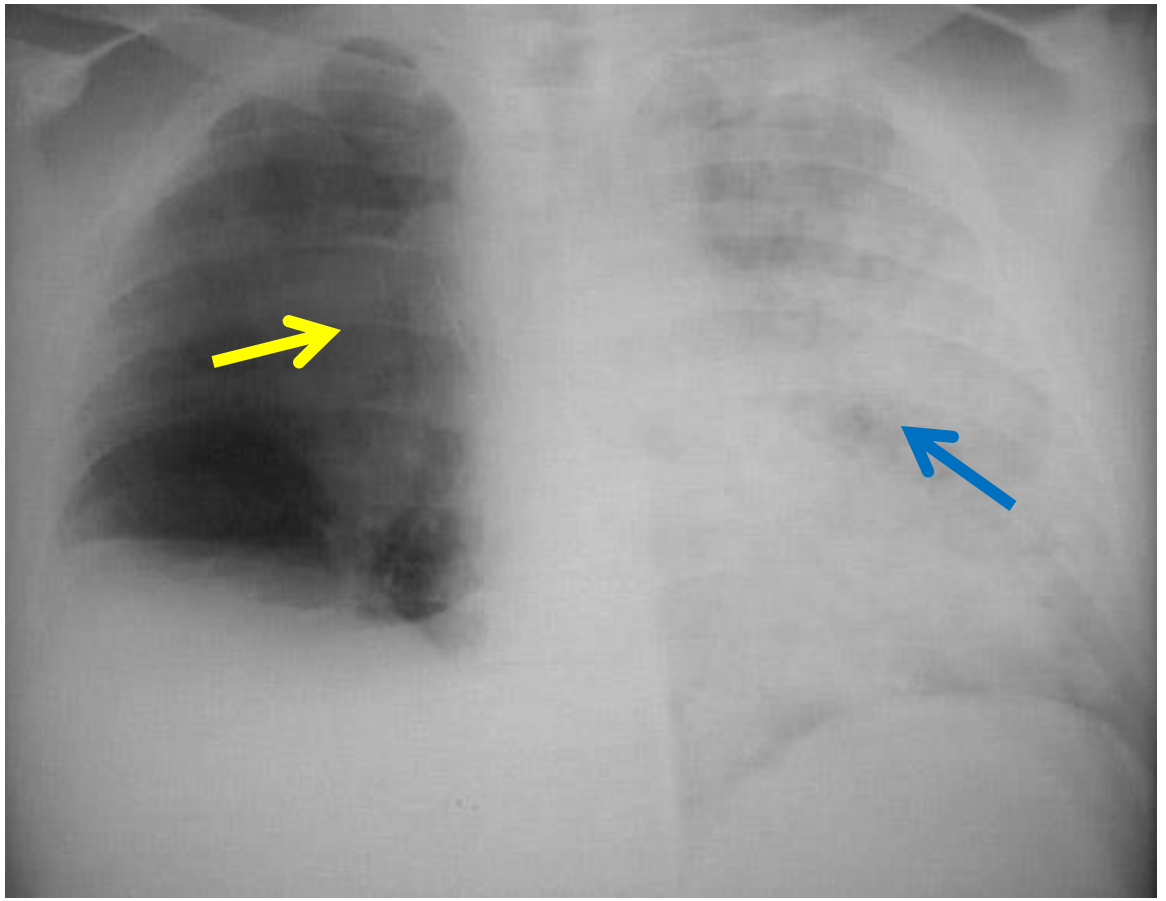
Small Cell Carcinoma of the Lung "Oat cell" – Gross

- *Arising centrally in this lung and spreading extensively is a small cell anaplastic (oat cell) carcinoma.*
- *The cut surface show infiltrating tumor, soft in consistency, lobulated margins and white to tan appearance.*
- *The tumor seen here has caused obstruction of the main bronchus to left lung so that the distal lung is collapsed*

Small Cell Carcinoma of the Lung "Oat cell" – Gross

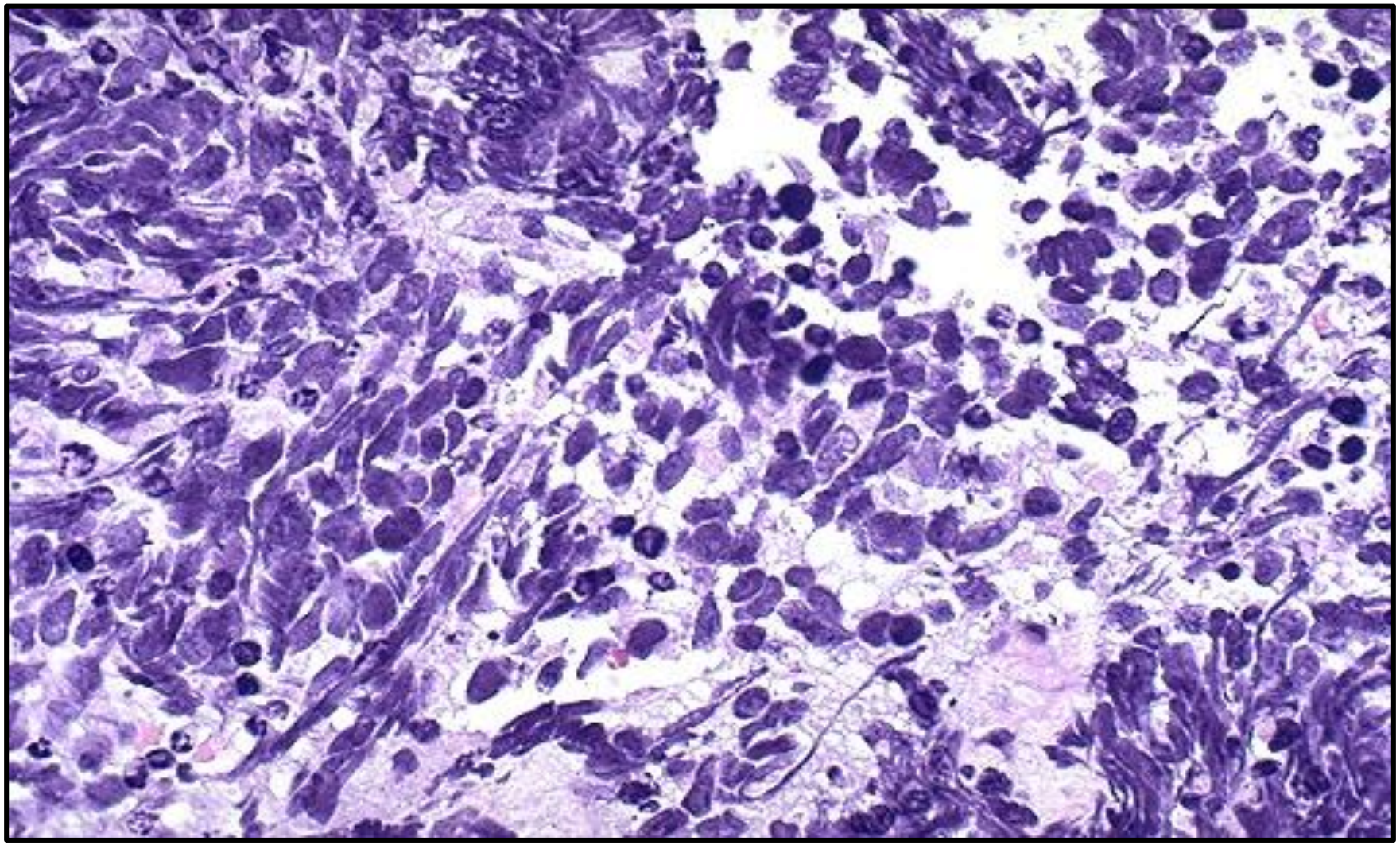
Oat cell carcinoma which is spreading along the bronchi. The speckled black rounded areas represent hilar lymph nodes with metastatic carcinoma

Small Cell Carcinoma of the Lung "Oat cell" : X-Ray



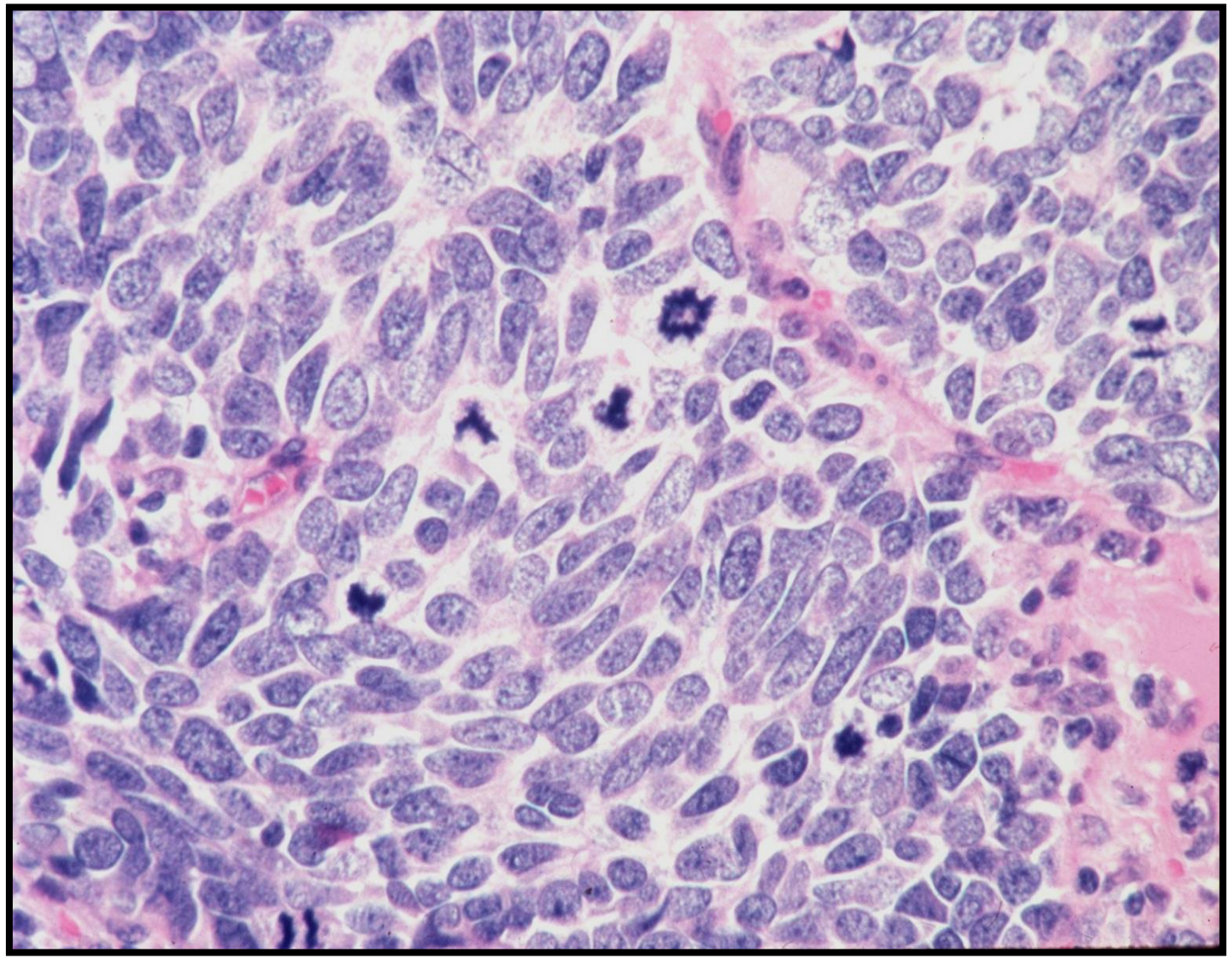
This chest radiograph demonstrates a mass lesion in the right upper lobe. This was an oat cell carcinoma (yellow arrow). It obstructed the right main bronchus, leading to atelectasis on the right, evidenced by a raised right hemidiaphragm. The patient aspirated gastric contents, producing a diffuse pneumonia (blue arrow) on the left (since aspirated material could not pass the obstruction on the right).

Small Cell Carcinoma of the Lung "Oat cell" – HPF



This is the microscopic pattern of a small cell anaplastic (oat cell) carcinoma in which small dark blue cells with minimal cytoplasm are packed together in sheets.

Small cell carcinoma "Oat cell" of the lung - HPF



- Section of the tumor shows clusters of malignant cells which are small , round , oval , or spindle shaped cells
- prominent nuclear molding
- finely granular nuclear chromatin (salt and pepper pattern)
- high mitotic count and focal necrosis

Metastatic tumours of the lung

METASTATIC TUMORS

- LUNG is the MOST COMMON site for all metastatic tumors, regardless of the site of origin.
- The most common cancers that spread to the lung are: breast, colorectal and renal cancer
- Cancer spread to the lungs via blood or lymphatics or by direct continuity
- It is the site of FIRST CHOICE for metastatic sarcomas for purely anatomic reasons !

Metastatic Tumors of the Lung – Gross & X-ray

Multiple variably-sized masses are seen in all lung fields. These tan-white nodules are characteristic for metastatic carcinoma. Metastases to the lungs are more common even than primary lung neoplasms

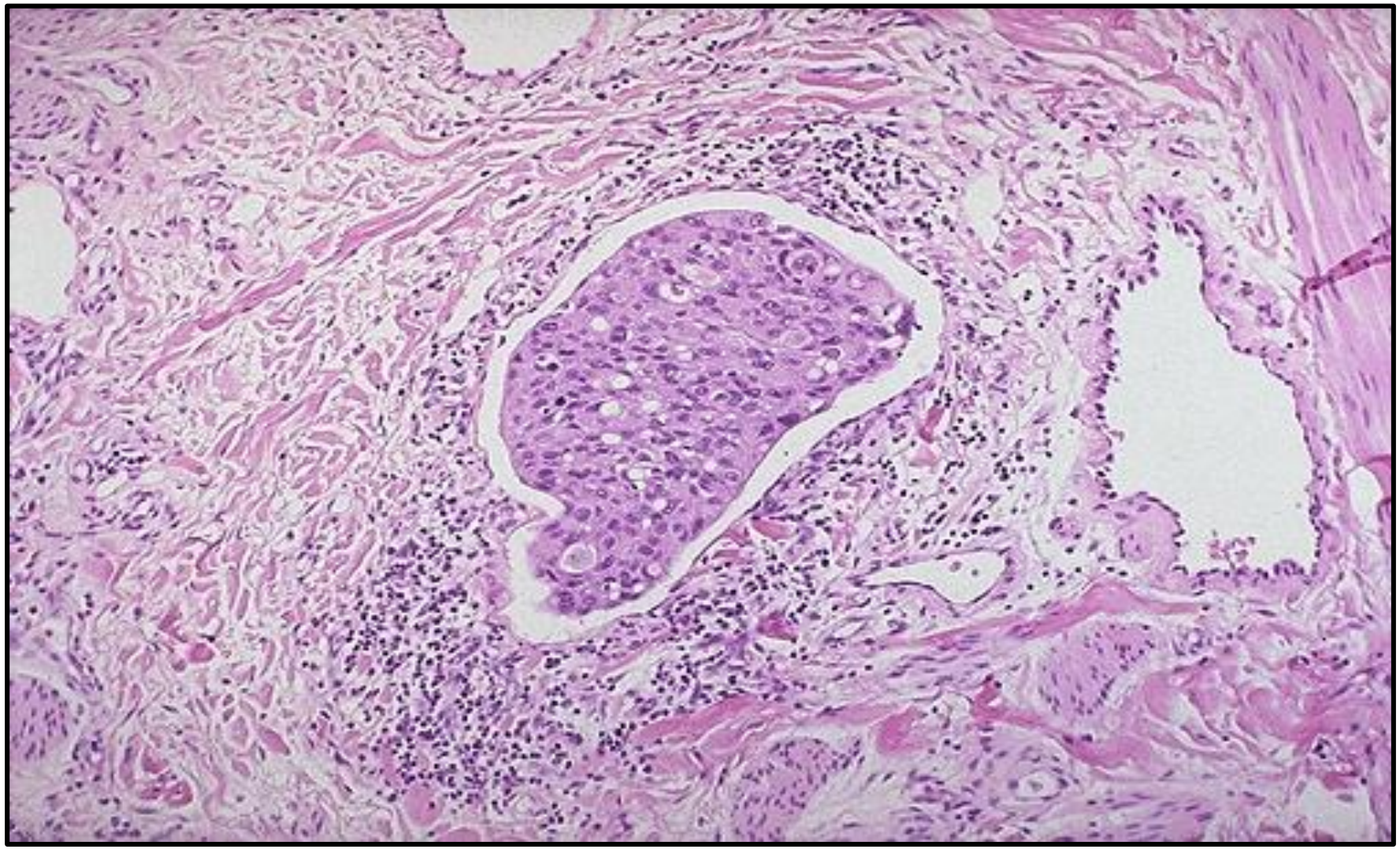
Chest X-ray showing multiple cannon ball opacities in both lung fields.

Metastatic Tumors of the Lung – Gross & CT scan

Here are larger but still variably-sized nodules of metastatic carcinoma in lung.

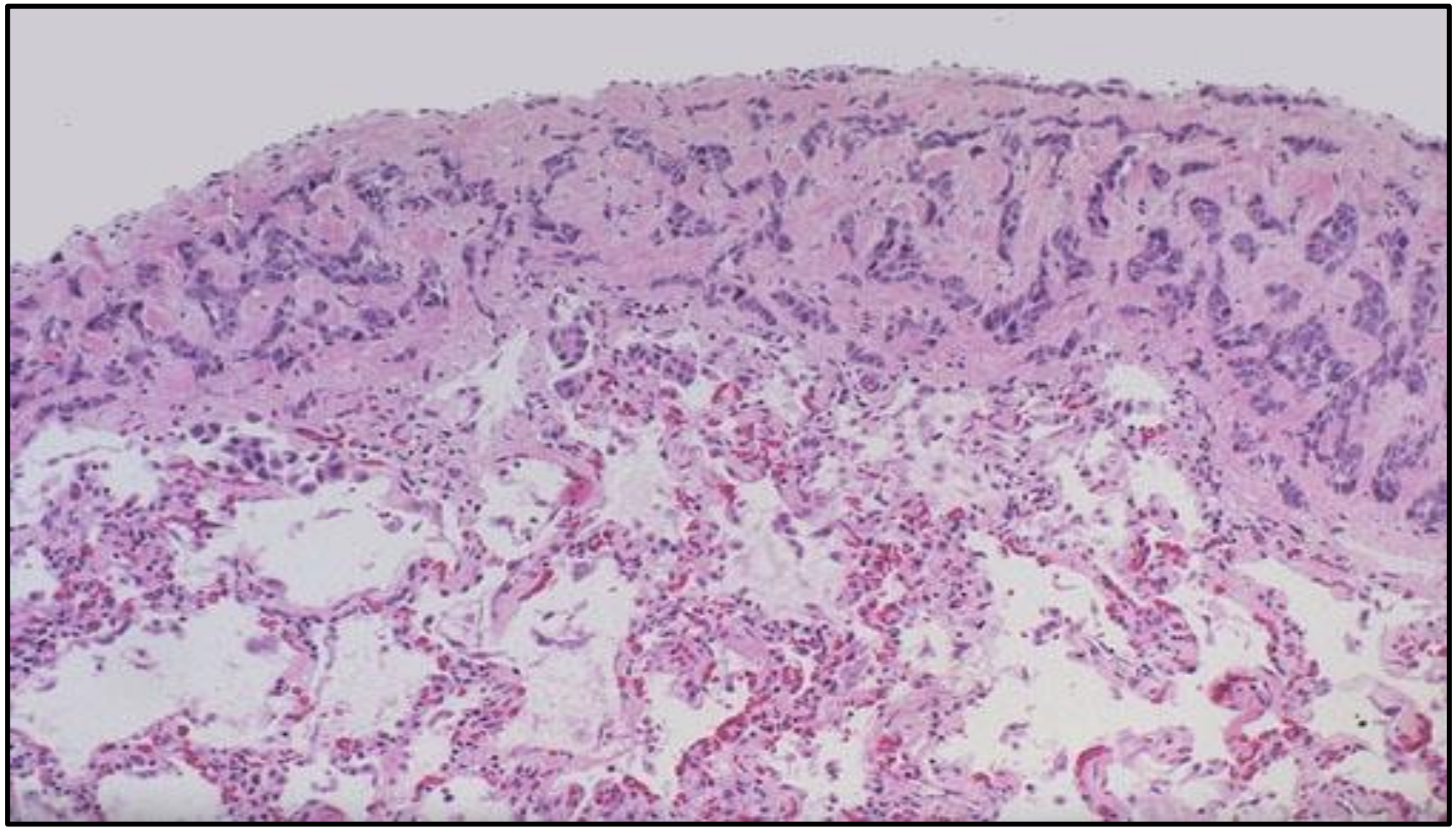
CT Lung shows Cannonball Metastases- large, hematogenously spread metastatic lesions in the lungs of varying sizes most often from colon, breast, renal, thyroid primaries

Metastatic Tumors of the Lung – LPF



A nest of metastatic infiltrating ductal carcinoma from breast is seen in a dilated lymphatic channel in the lung. Carcinomas often metastasize via lymphatics.

Metastatic Tumors of the Lung – LPF



A focus of metastatic carcinoma from breast is seen on the pleural surface of the lung. Such pleural metastases may lead to pleural effusions, including hemorrhagic effusions, and pleural fluid cytology can often reveal the malignant cells

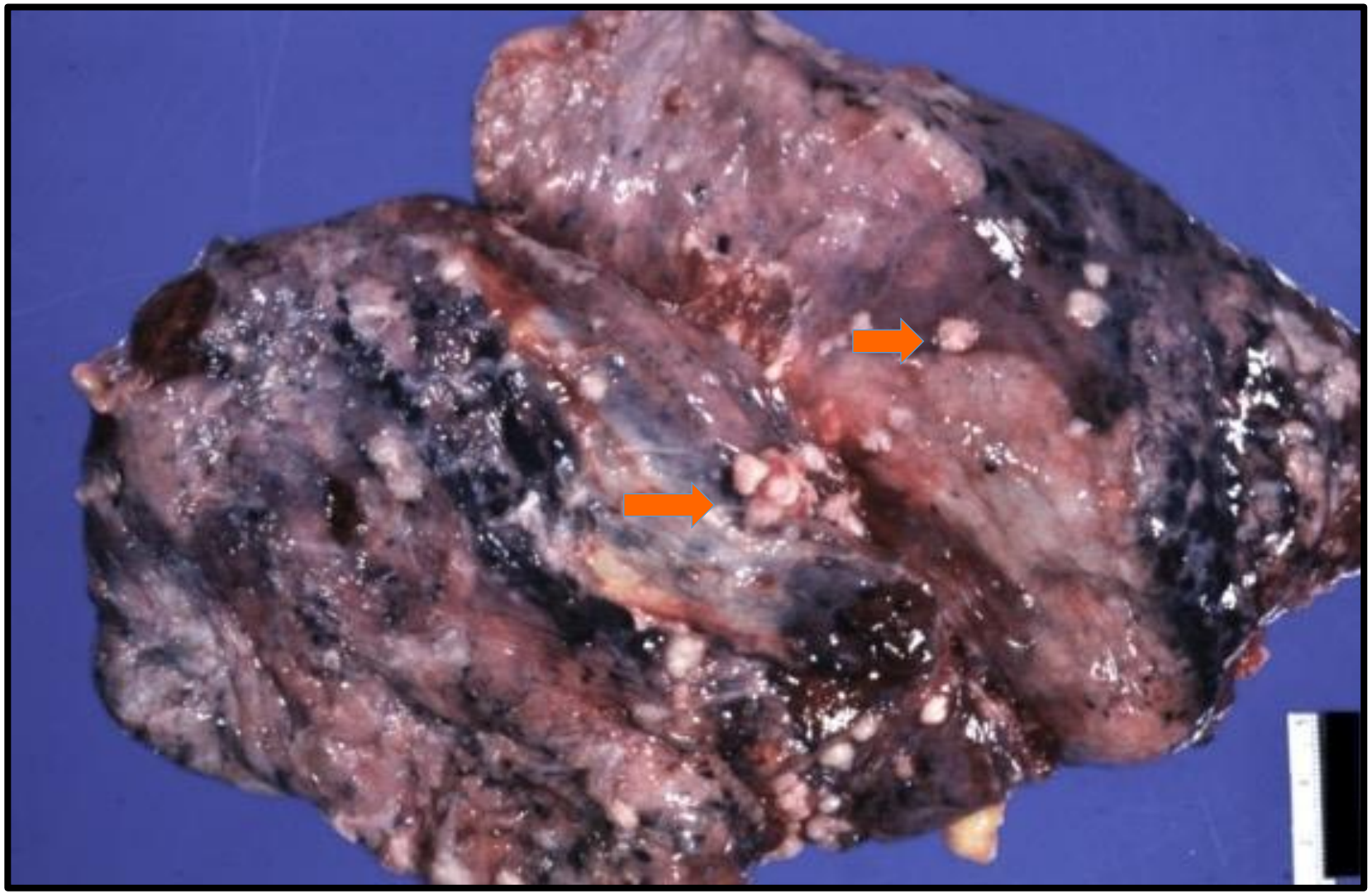
Mesothelioma of the lung

- Malignant pleural mesothelioma is a rare, aggressive cancer that develops in the pleura, a thin layer of tissue surrounding the lungs.
- Inhaling microscopic asbestos fibers is the primary cause of mesothelioma

Mesothelioma of the Lung – Gross

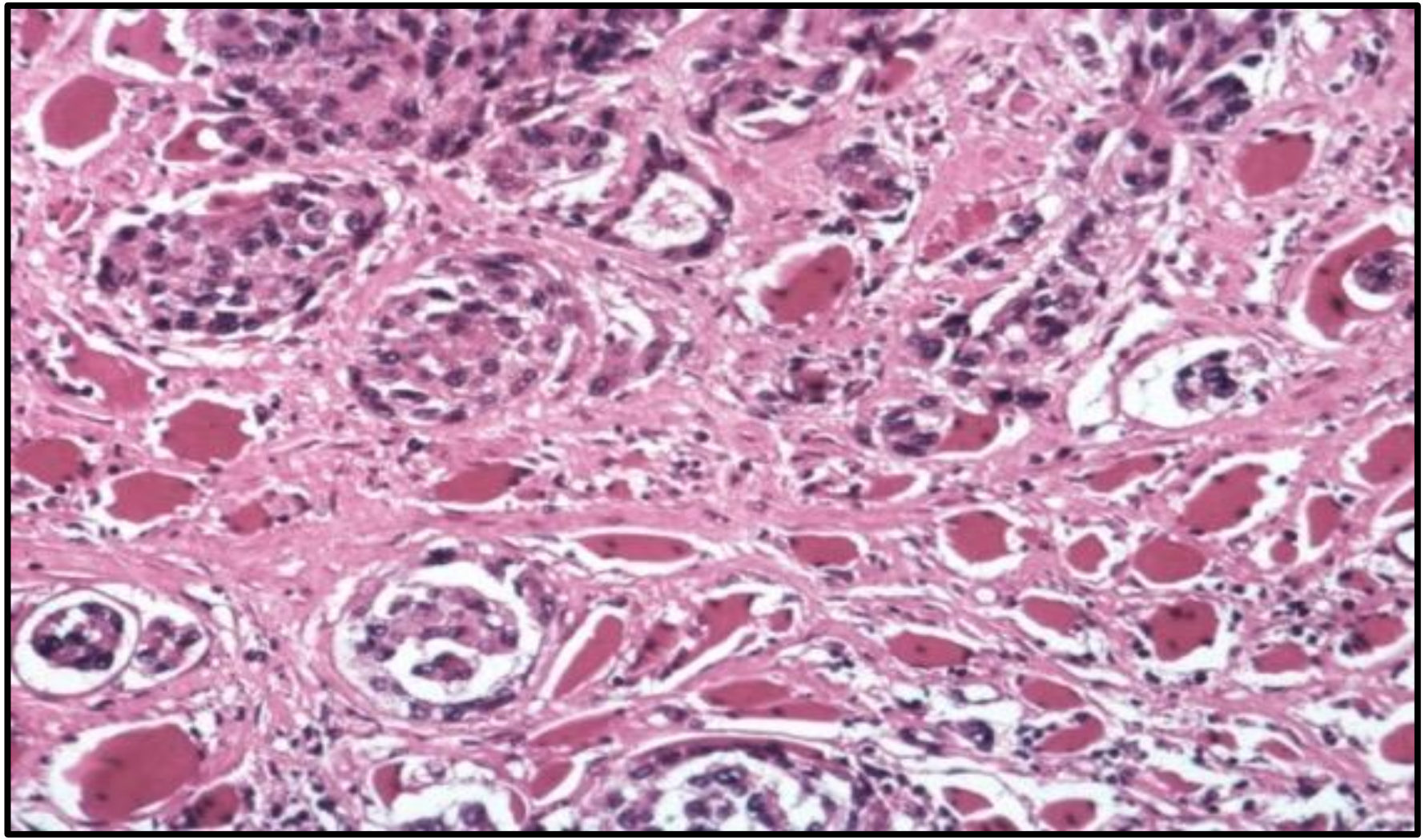
The dense white encircling tumor mass is arising from the visceral pleura and is a mesothelioma. These are big bulky tumors that can fill the chest cavity. The risk factor for mesothelioma is asbestos exposure.

Mesothelioma of the Lung – Gross



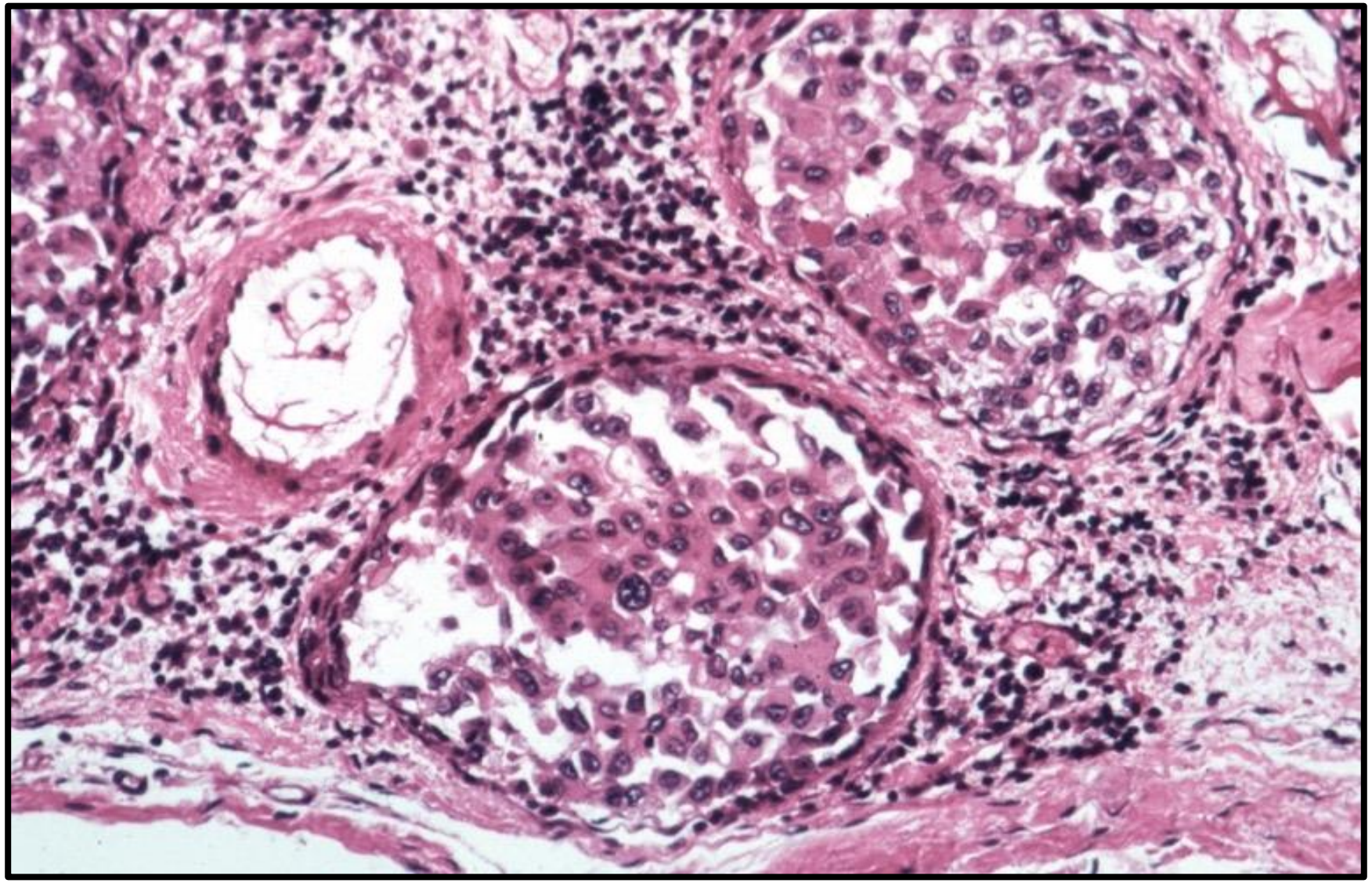
RESPIRATORY: Pleura: Mesothelioma: Gross natural color external view of lung with nodules of tumor on pleura

Mesothelioma of the Lung – MPF



Mesotheliomas have either spindle cells or plump rounded cells forming gland-like configurations, as seen here at high power microscopically. They are very difficult to diagnose cytologically.

Mesothelioma of the Lung – HPF



Mesothelioma: Micro epithelial pattern plump rounded cells forming gland-like configurations