

Lung Cytology: Lessons Learned from Errors in Practice

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Overview

- Cases in which medical error occurred
- Root cause analysis showed cognitive and technical components
- Cognitive components reflected biases secondary to criteria and pattern recognition issues

Overview

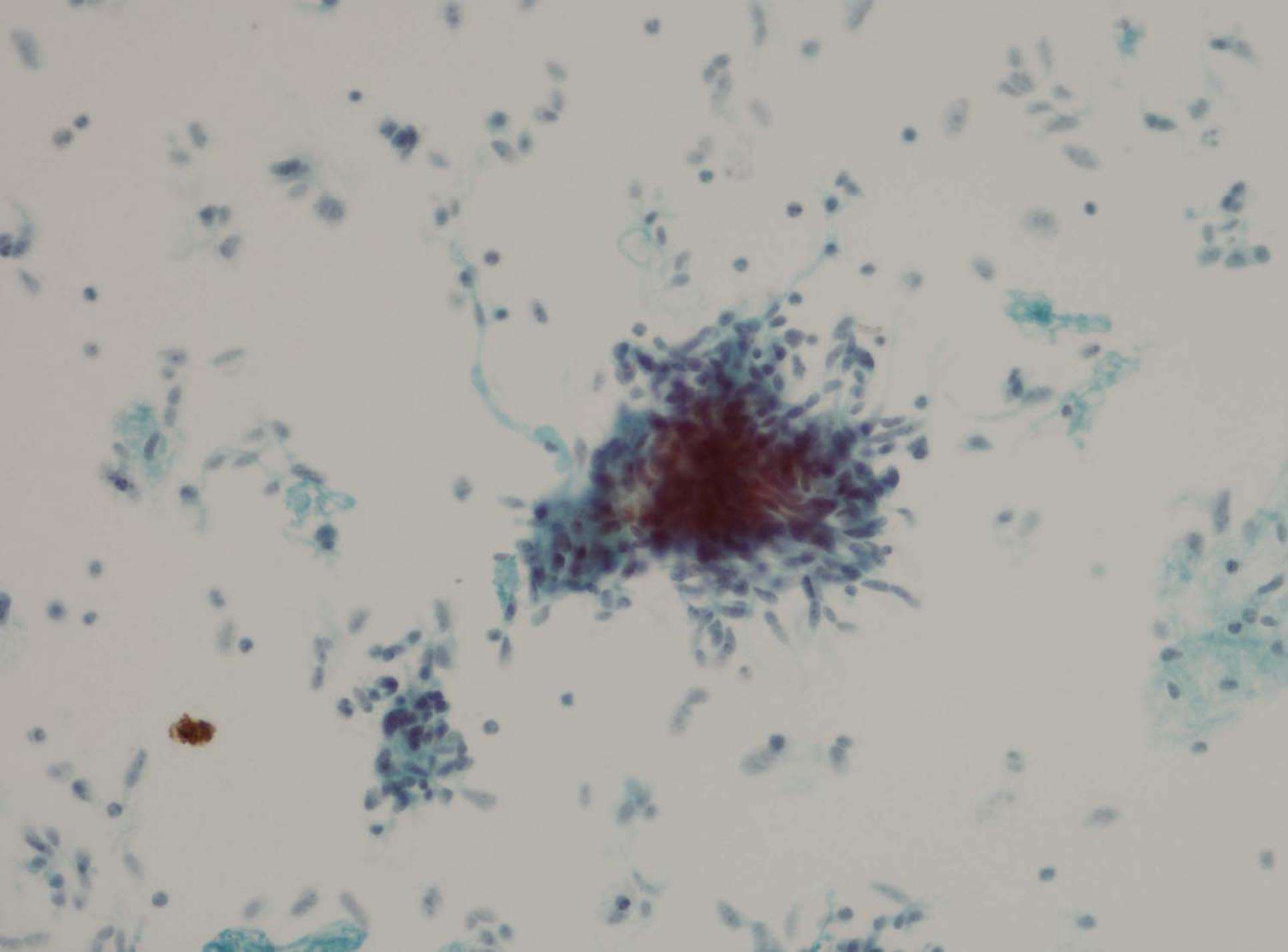
- Thinking Fast and Slow (Daniel Kahneman)
- Pattern recognition versus slower, rational thought
- Heuristics
 - Mental shortcut
 - Pattern of thinking that allows for quick action

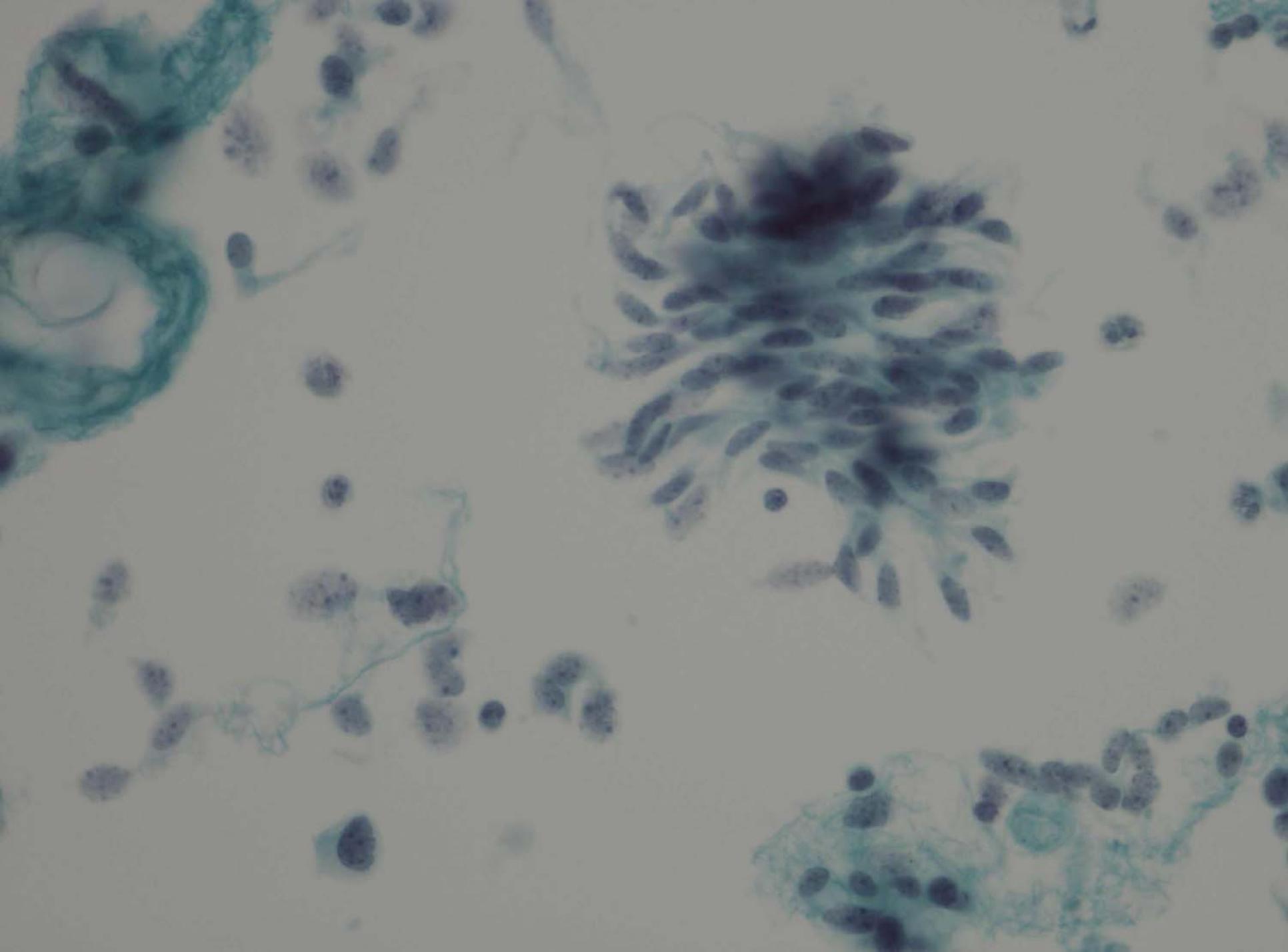
Overview

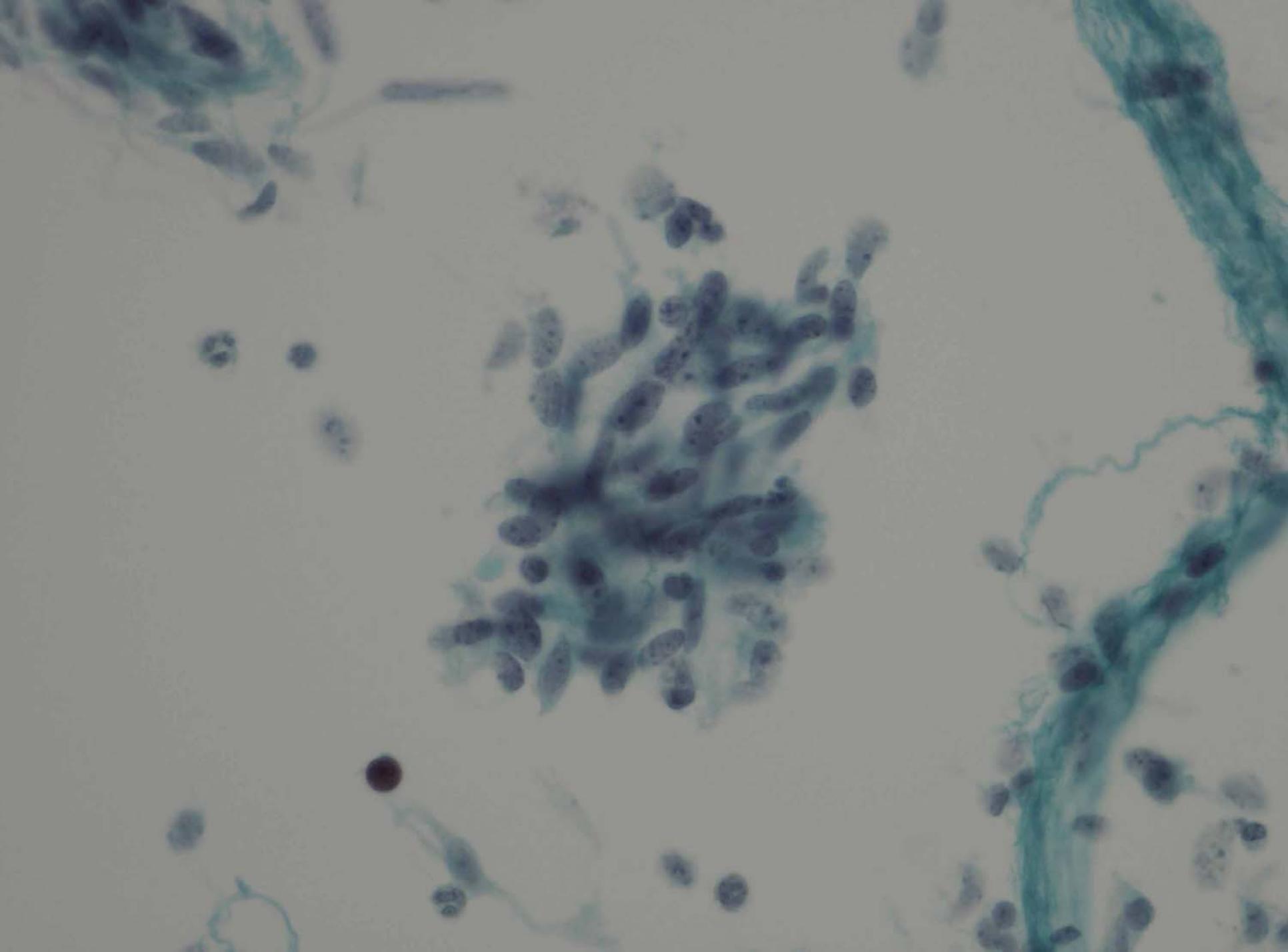
- Recognize cytologic criteria
- Name three criteria for each case
- Recognize patterns of criteria and biases that relate to pattern recognition

Case 1

- The patient is a 45 year old man who presented with a two week history of cough
- Radiologic studies showed a 2.2 peripherally based mass
- A fine needle aspiration was performed







Case 1

- Original diagnosis: Spindle cell neoplasm, favor fibrous tumor of the pleura versus a malignant mesothelioma
- Immunohistochemical studies were not performed as little tissue was present on a cell block
- Three months later, a follow-up chest CT for pre-surgical staging showed mediastinal adenopathy

Case 1

■ Criteria

- Spindle cells
- Uniform nuclei
- Granular chromatin

■ Patterns

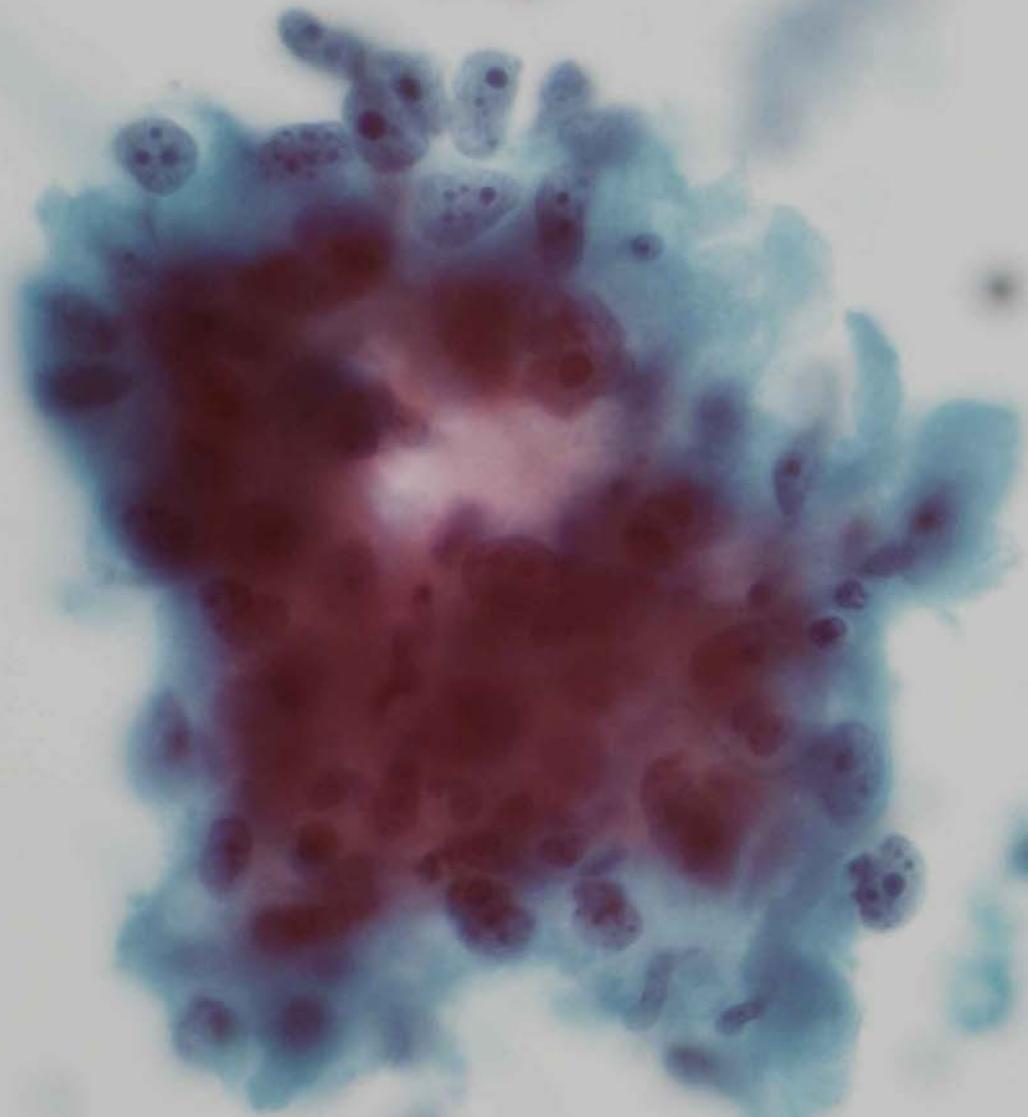
- Stromal lesion, mesothelial lesion, epithelial lesion

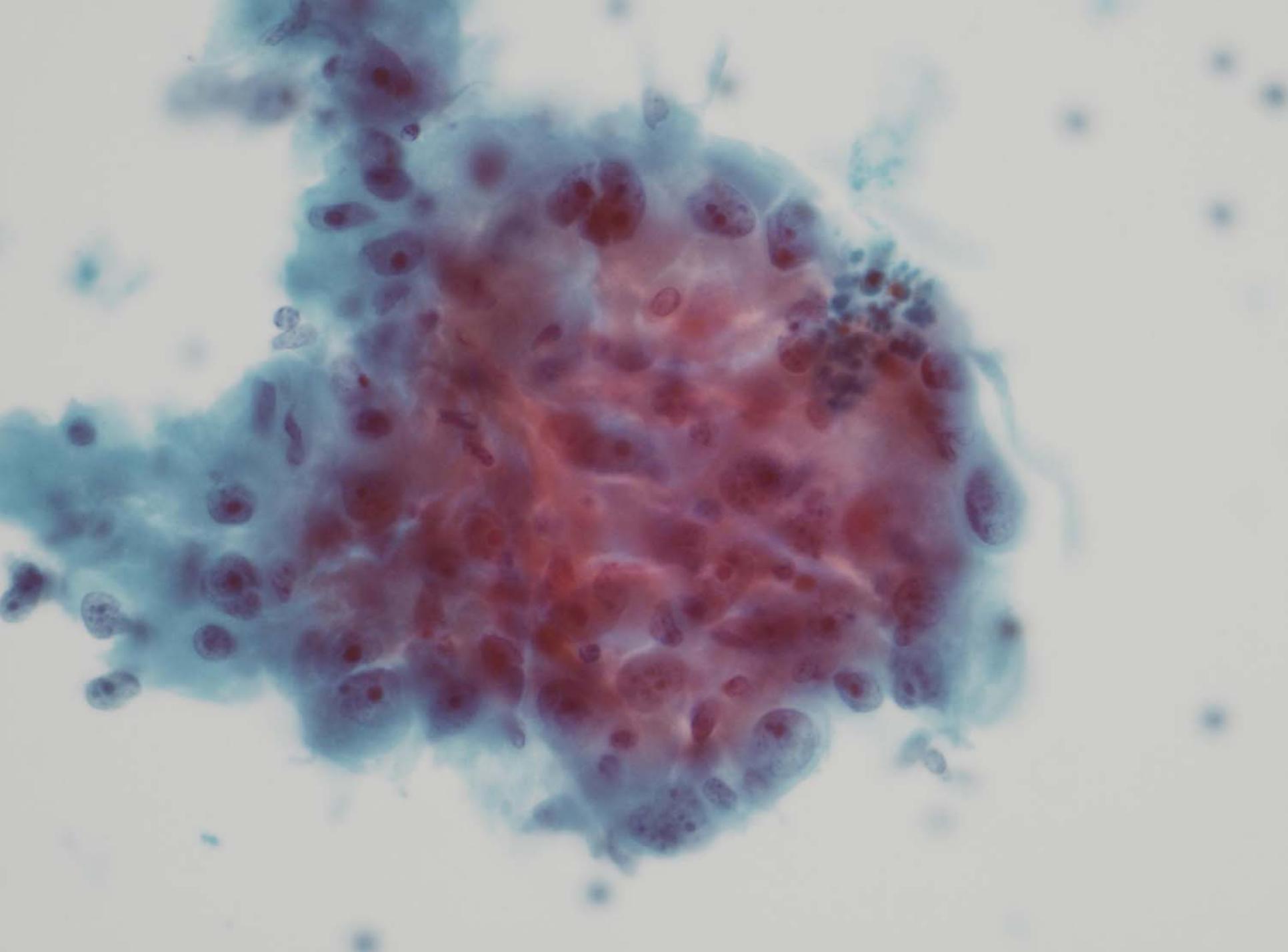
Case 1

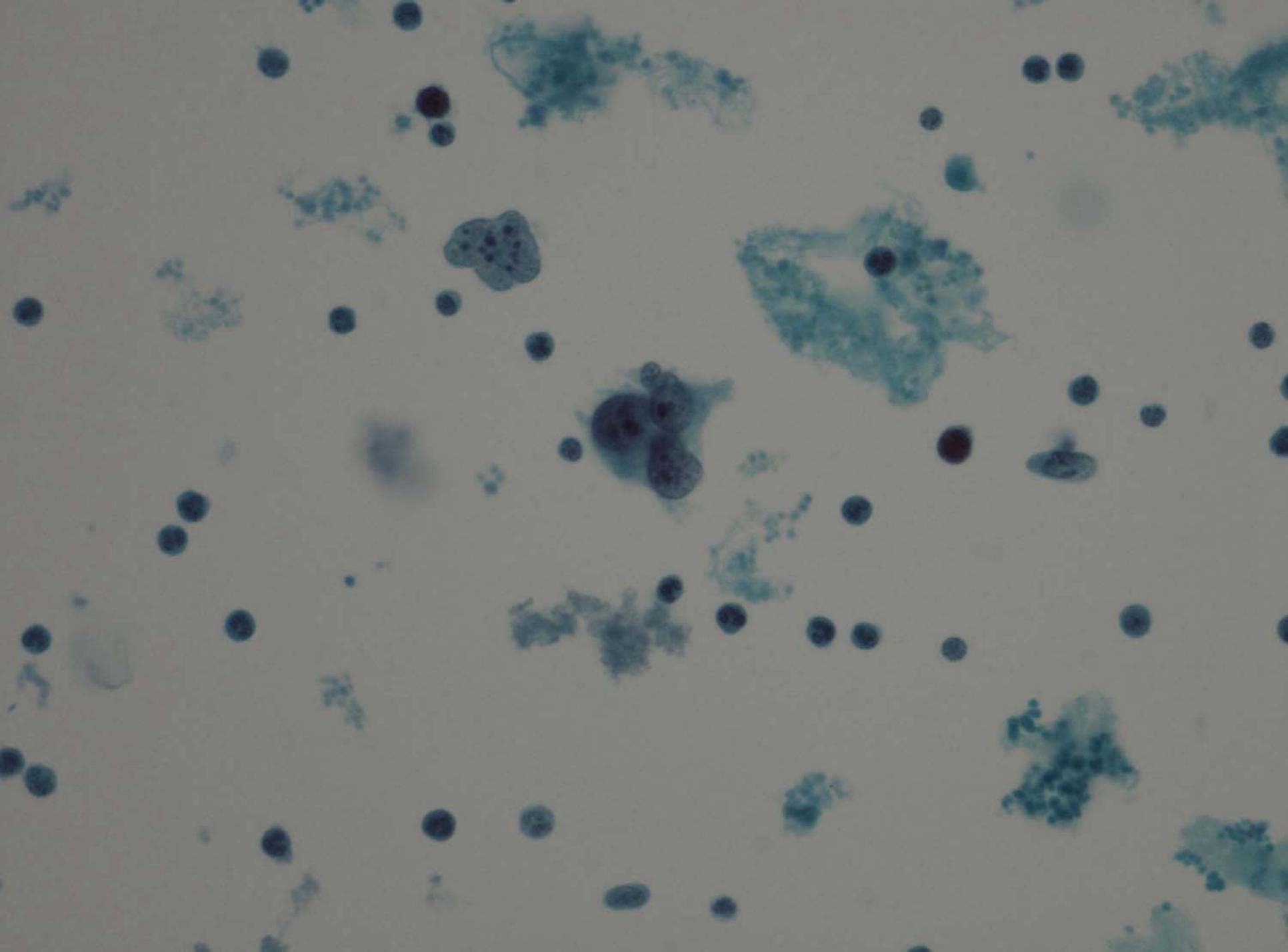
- Correct diagnosis: Atypical carcinoid tumor (neuroendocrine carcinoma)
- Biases
 - Availability – more recent example comes to mind first
 - Recall – information in memory drives current process

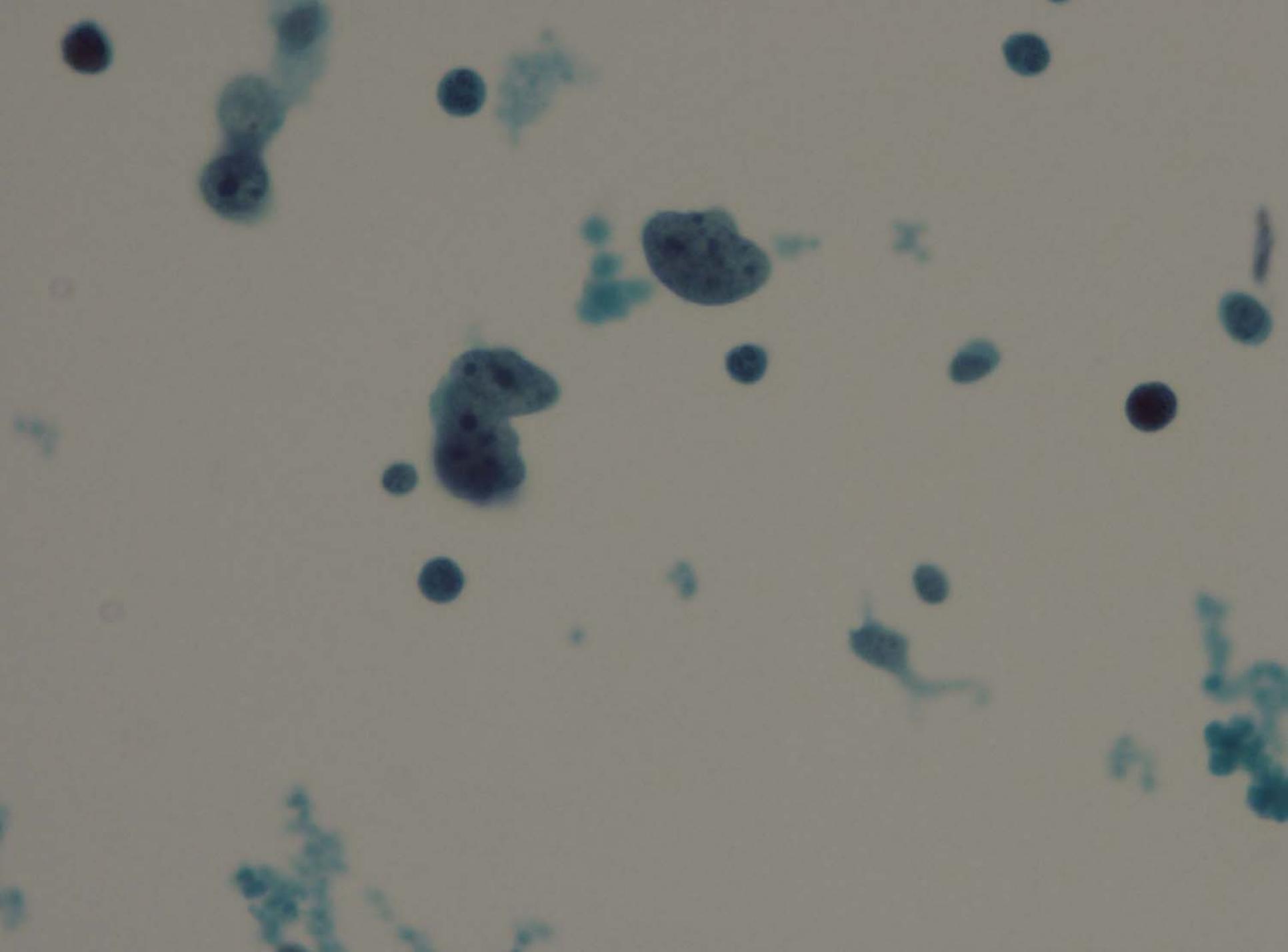
Case 2

- The patient is a 61 year old woman who liked chocolate. She presented with shortness of breath and a chest CT showed a 2 cm mass in the right lung
- A fine needle aspiration was performed









Case 2

- Original diagnosis: Adenocarcinoma, poorly differentiated
- Surgical excision; all lymph nodes benign
- Pancytokeratin +, vimentin +, all other stains ordered -
- Eight months later, a follow-up chest CT showed three lesions in the right lung and two in the left lung, ranging in size from 2 cm to 4 cm

Case 2

■ Criteria

- Large malignant cells
- Stripped nuclei
- Hard cytoplasm in areas
- Large nucleoli

■ Patterns

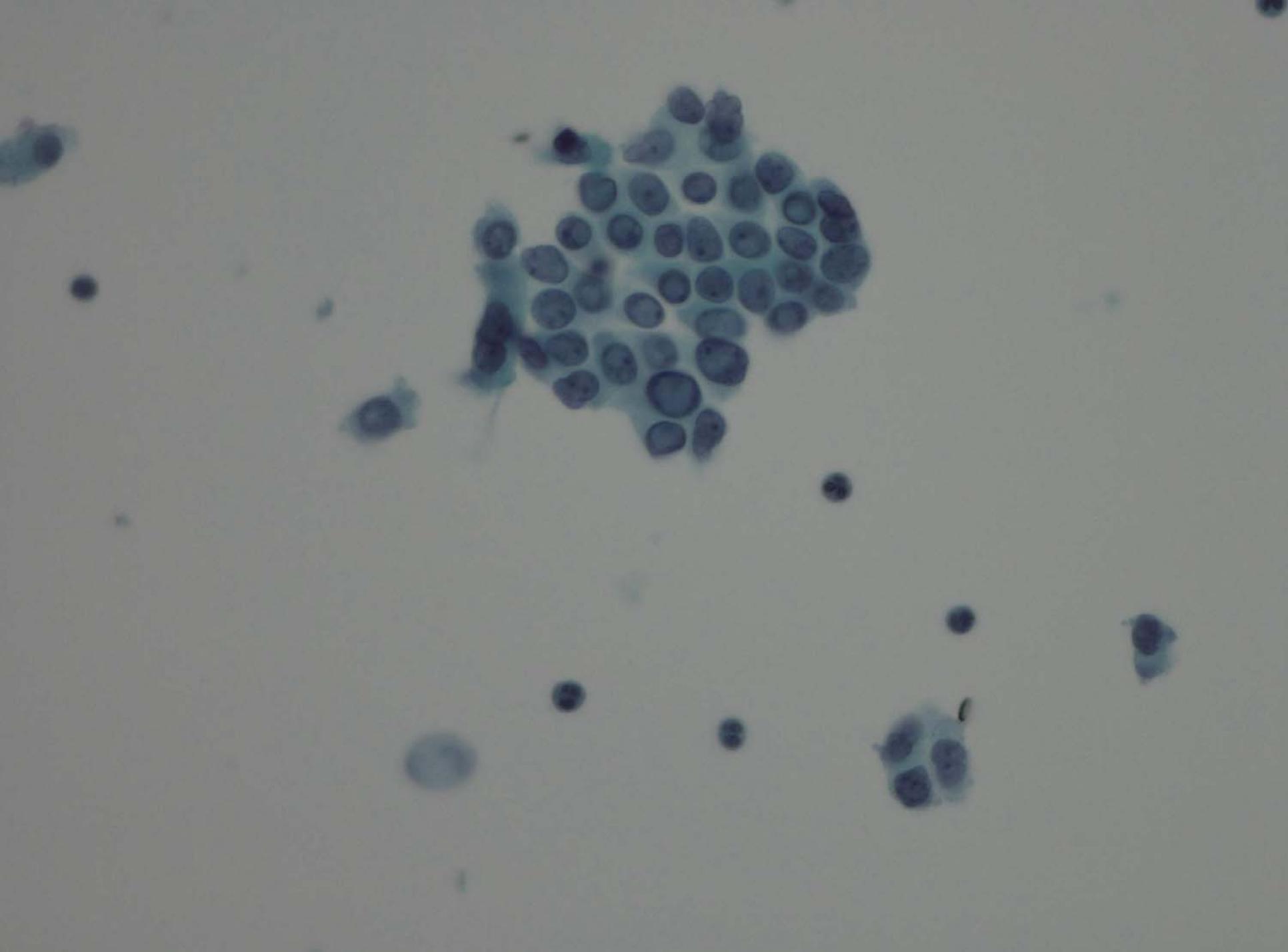
- Sarcoma, primary lung cancer, metastatic cancer

Case 2

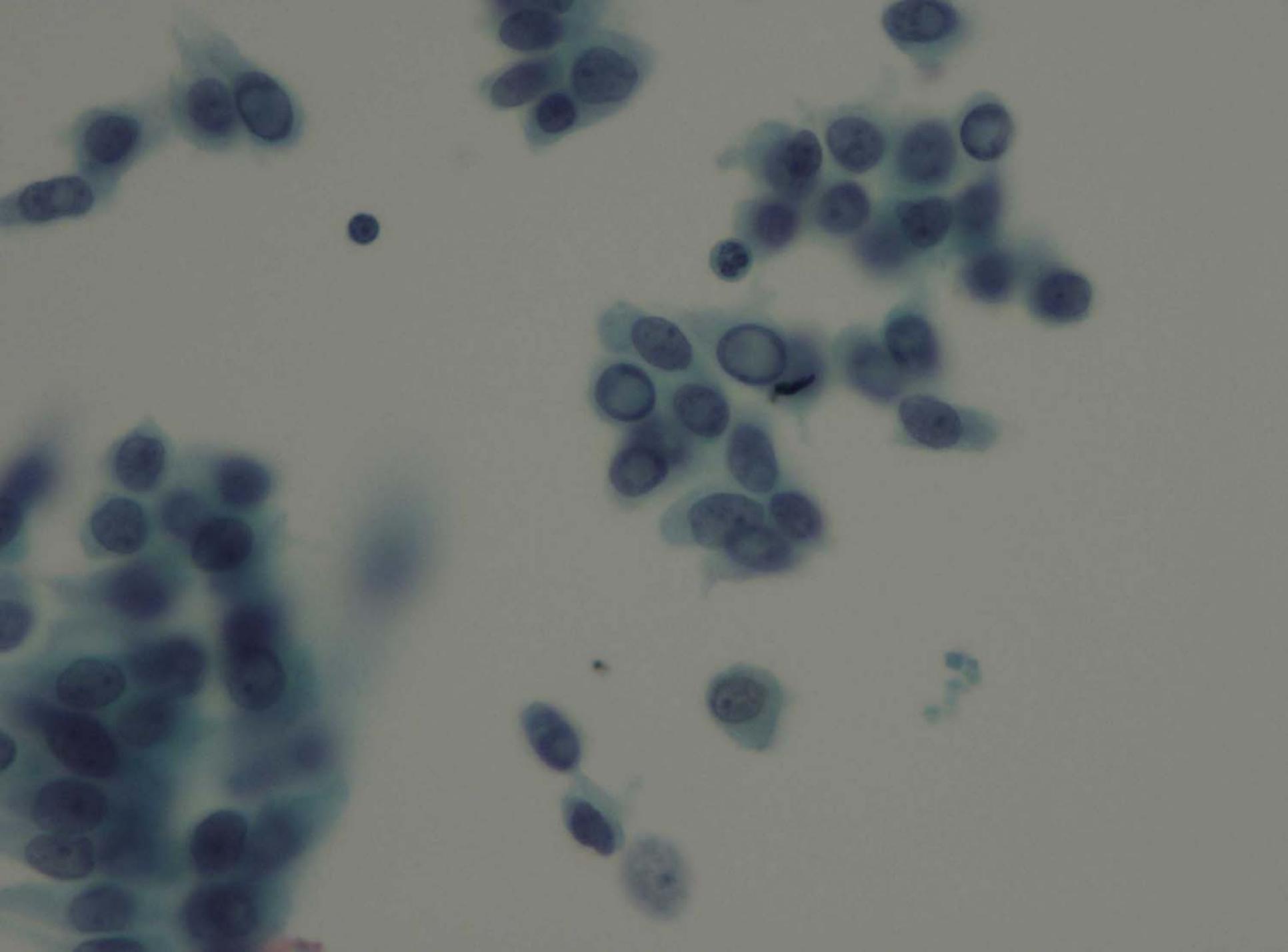
- Correct diagnosis: Metastatic adenocarcinoma of renal origin
- Biases
 - Anchoring – tendency to heavily rely on one trait or criterion
 - Expectation – disbelieve data that does not conform to opinion

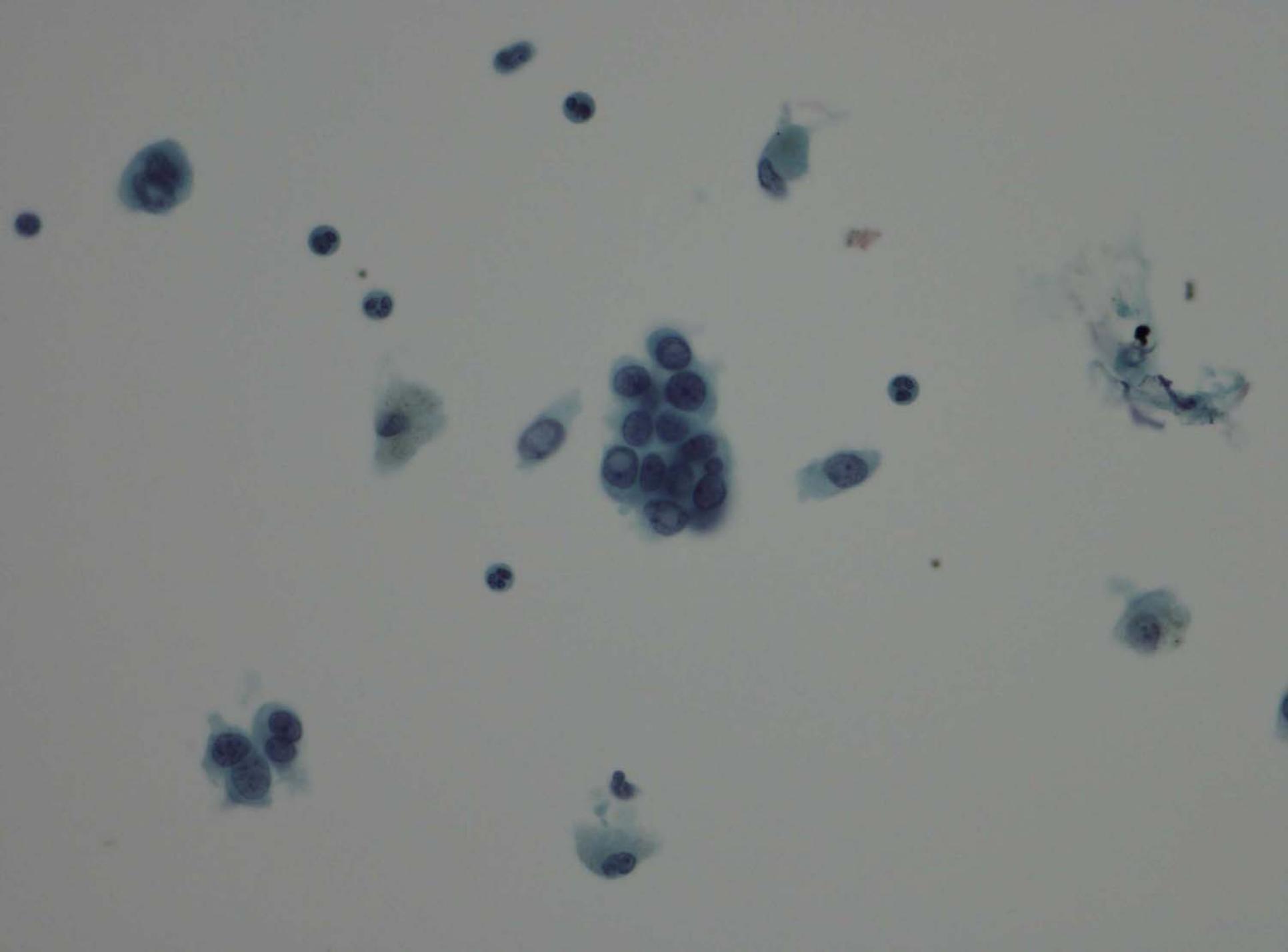
Case 3

- The patient is a 56 year old woman who had a parrot. She presented with shortness of breath and a chest CT showed a 2 cm mass in the right hilar region
- Endoscopy showed a raised endobronchial lesion with ulcer
- Bronchial brushing and washing were performed









Case 3

- Original diagnosis: Reactive lung; no evidence of malignancy
- One year later, a follow-up chest CT showed enlargement of the lesion, now reaching 4 cm in diameter

Case 3

■ Criteria

- Small cells
- Open nuclear chromatin
- Thickened nuclear rims
- No (or dot-like) nucleoli

■ Patterns

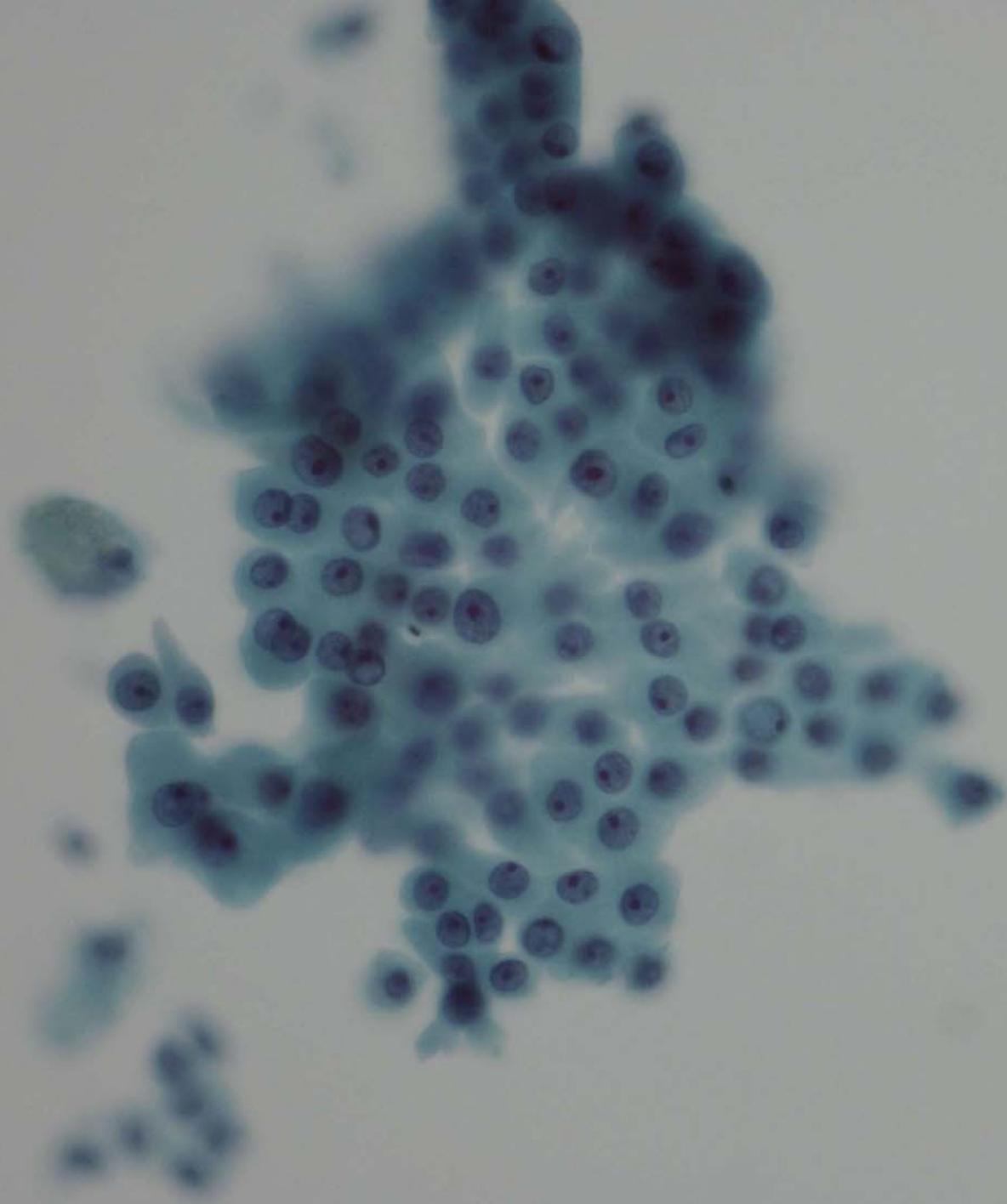
- Reactive bronchial cells, low grade tumor, viral effect

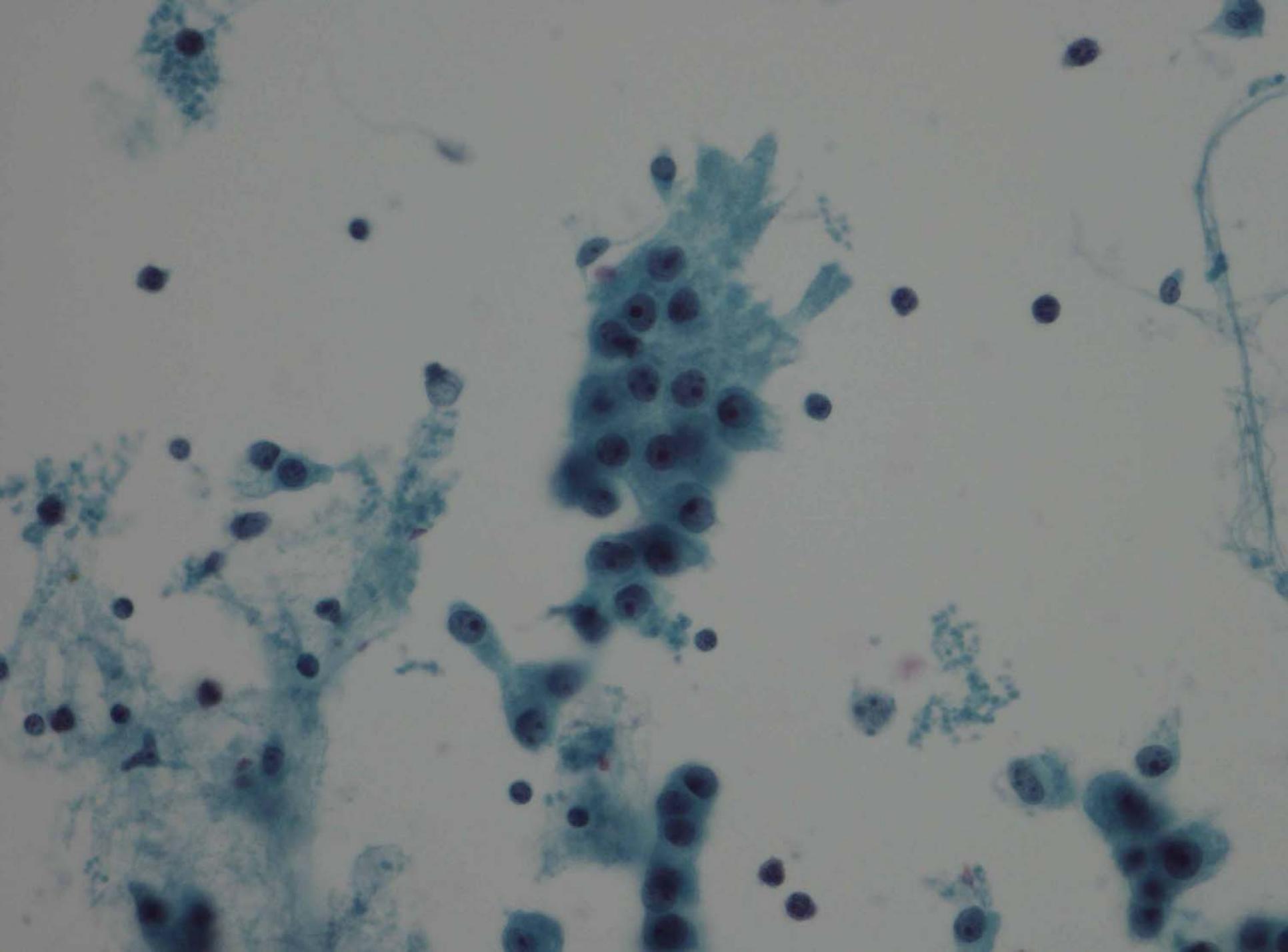
Case 3

- Correct diagnosis: Adenocarcinoma, well differentiated
- Biases
 - Neglect of probability – disregarding probability (of disease associated with criteria) under uncertainty
 - Confirmation bias – search for information that confirms expectations

Case 4

- The patient is a 58 year old man who had a Norwegian elkhound. He presented with shortness of breath and a chest CT showed a diffuse opacity in the left lung
- Bronchial brushing and washing were performed





Case 4

- Original diagnosis: Reactive changes; no evidence of malignancy
- Eight months later, a follow-up chest CT showed diffuse opacity

Case 4

■ Criteria

- Cell clusters
- Prominent nucleoli
- Nuclear rim thickening
- Hard cytoplasm

■ Patterns

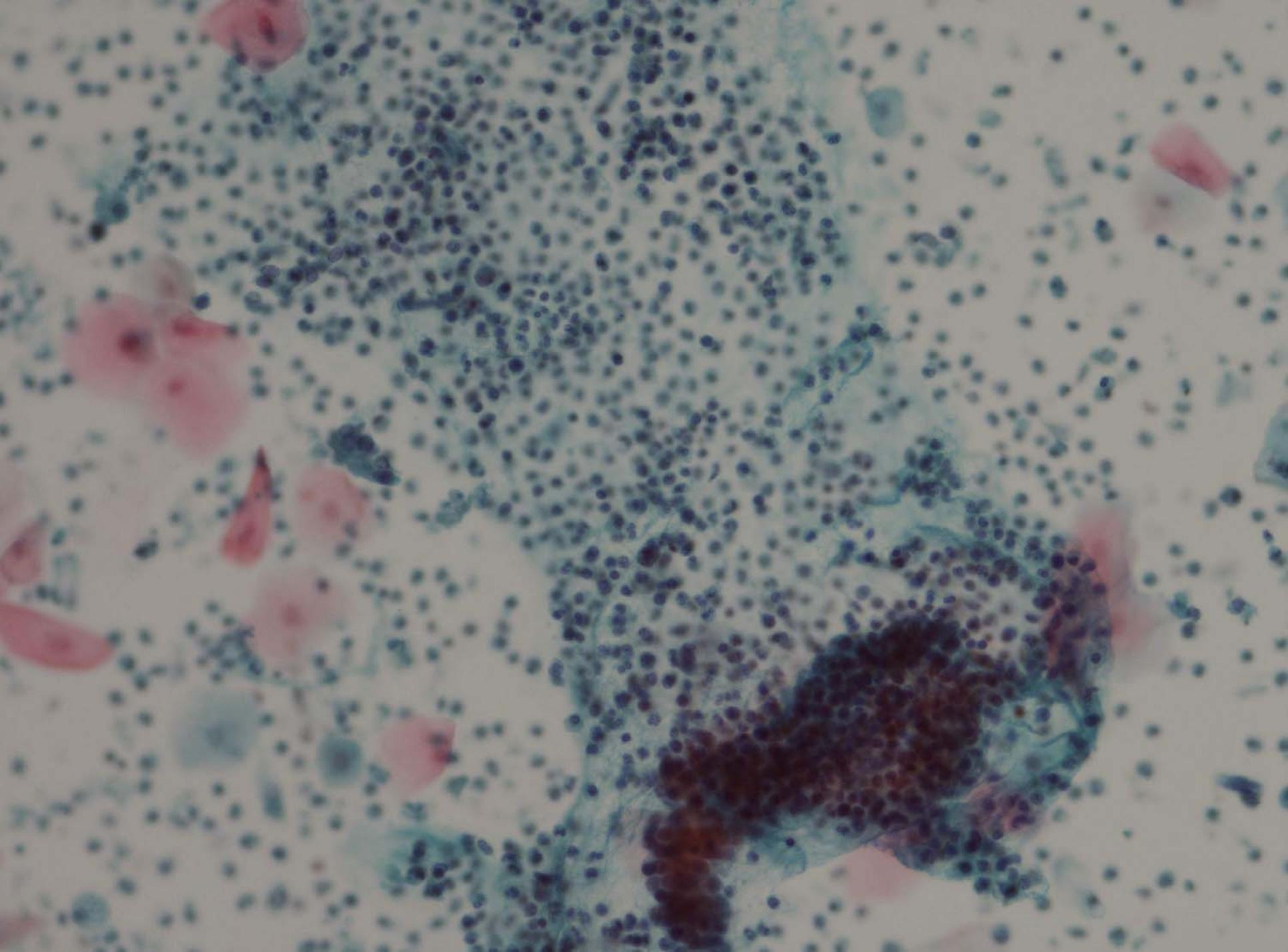
- Reactive changes, well differentiated tumor, viral

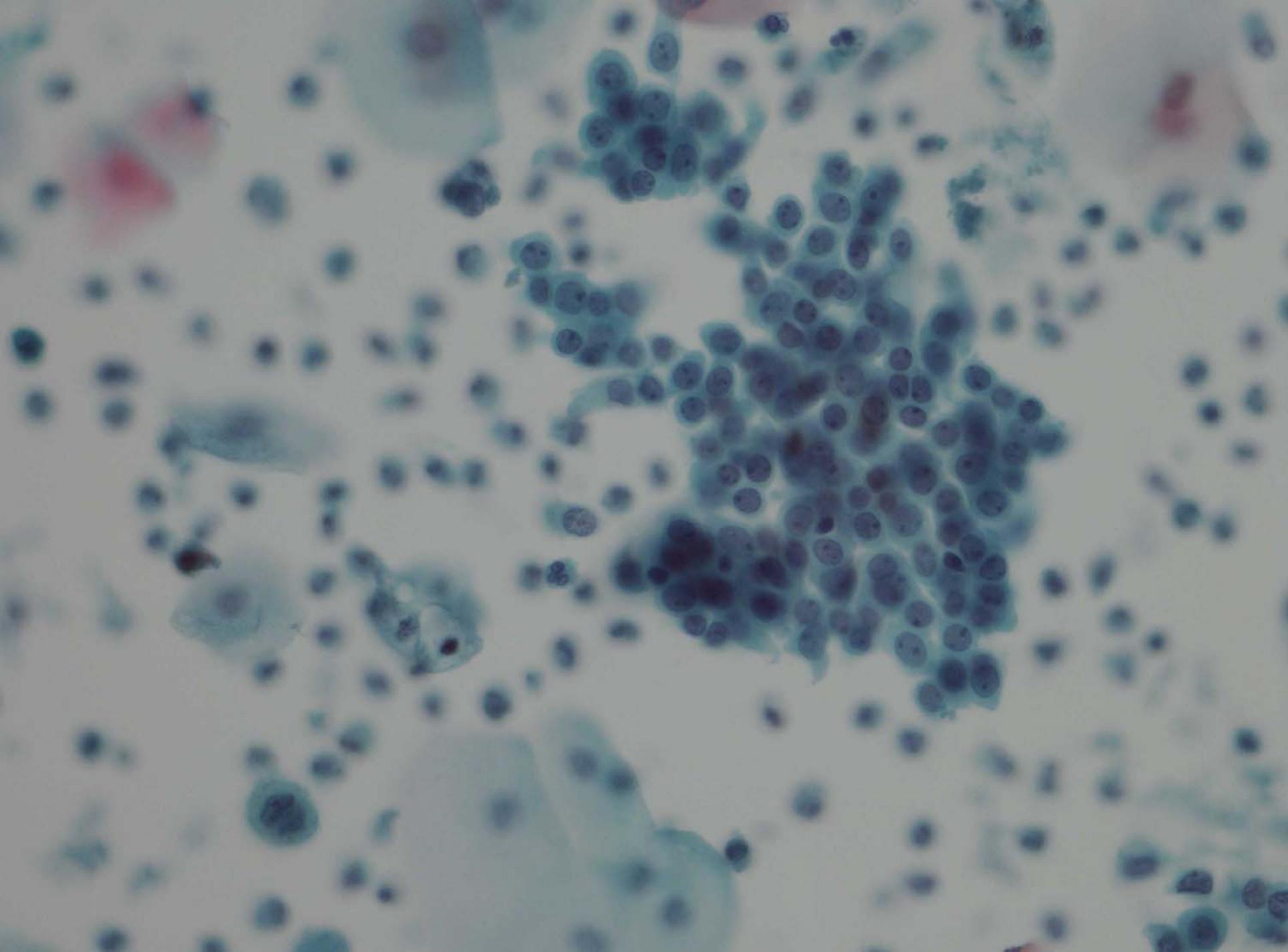
Case 4

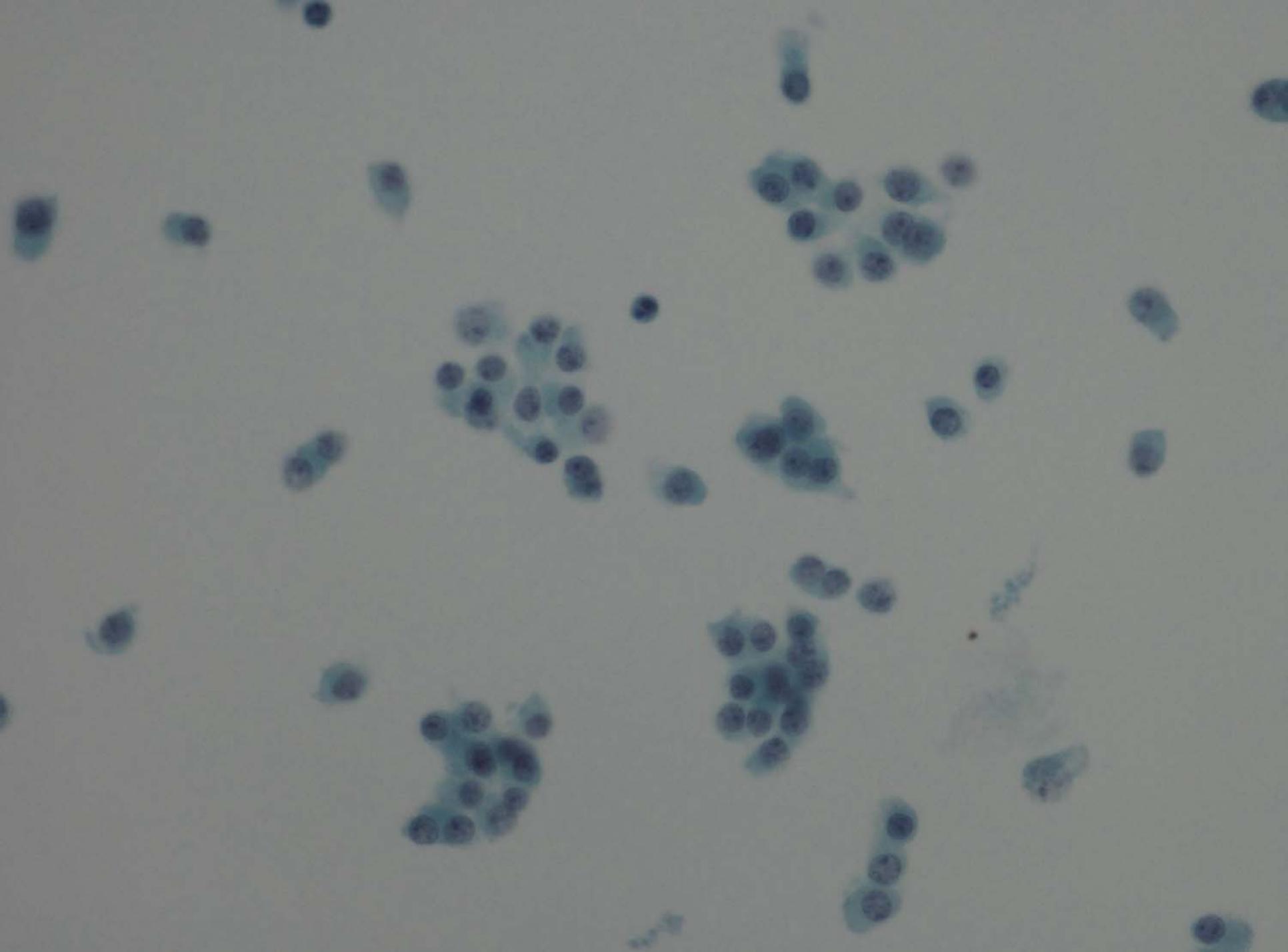
- Correct diagnosis: Adenocarcinoma, moderately differentiated
- Biases
 - Contrast - increase or decreasing a criterion compared to a recently observed contrasting object
 - Do no harm – judgment based on desired outcome of no harm

Case 5

- The patient is a 56 year old man who liked to travel to exotic places. He presented with a cough and a chest CT showed a 2.9 cm mass in the left hilum
- A transbronchial fine needle aspiration was performed







Case 5

- Original diagnosis: Reactive changes; no evidence of malignancy
- Eight months later, a follow-up chest CT showed no regression in lesion size

Case 5

■ Criteria

- Cellular
- Small cells, single and in small groups
- Granular chromatin
- Small nucleoli

■ Patterns

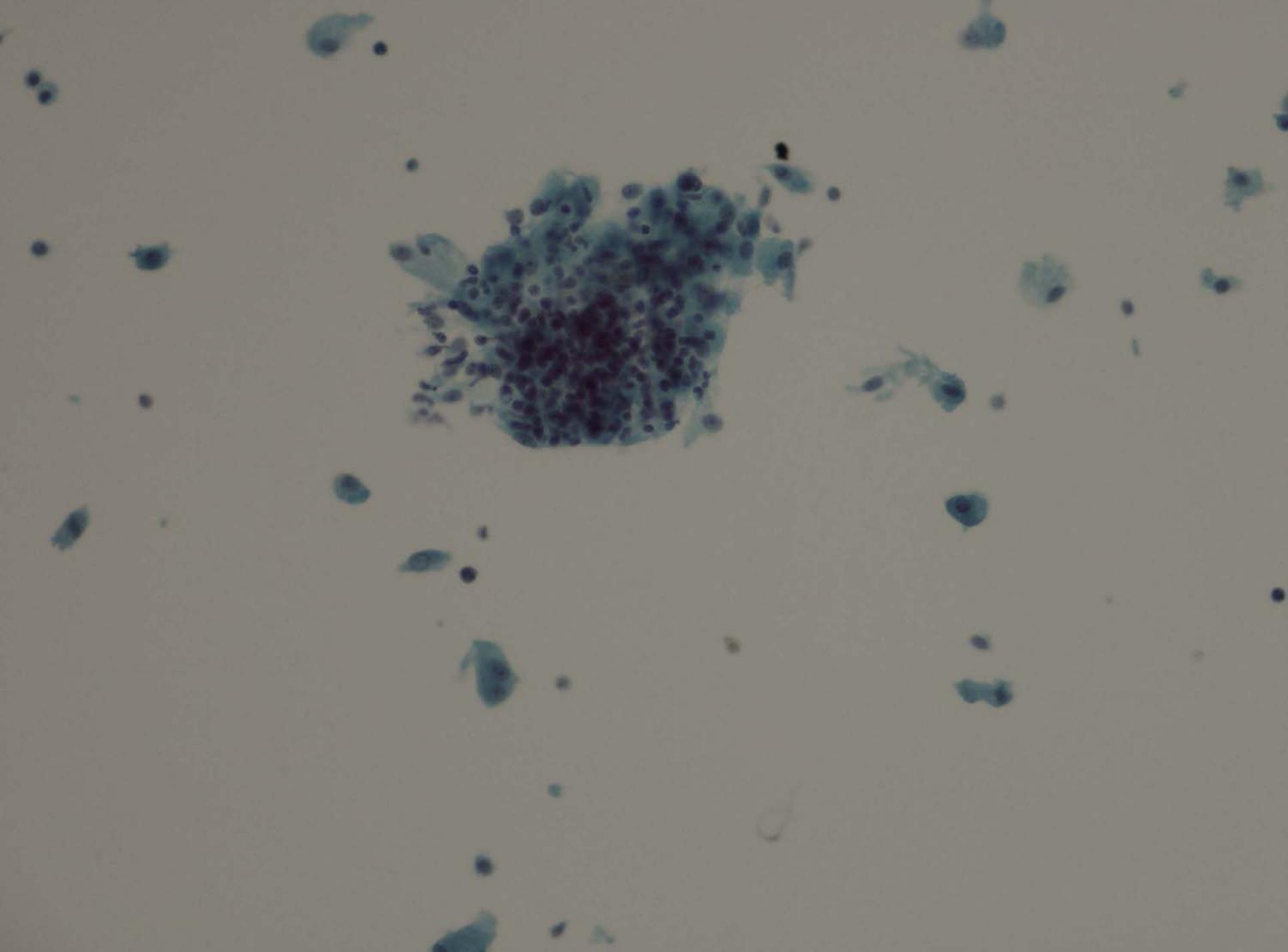
- Inflammation, well differentiated tumor, metastatic tumor

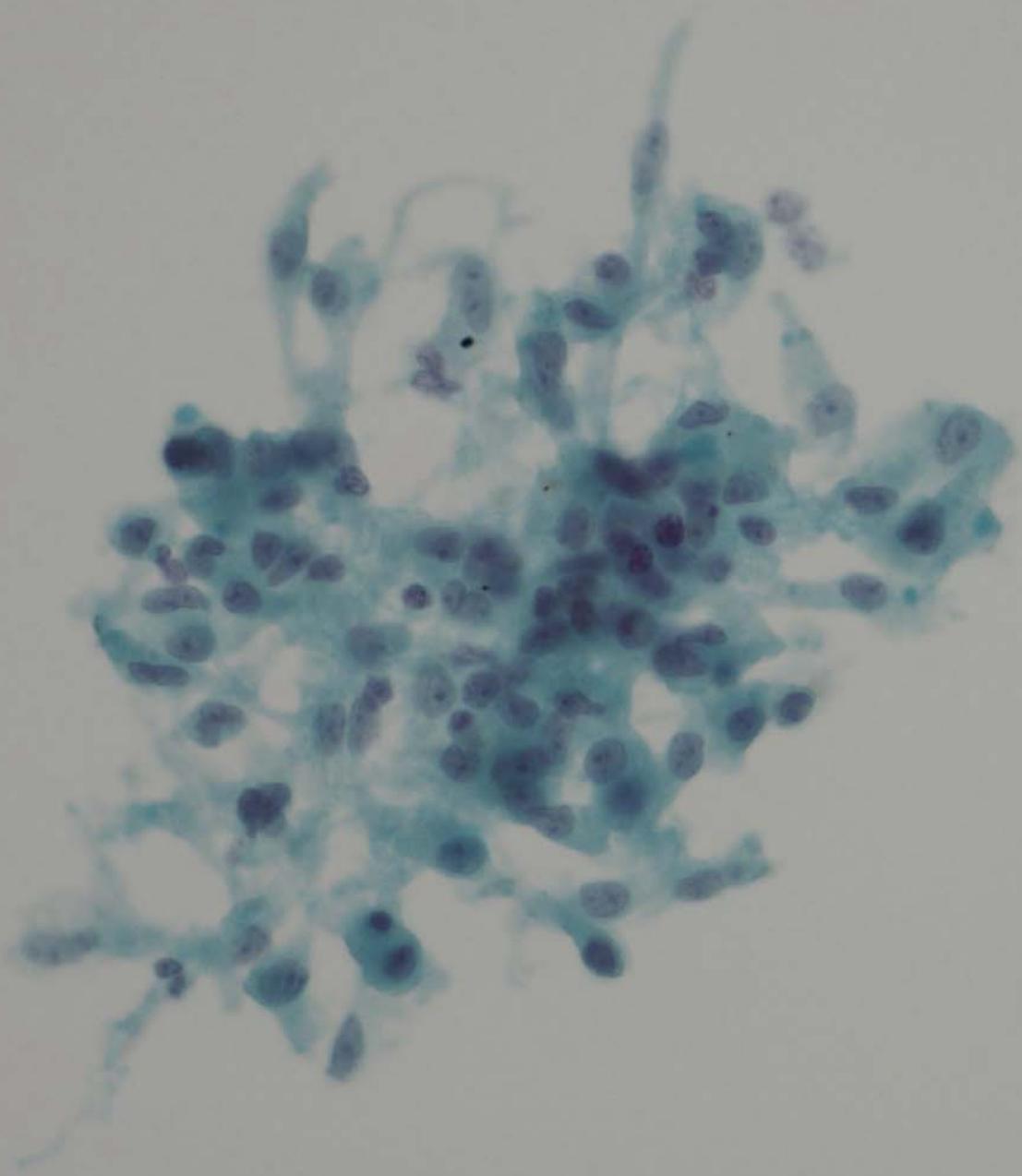
Case 5

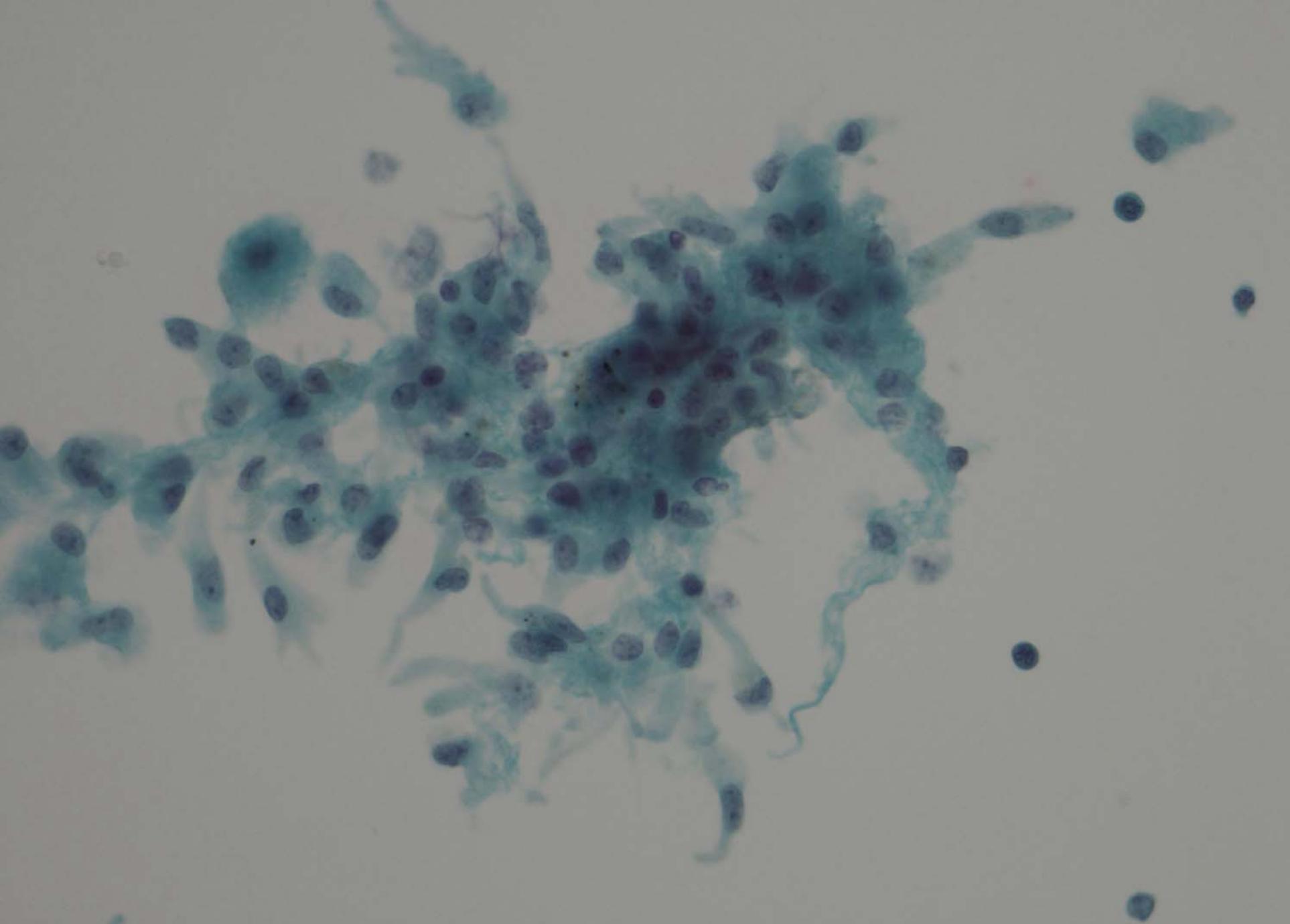
- Correct diagnosis: Well differentiated neuroendocrine carcinoma (carcinoid tumor)
- Biases
 - Cluster illusion – seeing patterns where none actually exist
 - Focusing bias – placing too much emphasis on one event and not entire picture

Case 6

- The patient is a 56 year old man who liked to travel to exotic places. He presented with a cough and a chest CT showed a 2.9 cm mass in the hilum
- A transbronchial fine needle aspiration was performed







Case 6

- Original diagnosis: Negative for malignant cells
- One year later, a follow-up chest CT an increase in lesion size and additional small nodules (generally less than 1 cm) in both lung fields

Case 6

■ Criteria

- Cell clusters and single cells
- Spindled cells and plump cells
- Low nuclear to cytoplasmic ratios
- Cytoplasmic tails

■ Patterns

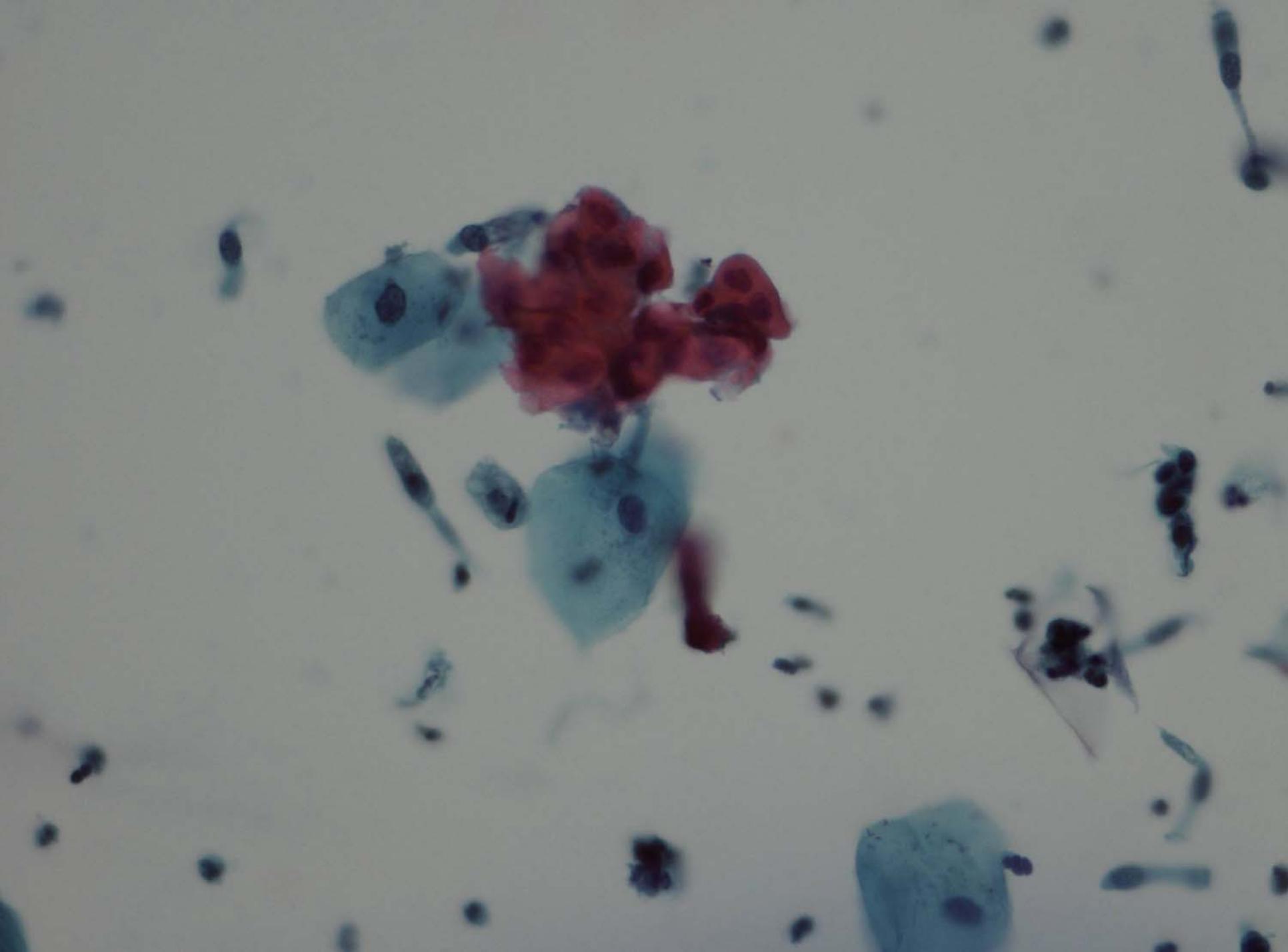
- Reactive changes, well differentiated tumor, specific inflammatory condition

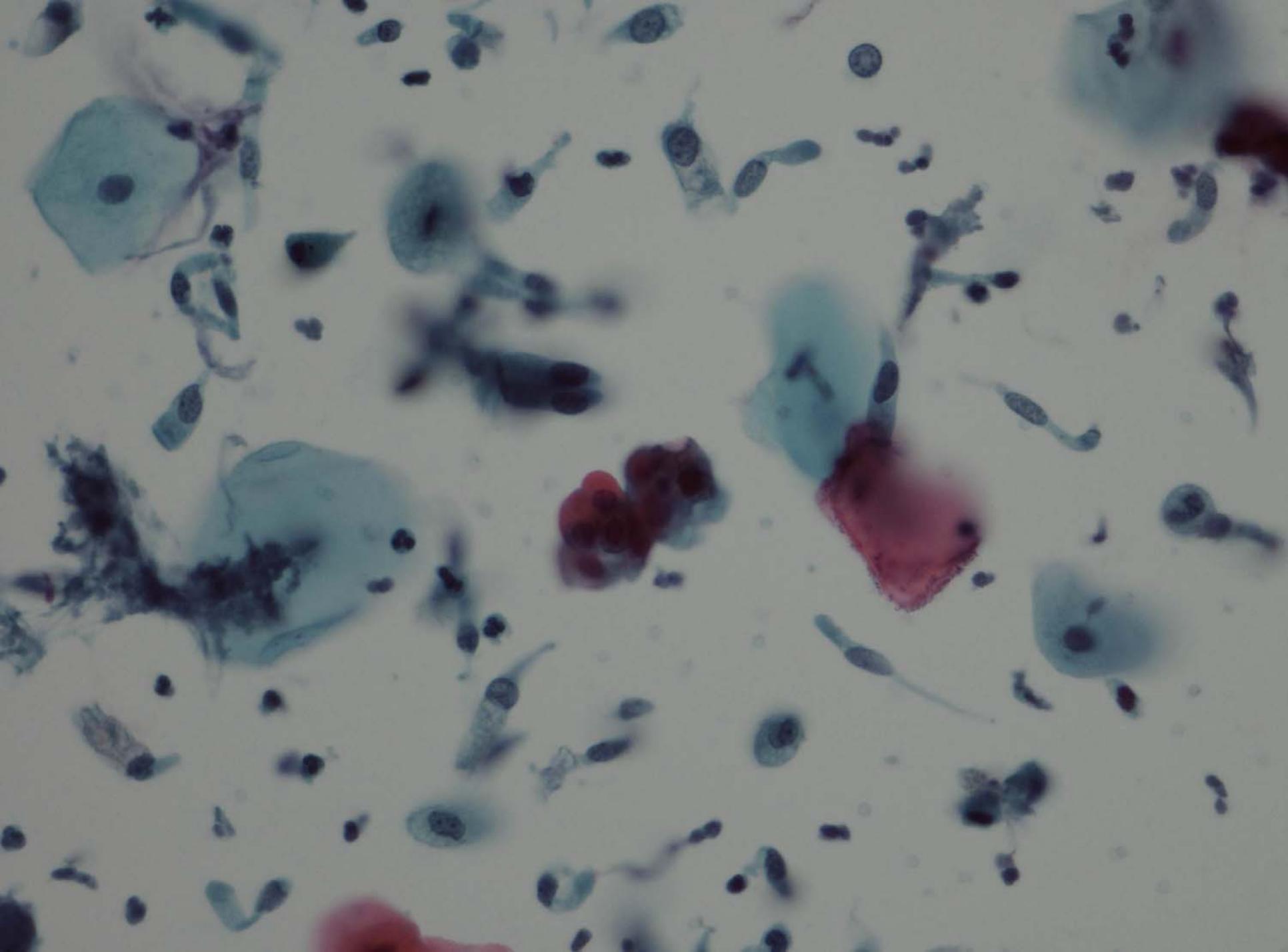
Case 6

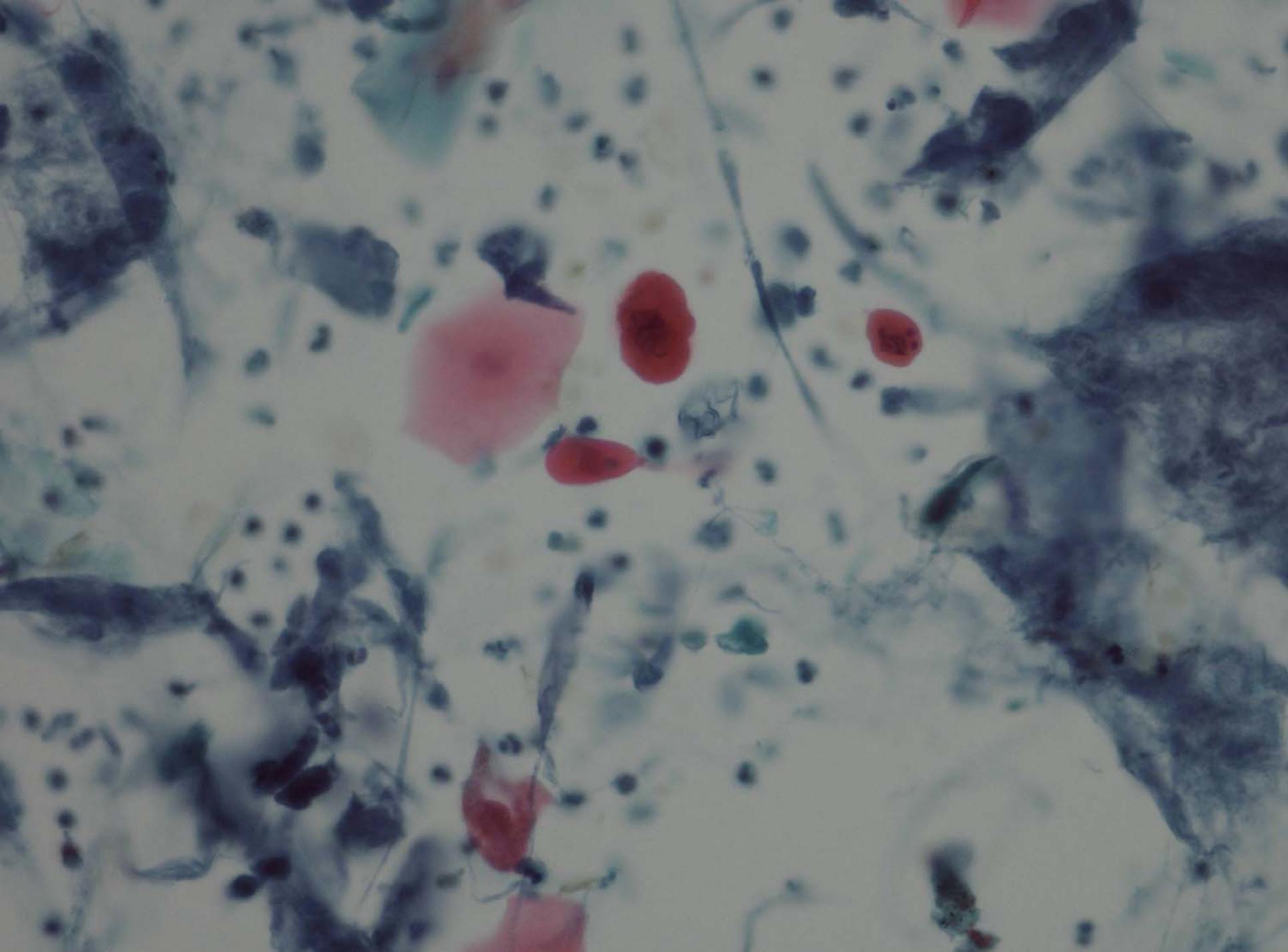
- Correct diagnosis: Granulomatous inflammation
- Cultures were positive for acid fast organisms
- Biases
 - Framing - drawing different conclusions from same information, depending on how information is presented
 - Congruence – failure to test alternative hypotheses

Case 7

- The patient is a 50 year old man who liked spicy hot Mexican food. He had a history of squamous cell carcinoma of the lip with metastasis in the head and neck region. One year later, a follow-up chest CT that showed a 2.5 cm mass in the left hilum
- A bronchial brushing was performed







Case 7

- Original diagnosis: Metastatic squamous cell carcinoma
- The patient was treated with radiation therapy
- One year later the lesion had grown in size and a biopsy was performed

Case 7

■ Criteria

- Squamoid cells
- Benign lung
- Mild atypia
- Rare cells

■ Patterns

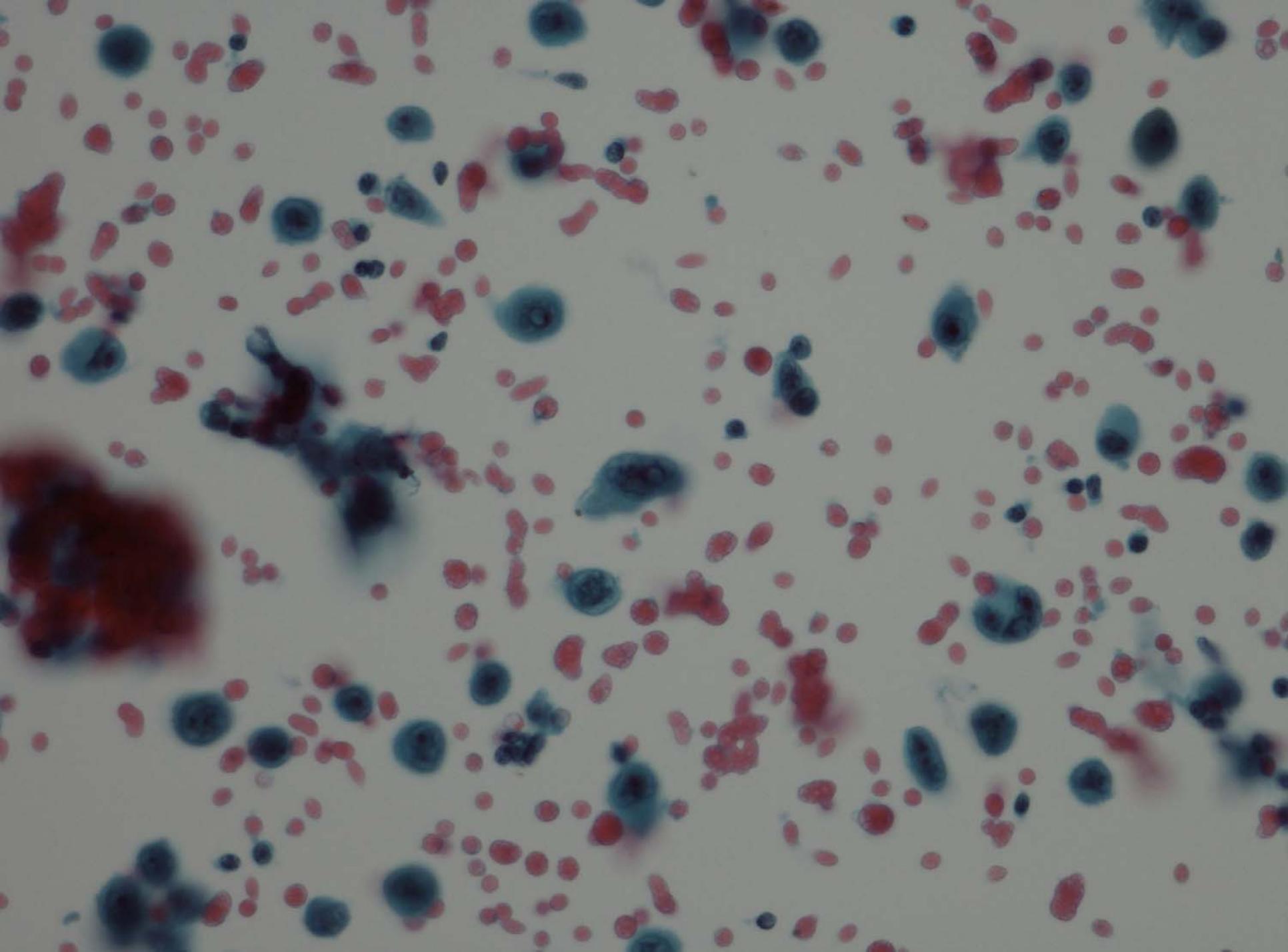
- Reactive changes, primary tumor, metastatic tumor

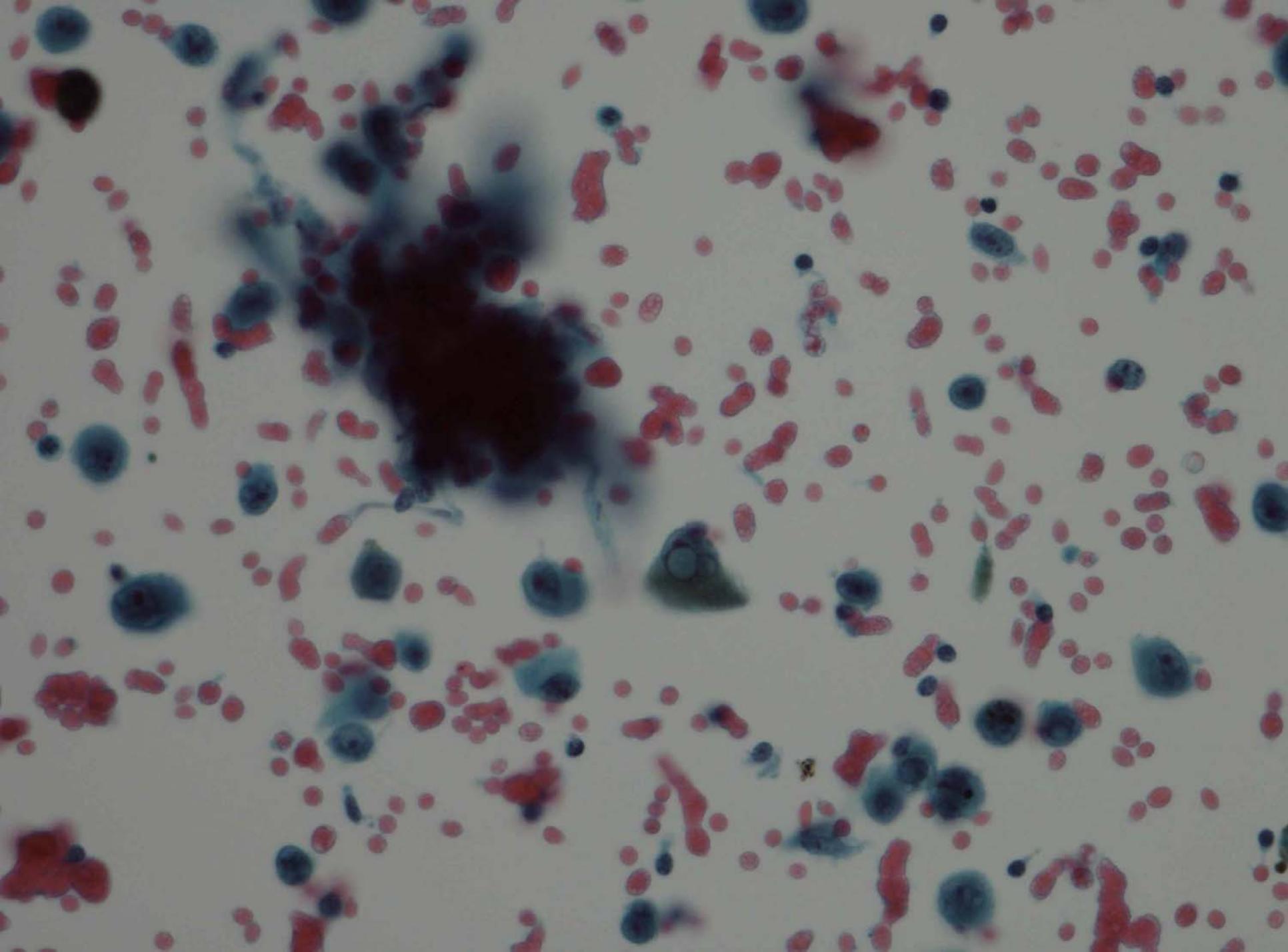
Case 7

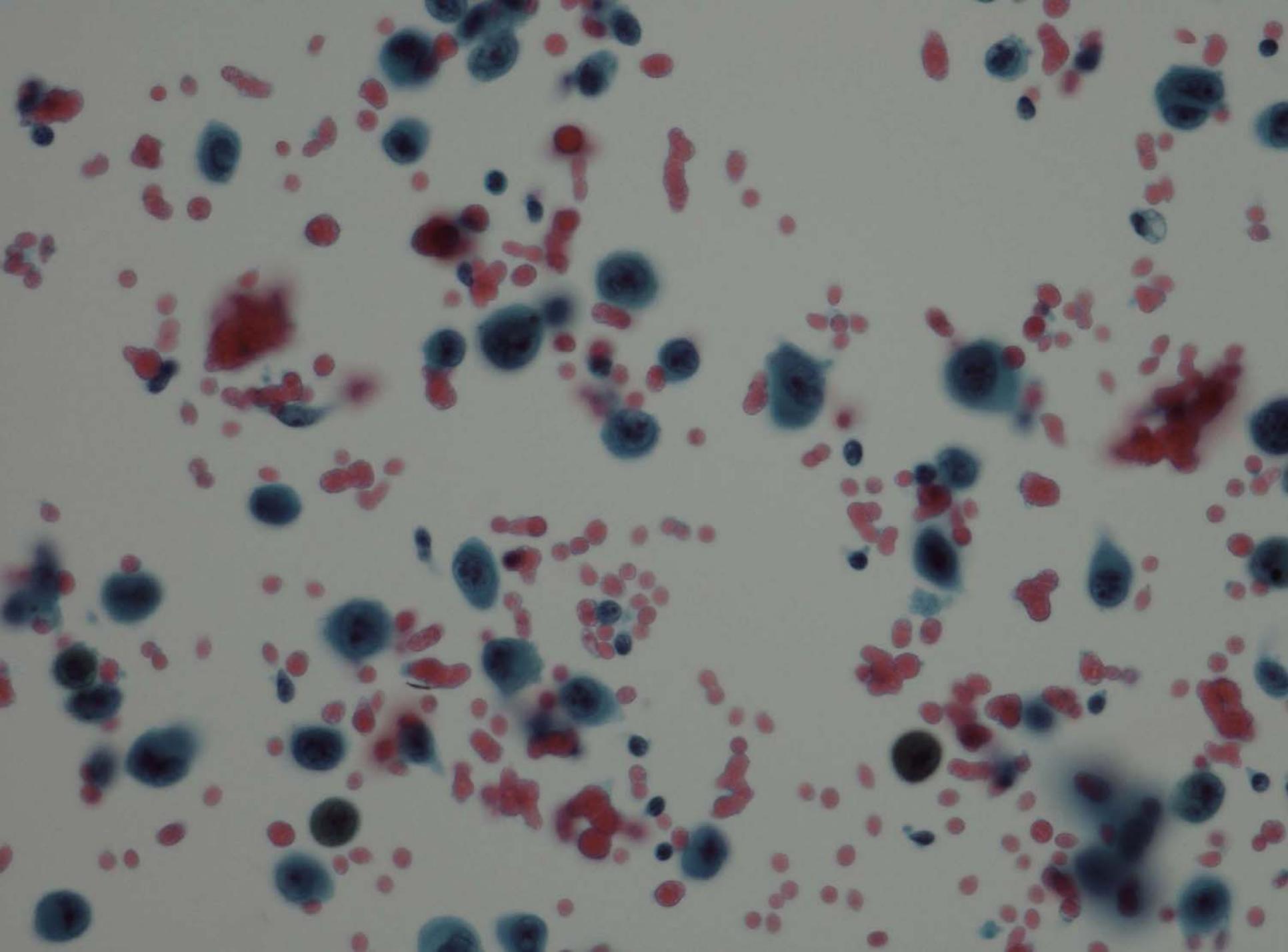
- Correct diagnosis: Reactive changes
- The biopsy showed granulomatous inflammation
- Biases
 - Observer-expectancy – observer expects a result and misinterprets criteria to support result
 - Overconfidence

Case 8

- The patient is a 50 year old man who was seen in the Emergency Department following a car accident. A chest CT showed a 2.2 cm lesion in the left lung
- A bronchial brushing and washing were performed







Case 8

- Original diagnosis: Malignant cells, favor poorly differentiated adenocarcinoma
- Insufficient material for immunohistochemical studies was available
- A surgical excision was performed

Case 8

■ Criteria

- Single cells
- Large nuclei with prominent nucleoli
- Pseudoinclusions
- Hard cytoplasm

■ Patterns

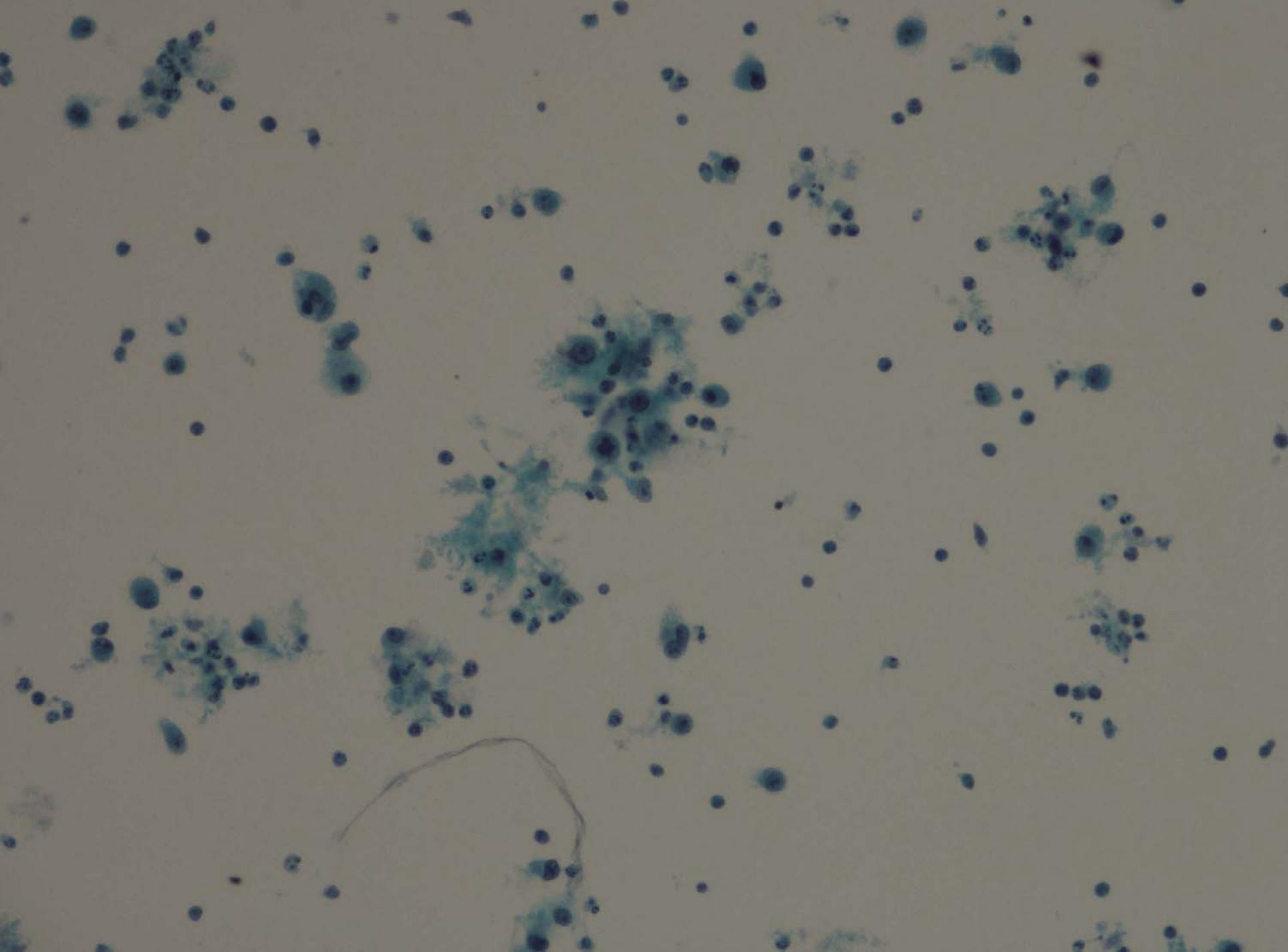
- Primary carcinoma, sarcoma, metastatic malignancy

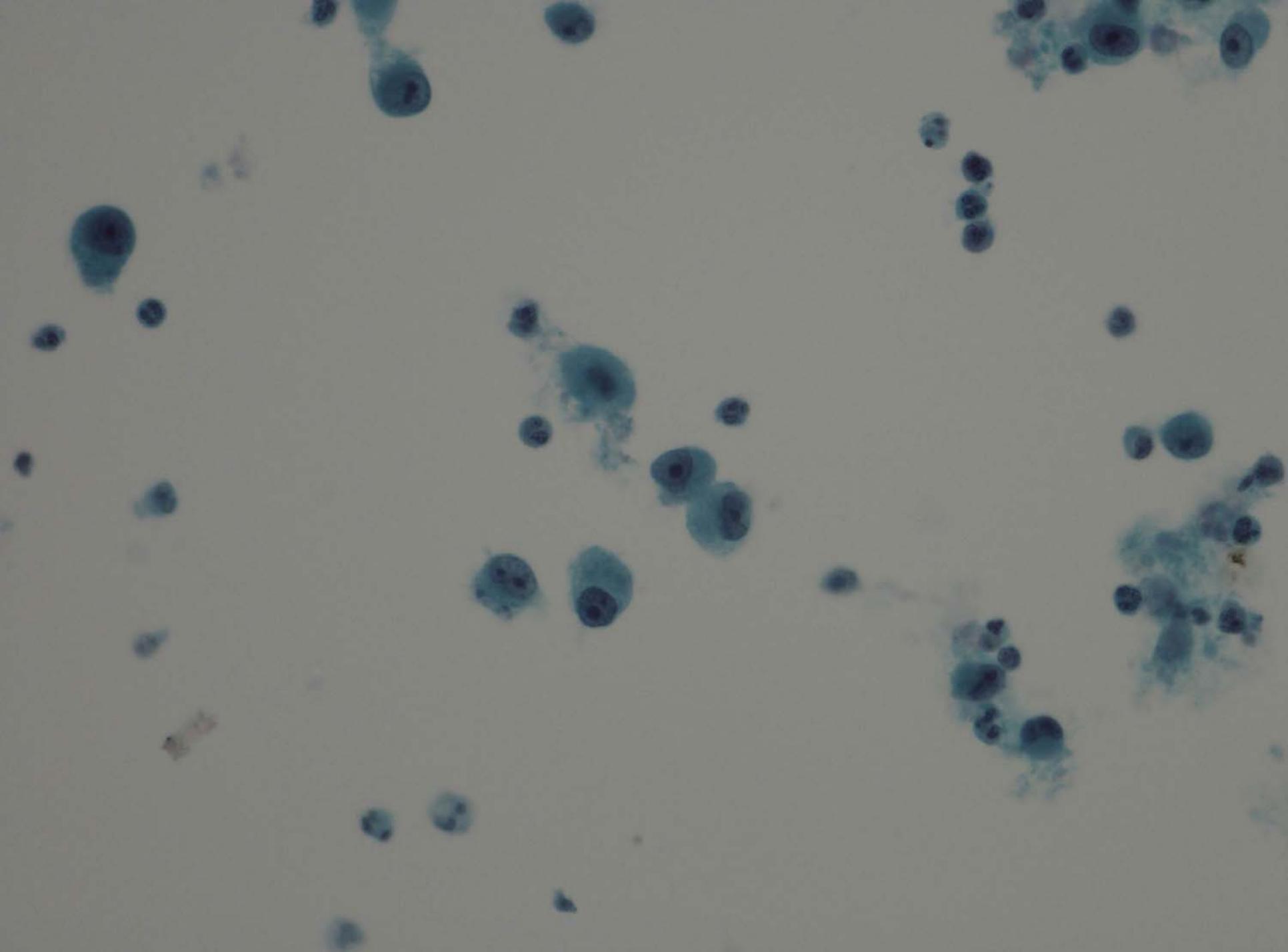
Case 8

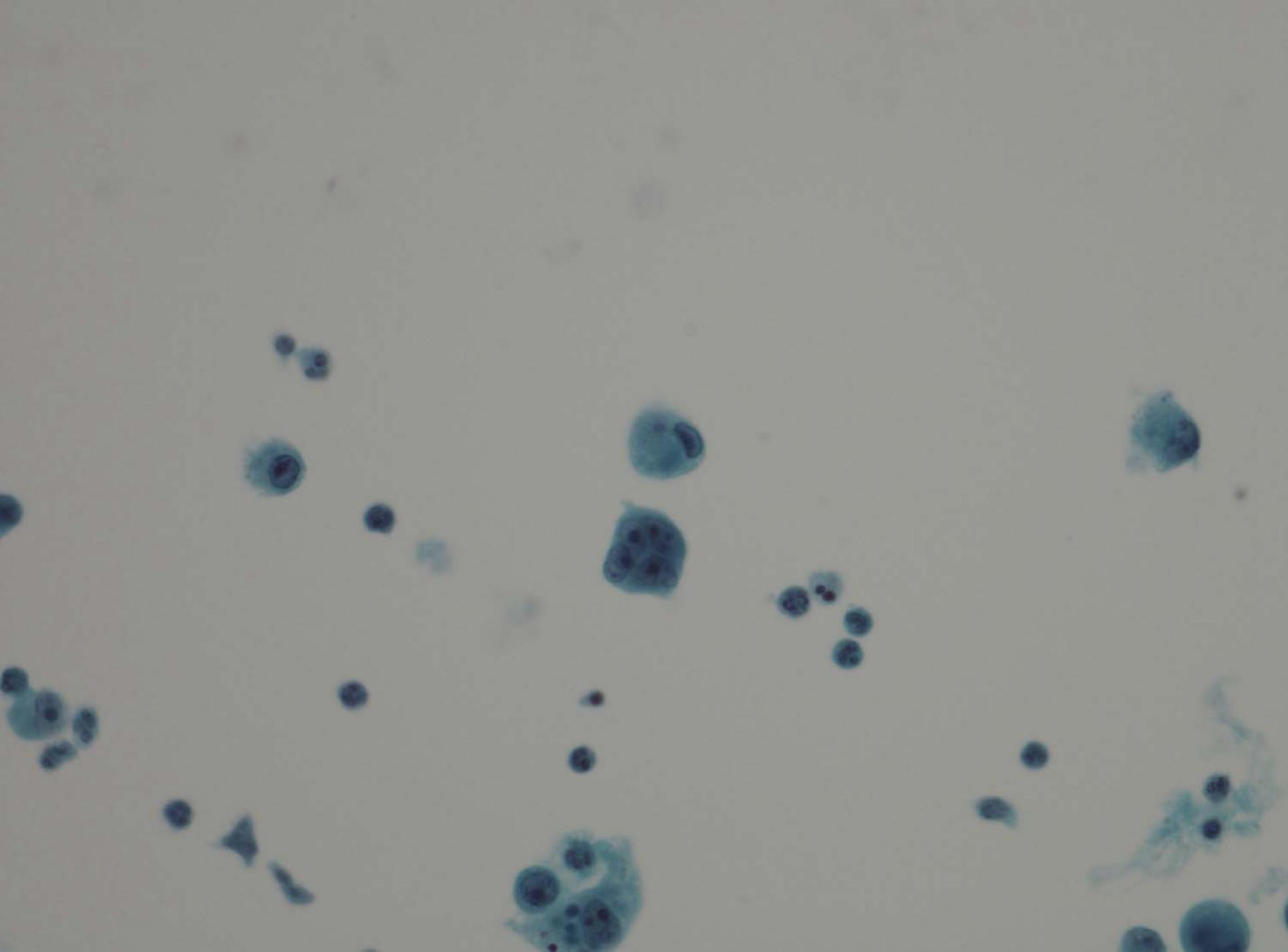
- Correct diagnosis: Malignant melanoma
- Biases
 - Availability
 - Exposure – more familiarity with some diagnoses compared to others

Case 9

- The patient is a 60 year old man who was an art historian. He had a history of malignant melanoma of the back with metastasis to the axillary lymph nodes. On a follow-up chest CT a 2 cm mass was seen in the left upper lobe
- A bronchial brushing was performed







Case 9

- Original diagnosis: Malignant melanoma
- Immunohistochemistry studies were not performed
- Two years later, the patient died and an autopsy was performed

Case 9

■ Criteria

- Single cells
- Multi-nucleated cells
- Nuclear rim thickening
- Eccentric nuclei

■ Patterns

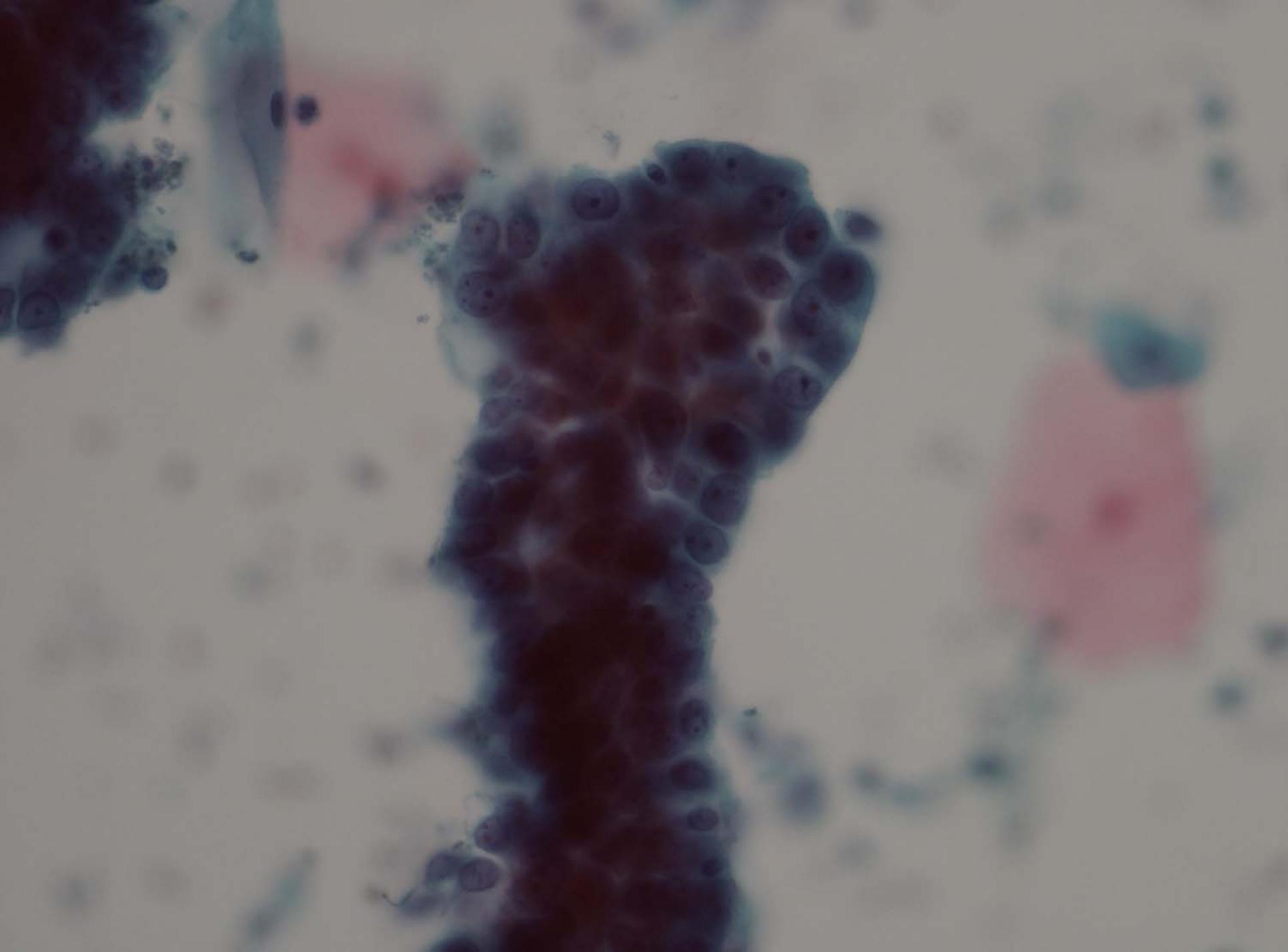
- Metastatic malignancy, primary malignancy

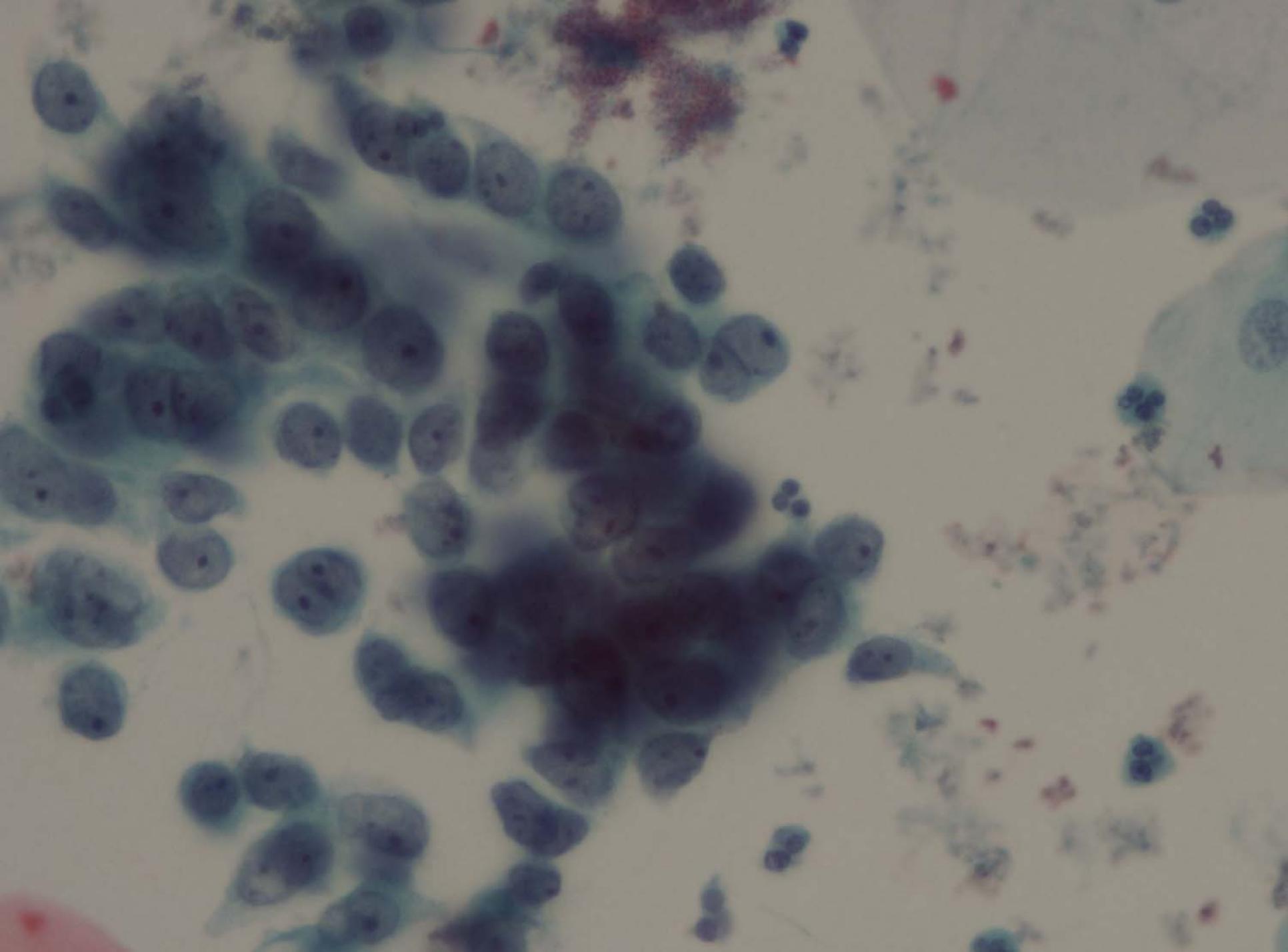
Case 9

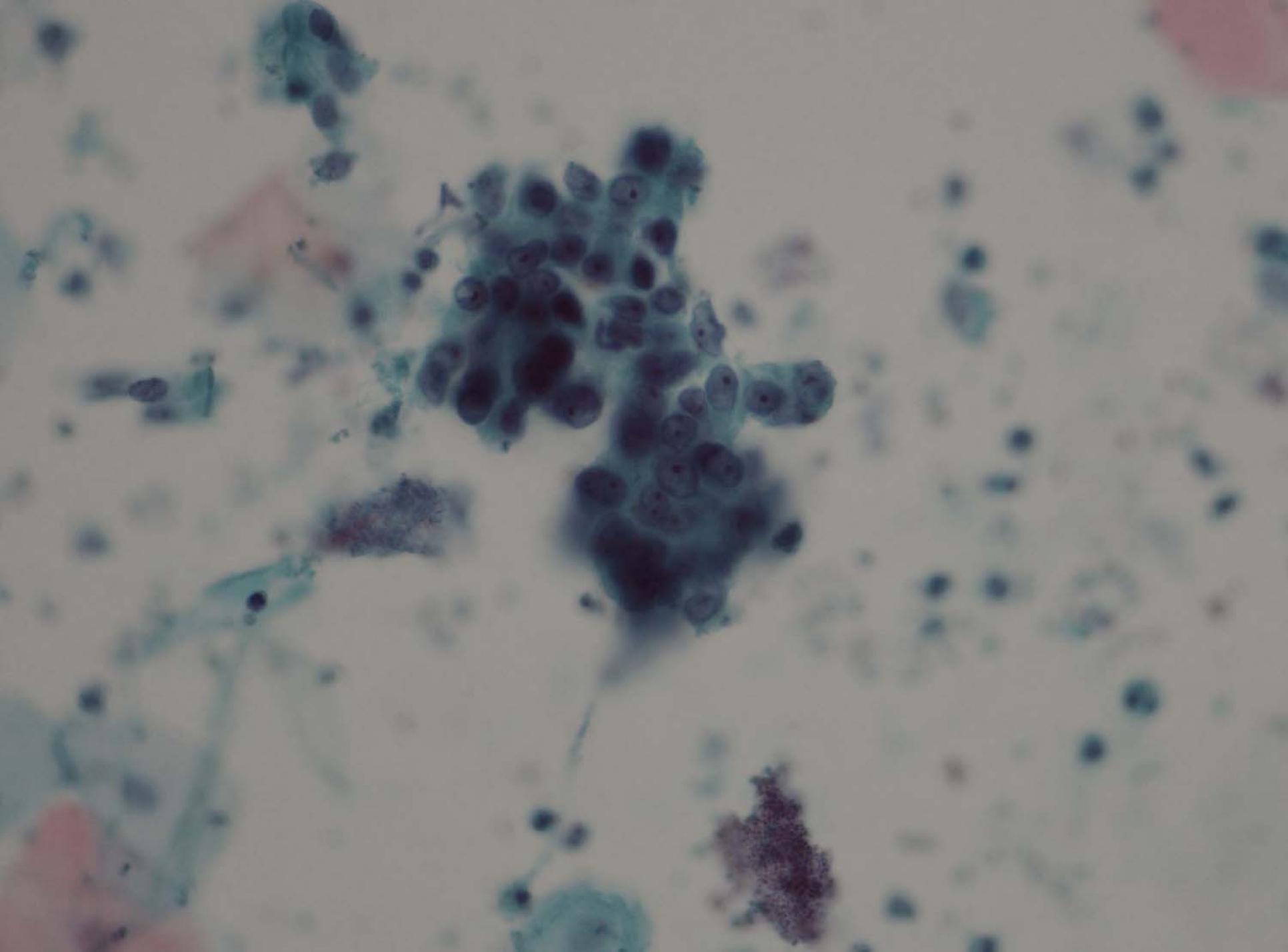
- Correct diagnosis: Poorly differentiated adenocarcinoma
- Biases
 - Observer-expectancy
 - Wishful thinking bias – making decisions based on what one wants to see instead of evidence

Case 10

- The patient is an 81 year old woman who had a history of serous papillary carcinoma of the ovary. She presented with shortness of breath. A chest CT that showed a pleural effusion
- A bronchioalveolar lavage was performed







Case 10

- Original diagnosis: Metastatic adenocarcinoma

Case 10

■ Criteria

- Cell clusters
- Prominent nucleoli
- Variable cell size
- Finely granular chromatin

■ Patterns

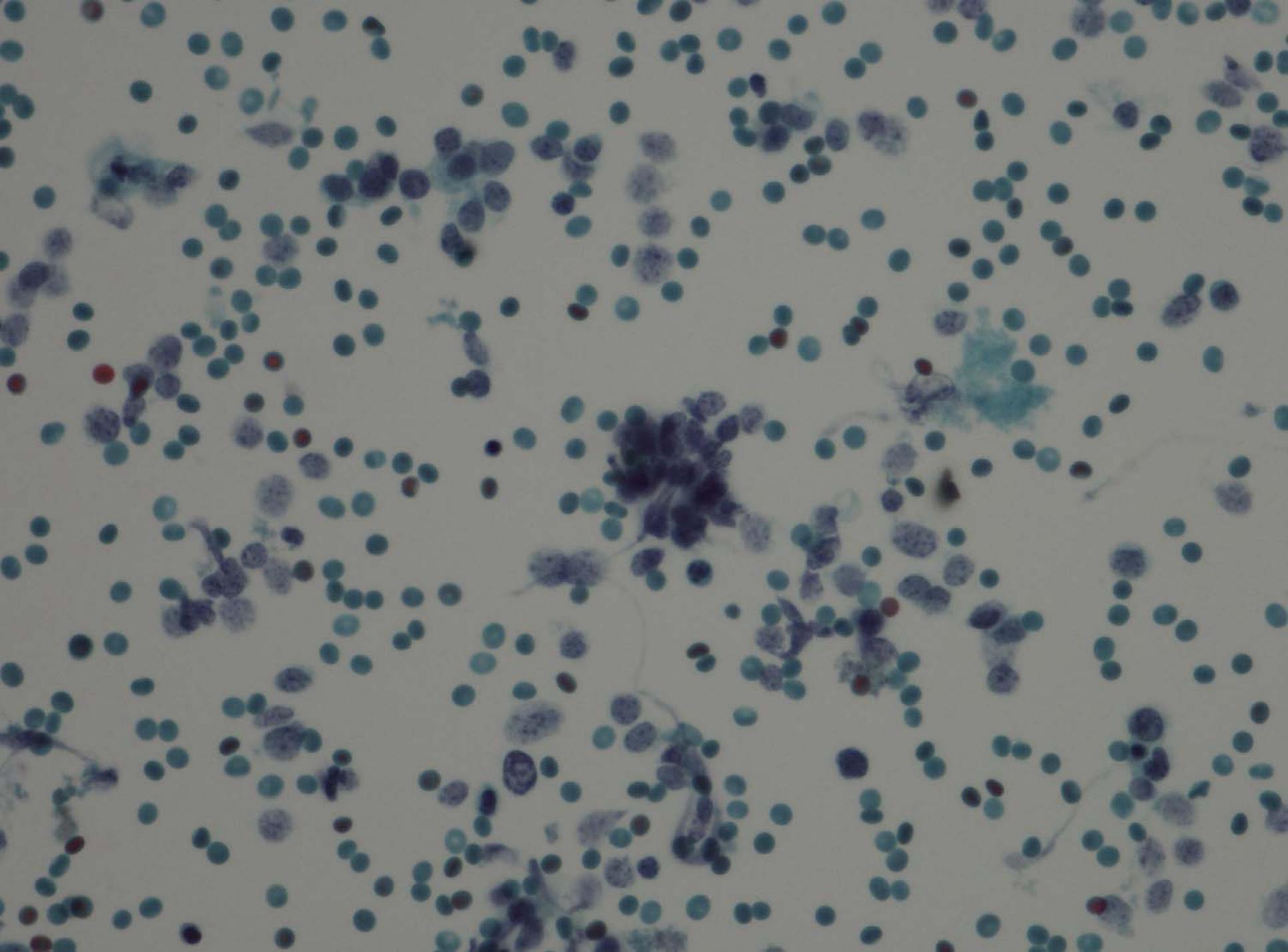
- Metastatic malignancy, primary malignancy

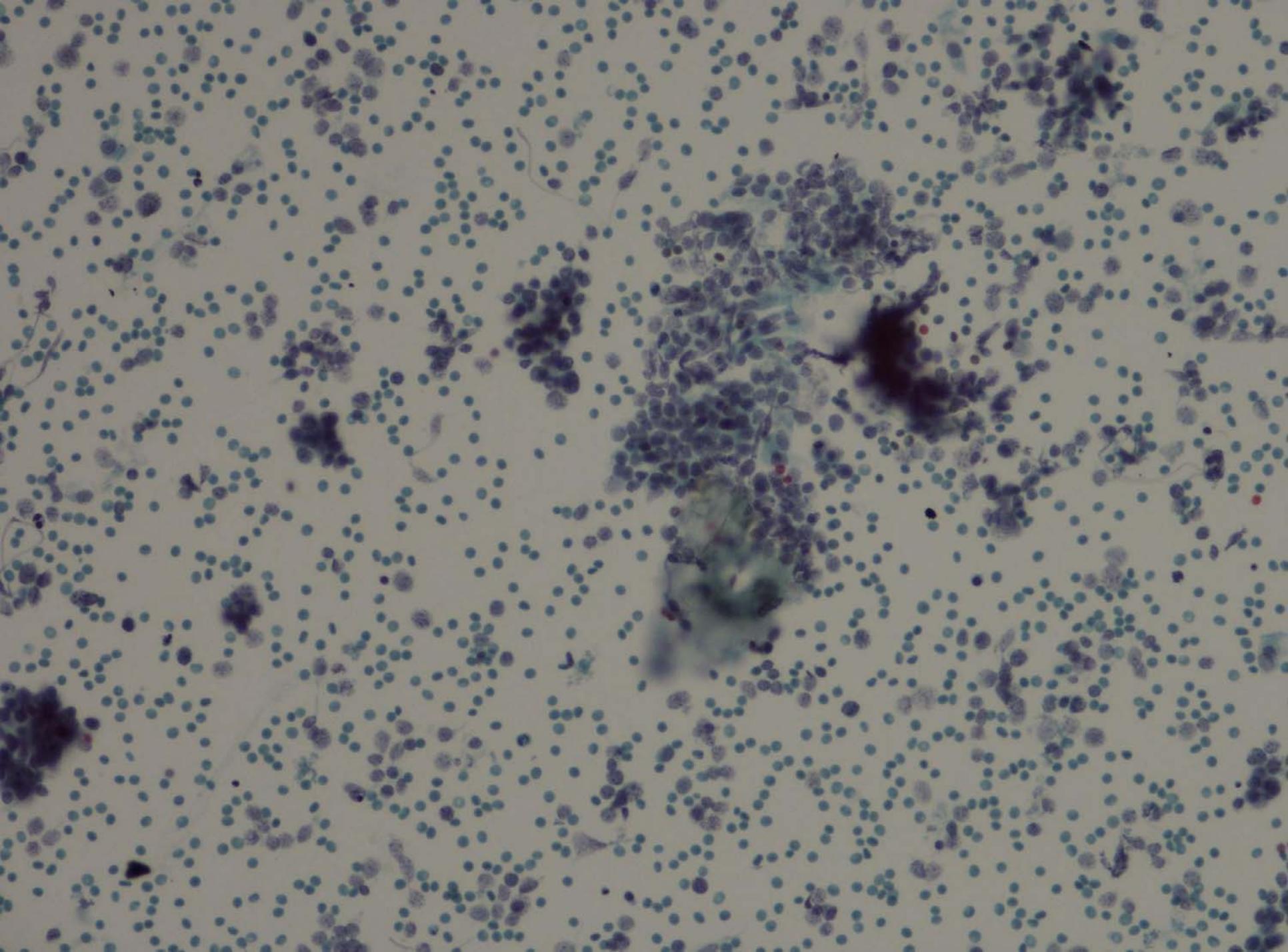
Case 10

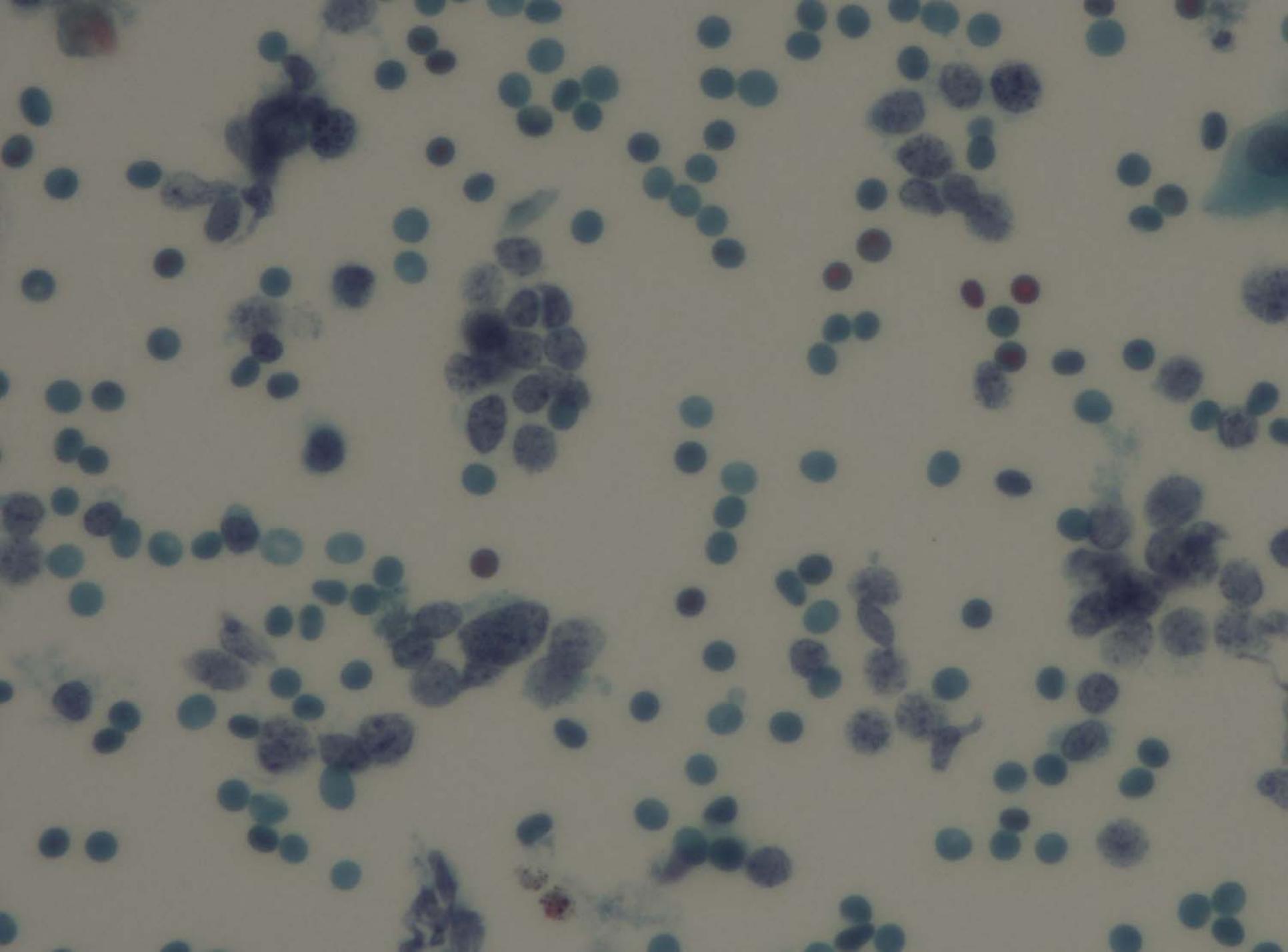
- Correct diagnosis: Adenocarcinoma, with bronchioalveolar features
- Biases
 - Framing
 - Focusing

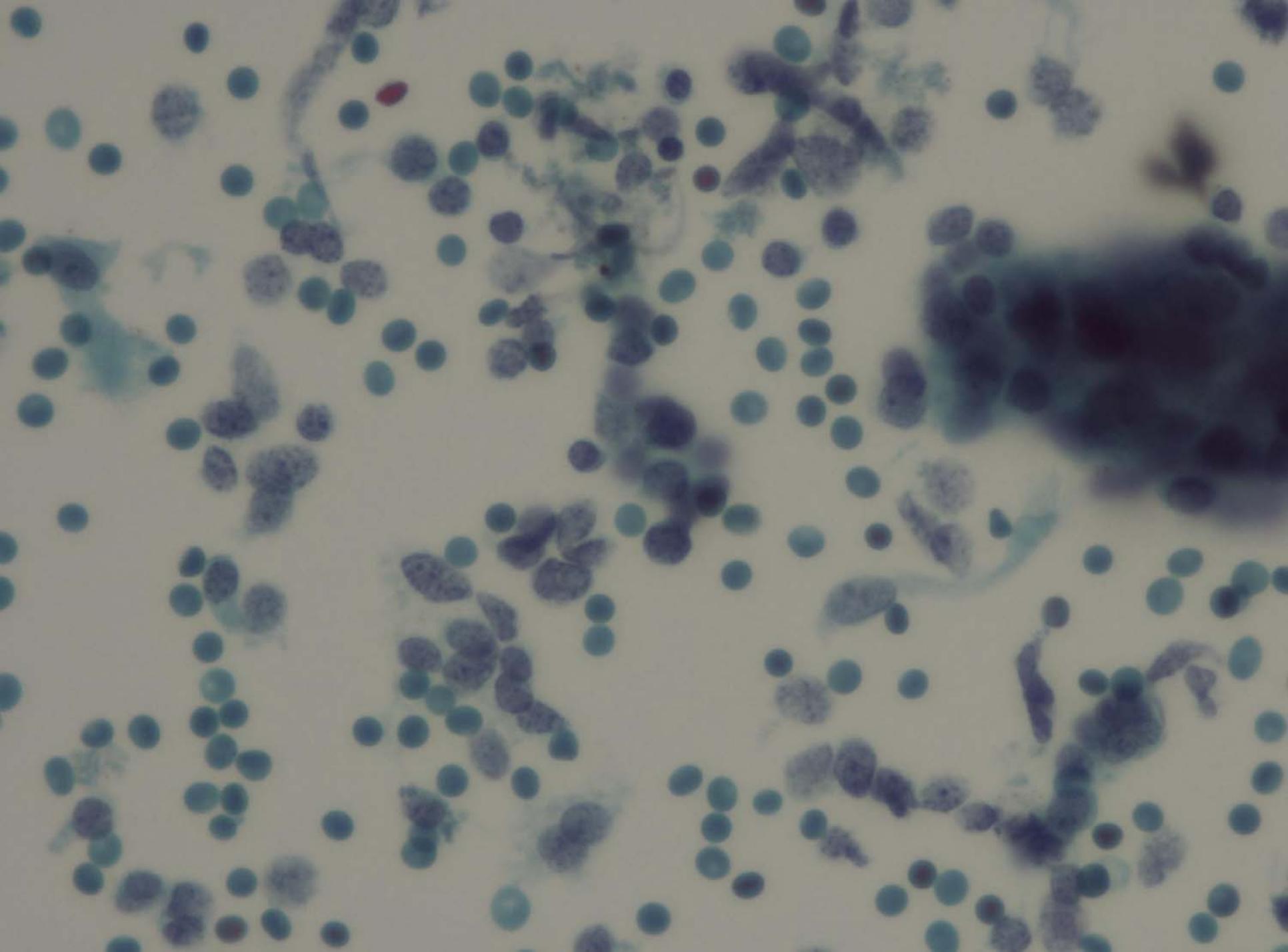
Case 11

- The patient is a 59 year old man who smoked Cuban cigars. He presented with chest pain and shortness of breath. A chest CT showed a 2.1 cm mass was seen in the right upper lobe
- A fine needle aspiration was performed









Case 11

- Original diagnosis: Non-small cell carcinoma

Case 11

■ Criteria

- Single cells
- Stripped nuclei
- Granular chromatin
- Crushed nuclei

■ Patterns

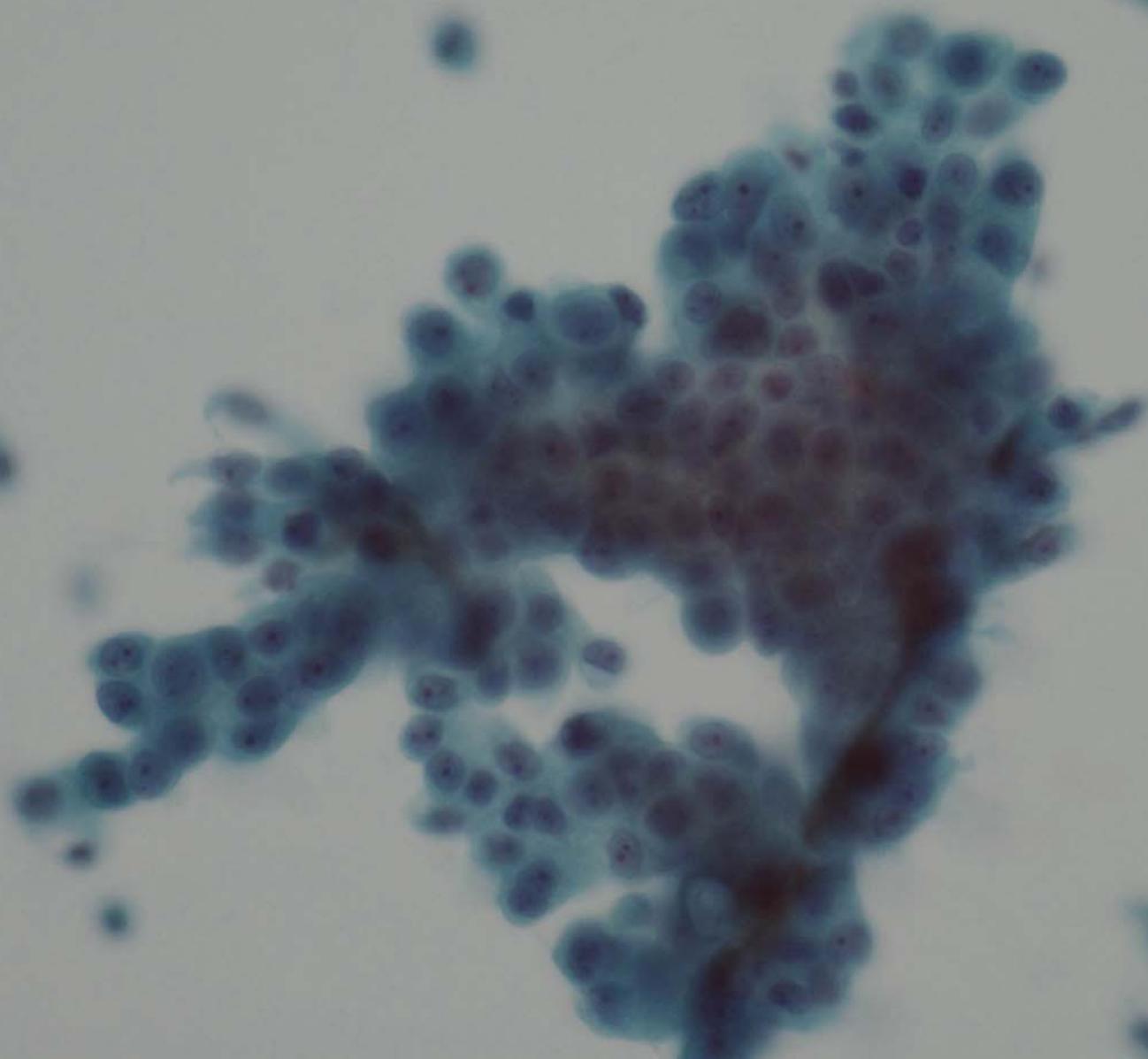
- Malignancies of various types

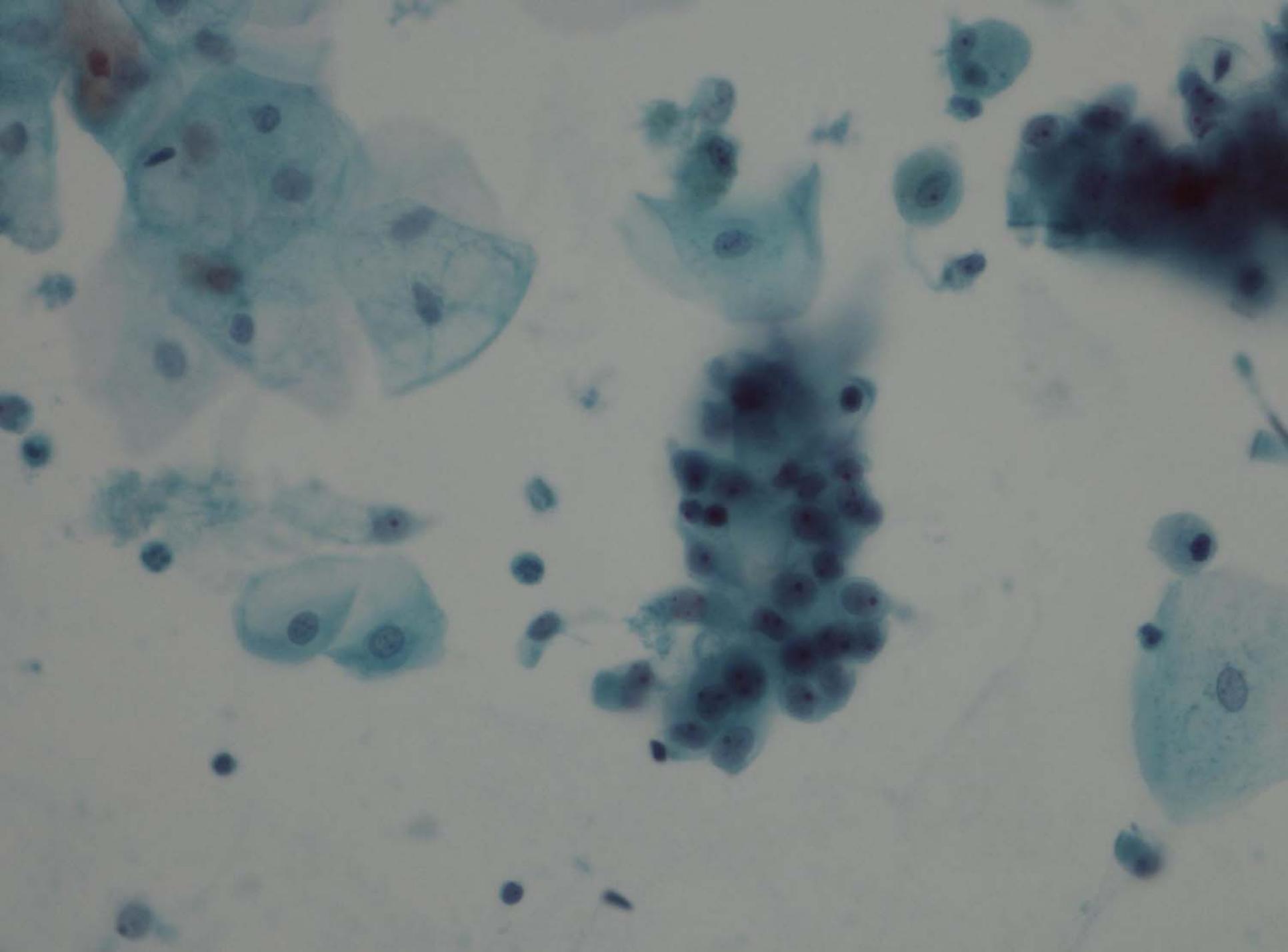
Case 11

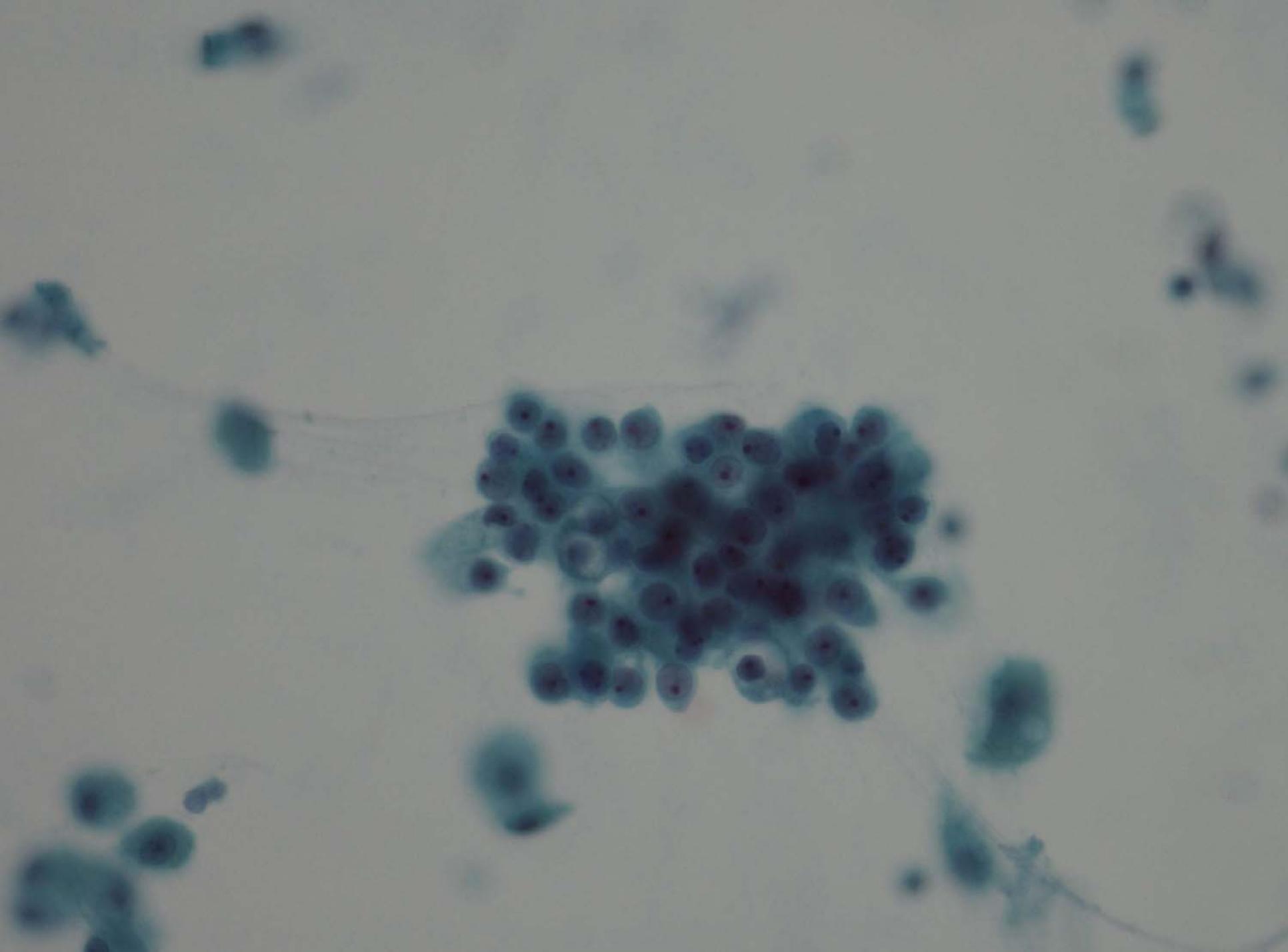
- Correct diagnosis: Small cell carcinoma

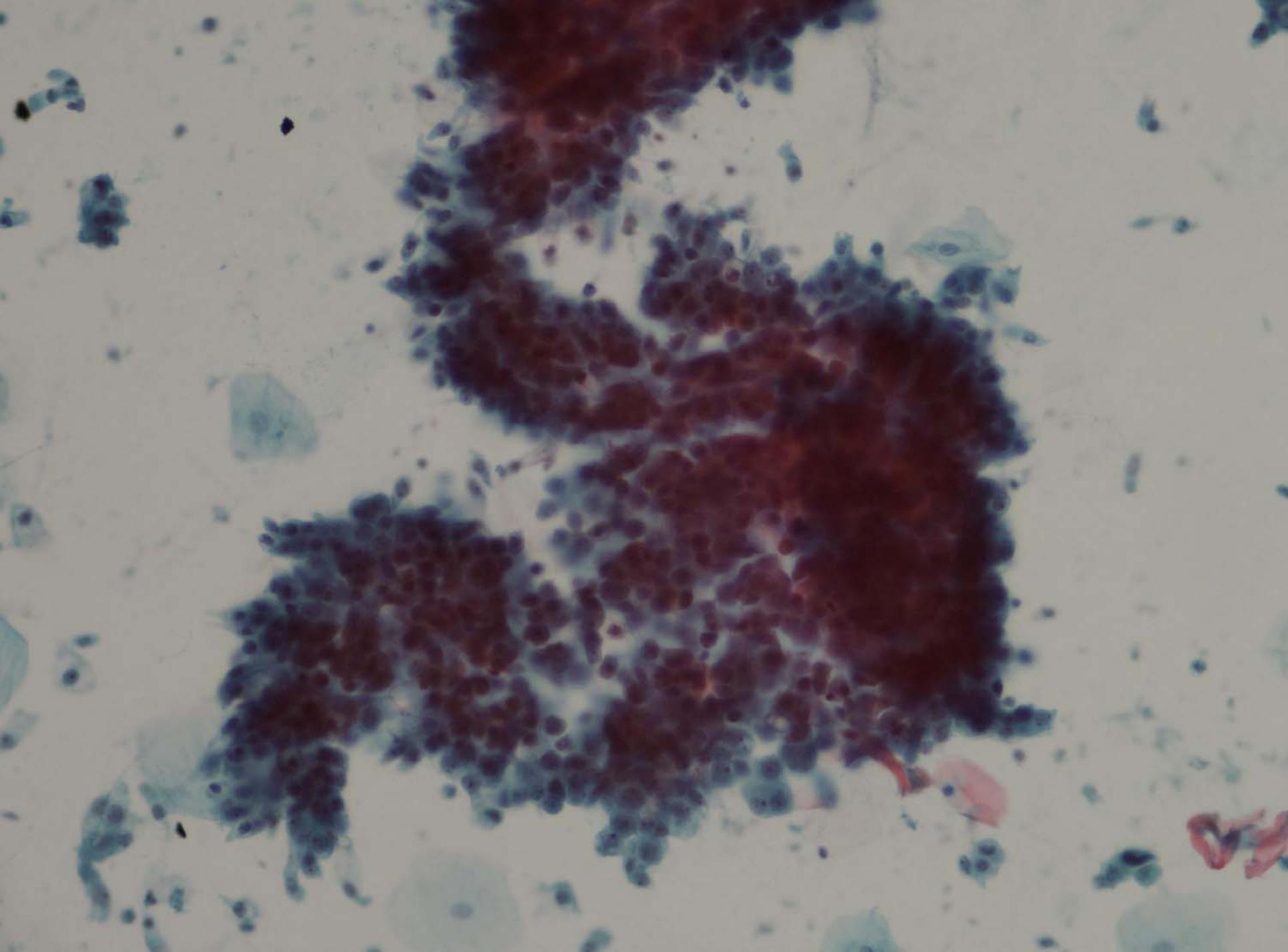
Case 12

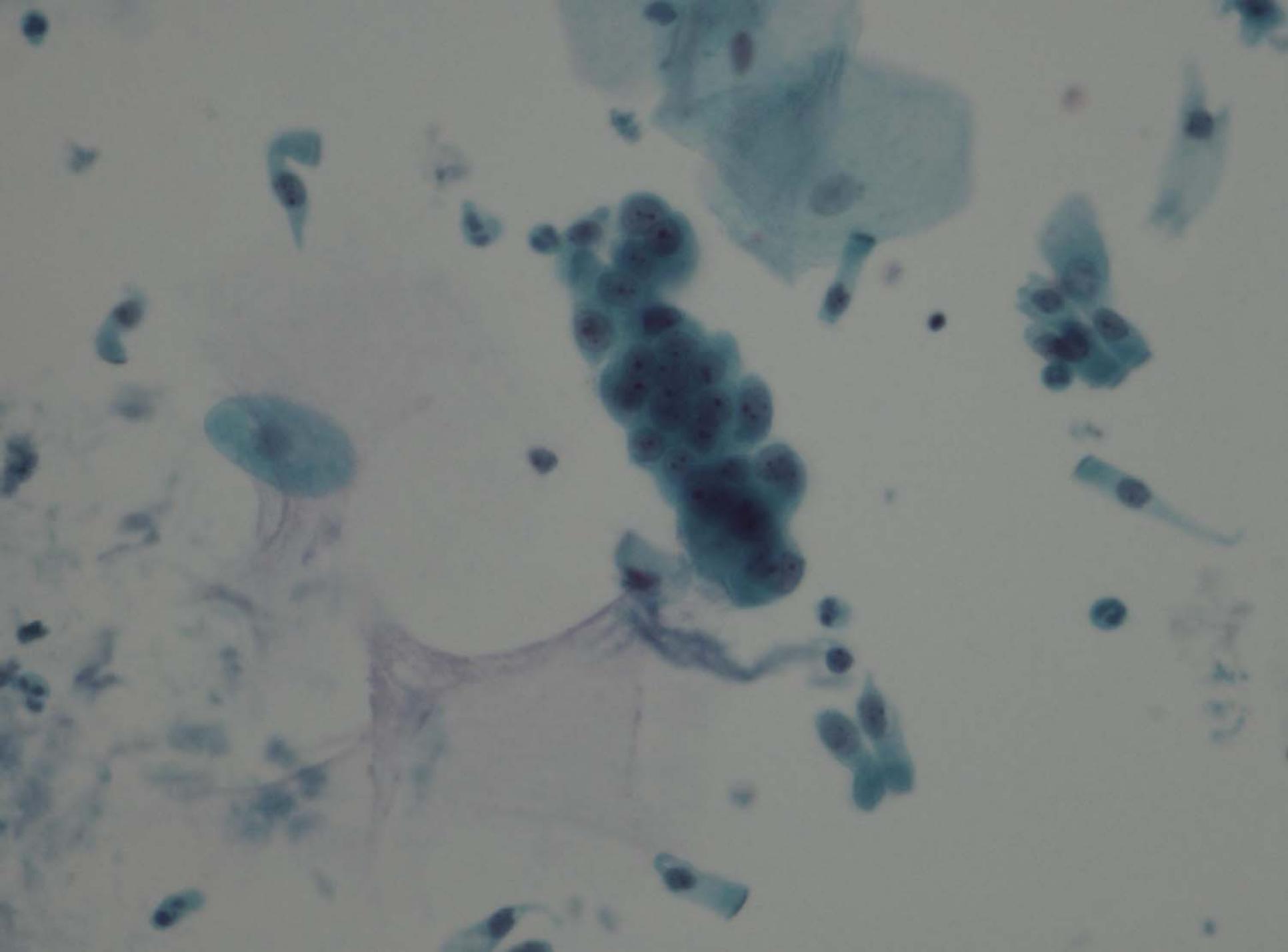
- The patient is a 47 year old woman who uses an inhaler for asthma. A chest CT showed an ill defined opacity in the right lower lobe
- A bronchial washing was performed











Case 12

- Original diagnosis: Adenocarcinoma
- Immunohistochemically, the cells were reactive for cytokeratin 7 and TTF-1
- A surgical excision was performed

Case 12

- Criteria

- ?

- Patterns

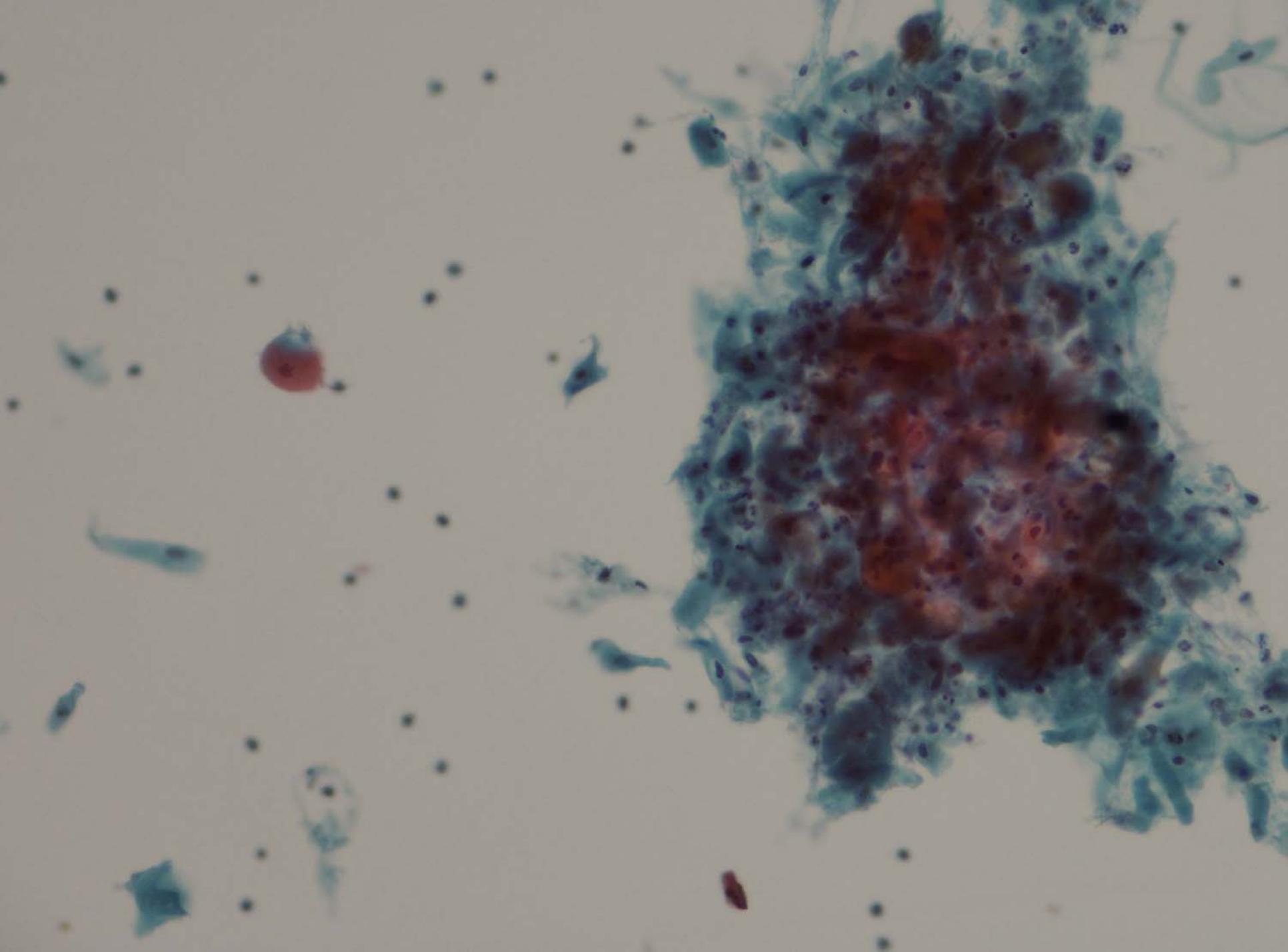
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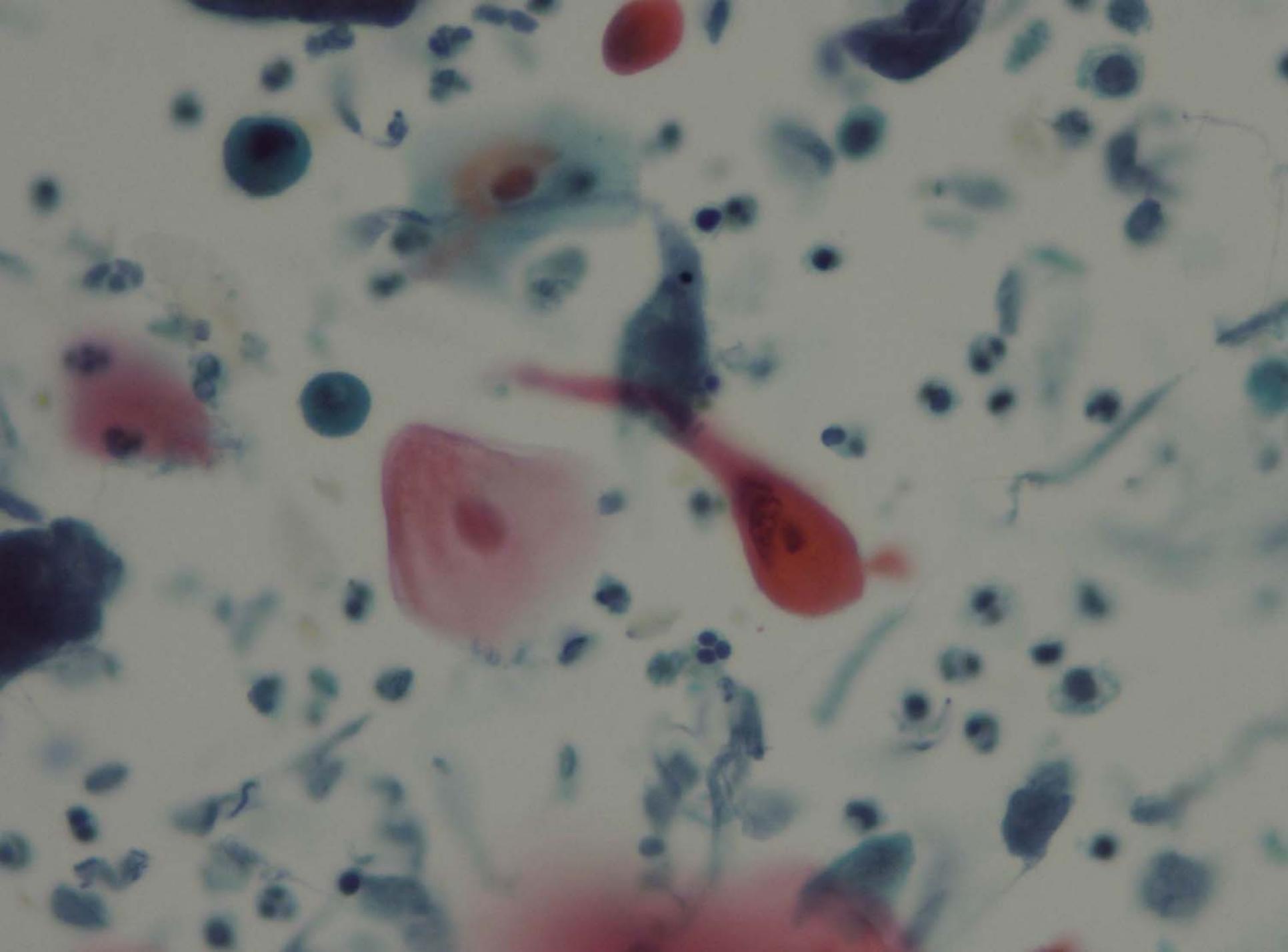
Case 12

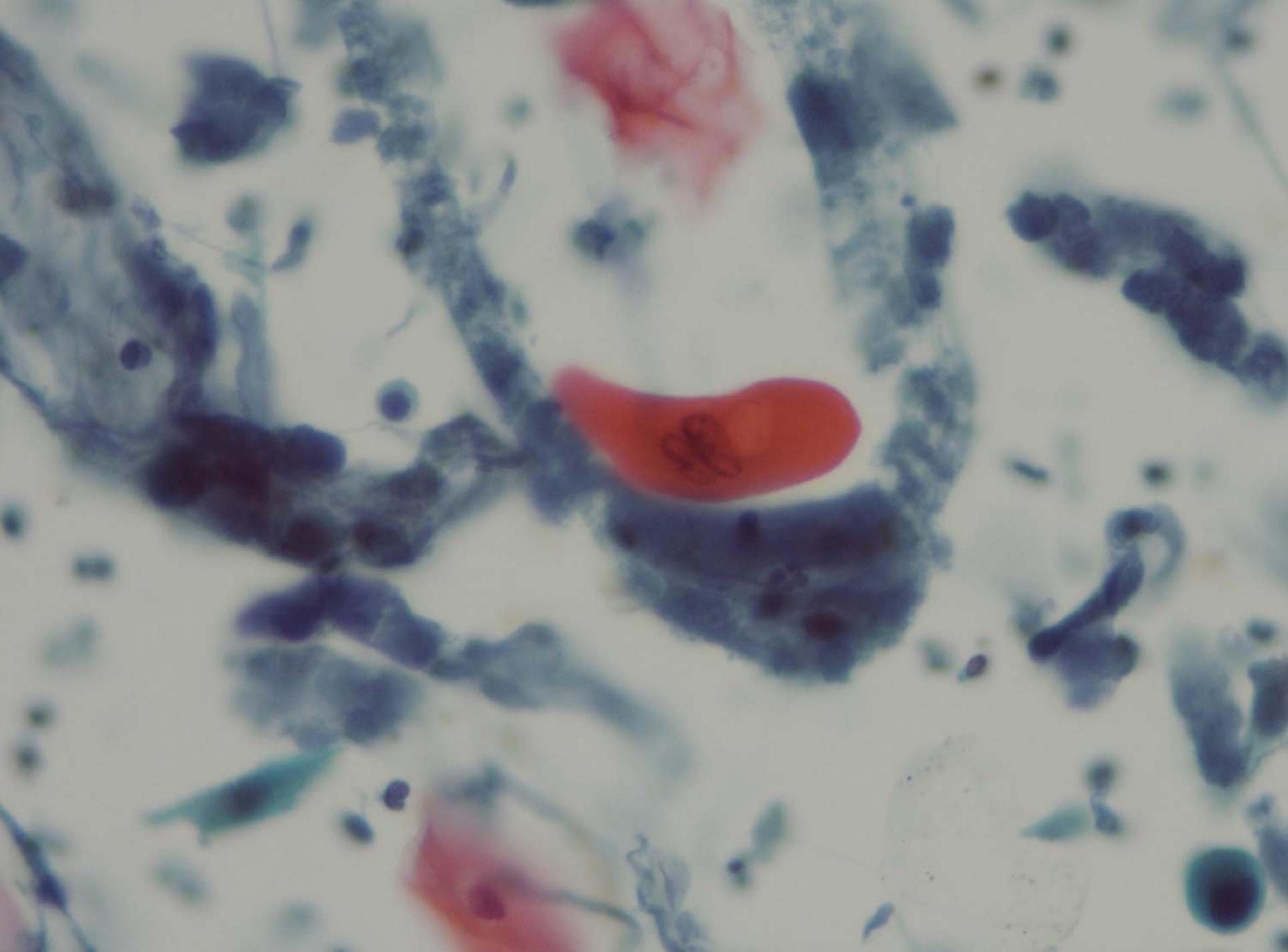
- Correct diagnosis: Reactive changes
- Biases
 - ?

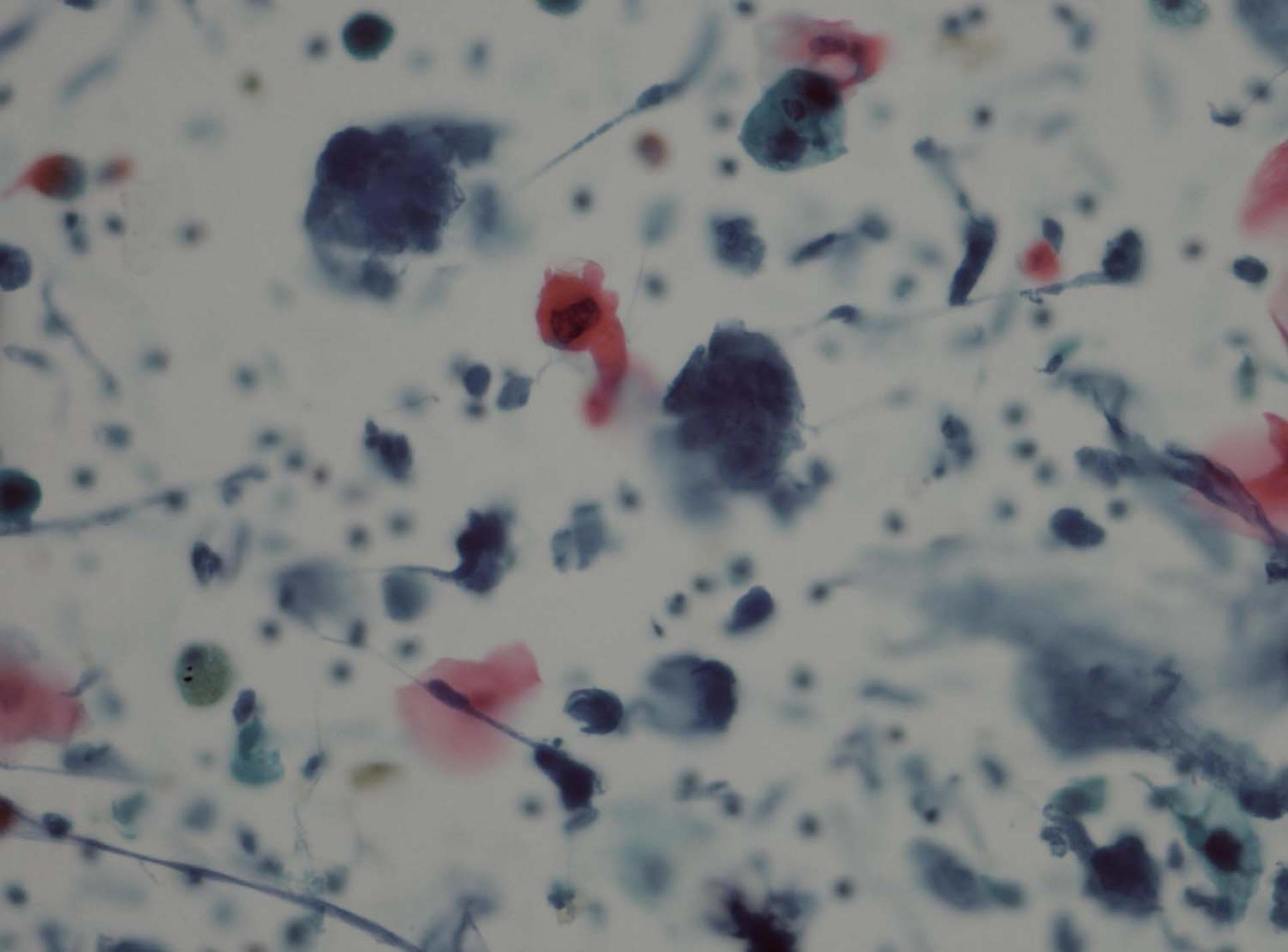
Case 13

- The patient is a 50 year old man who was a tobacco user. He had a history of small cell carcinoma that was treated with chemotherapy and radiation therapy. A follow-up CT showed a 1.6 cm left hilar lesion
- A bronchial brushing was performed









Case 13

- Original diagnosis: Reactive changes

Case 13

- Criteria

- ?

- Patterns

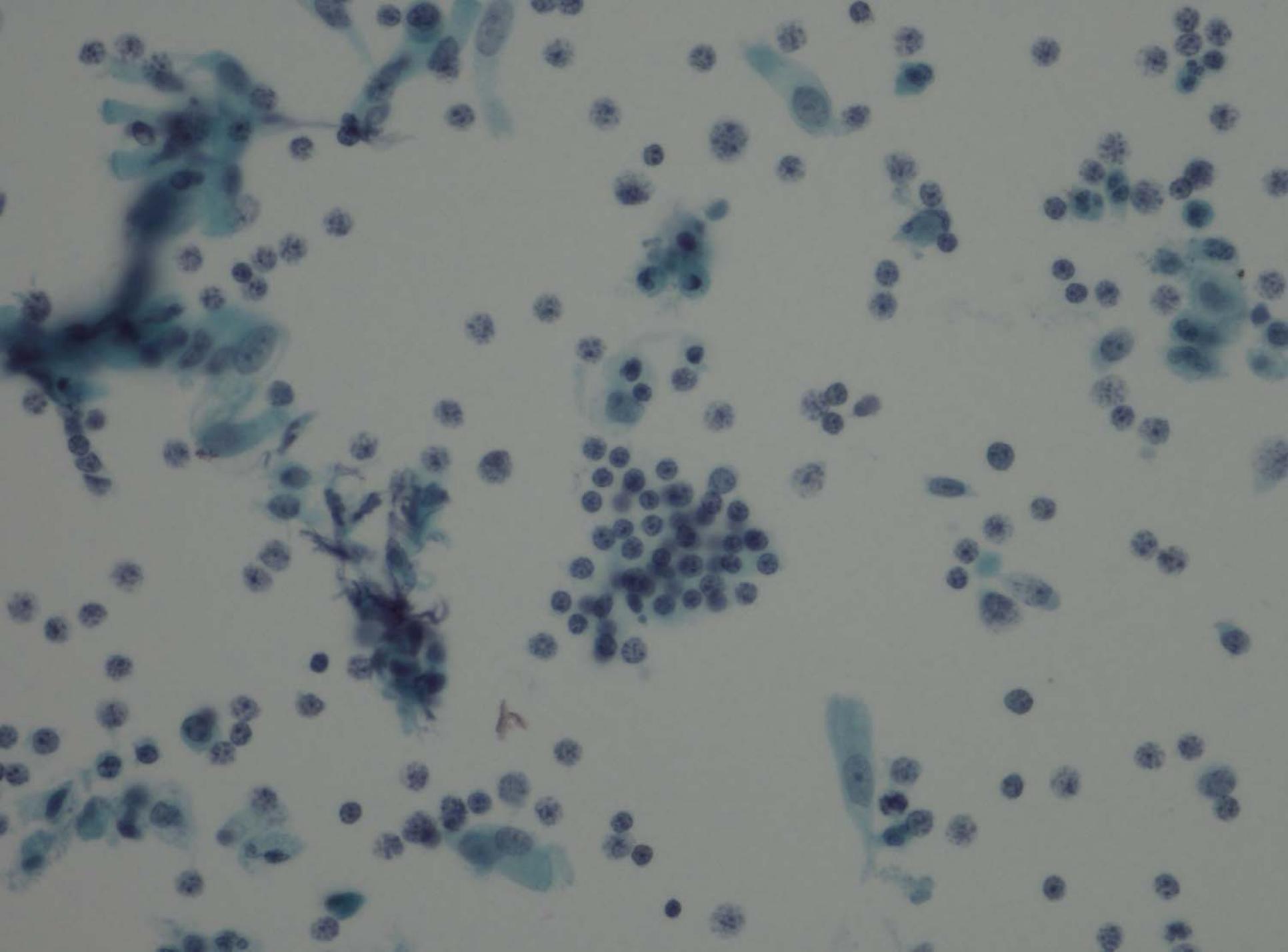
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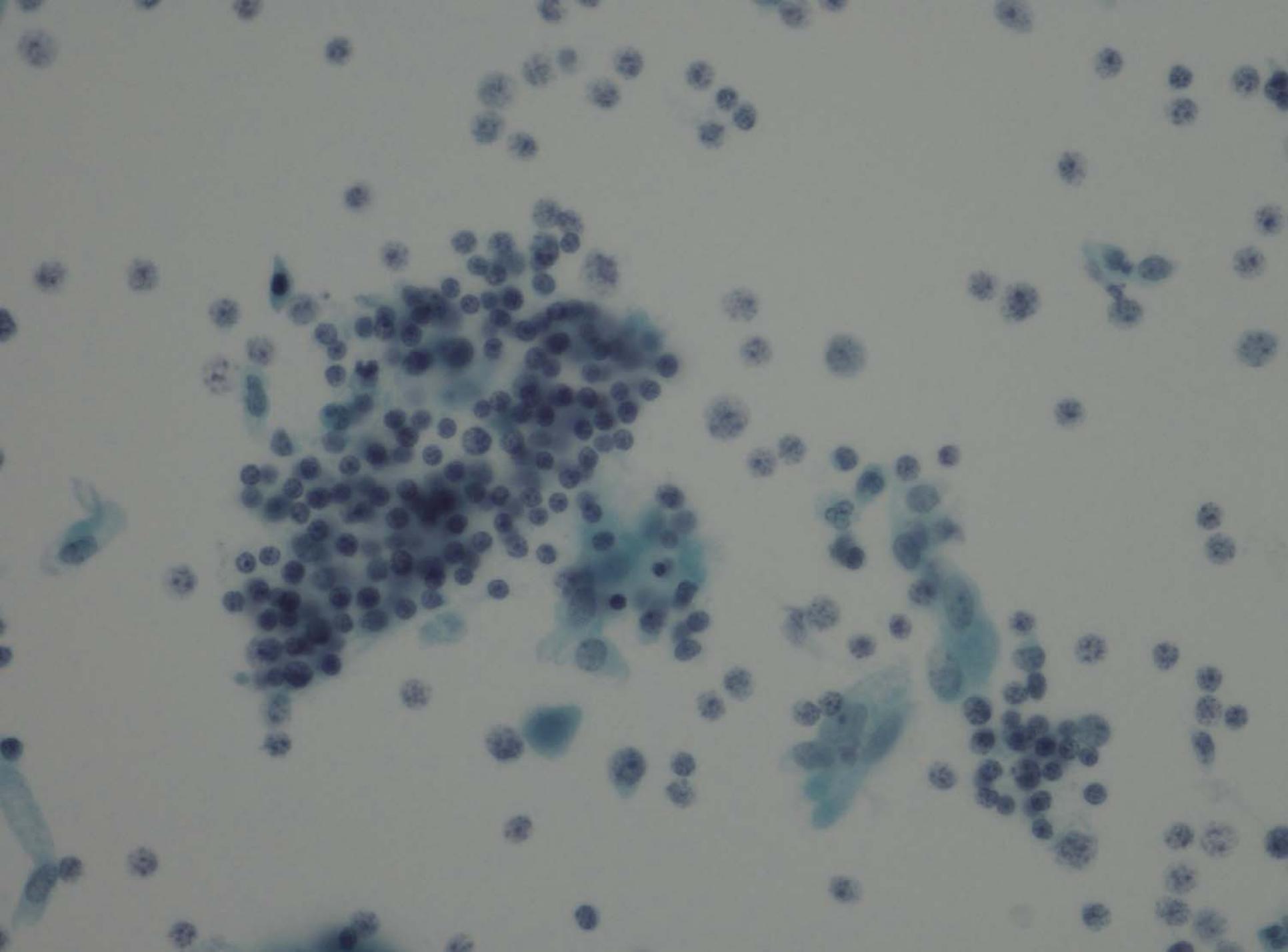
Case 13

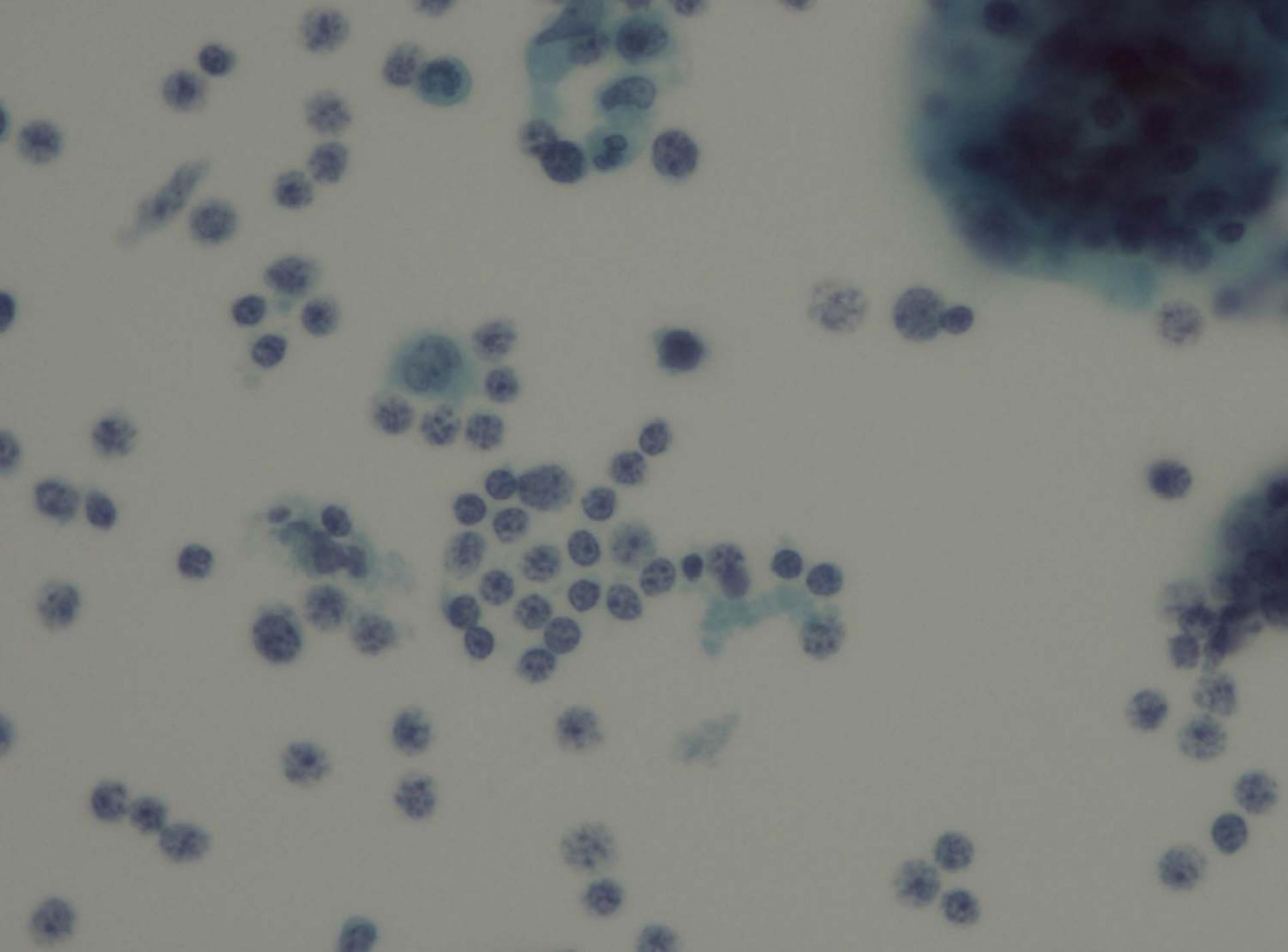
- Correct diagnosis: Squamous cell carcinoma
- Biases
 - ?

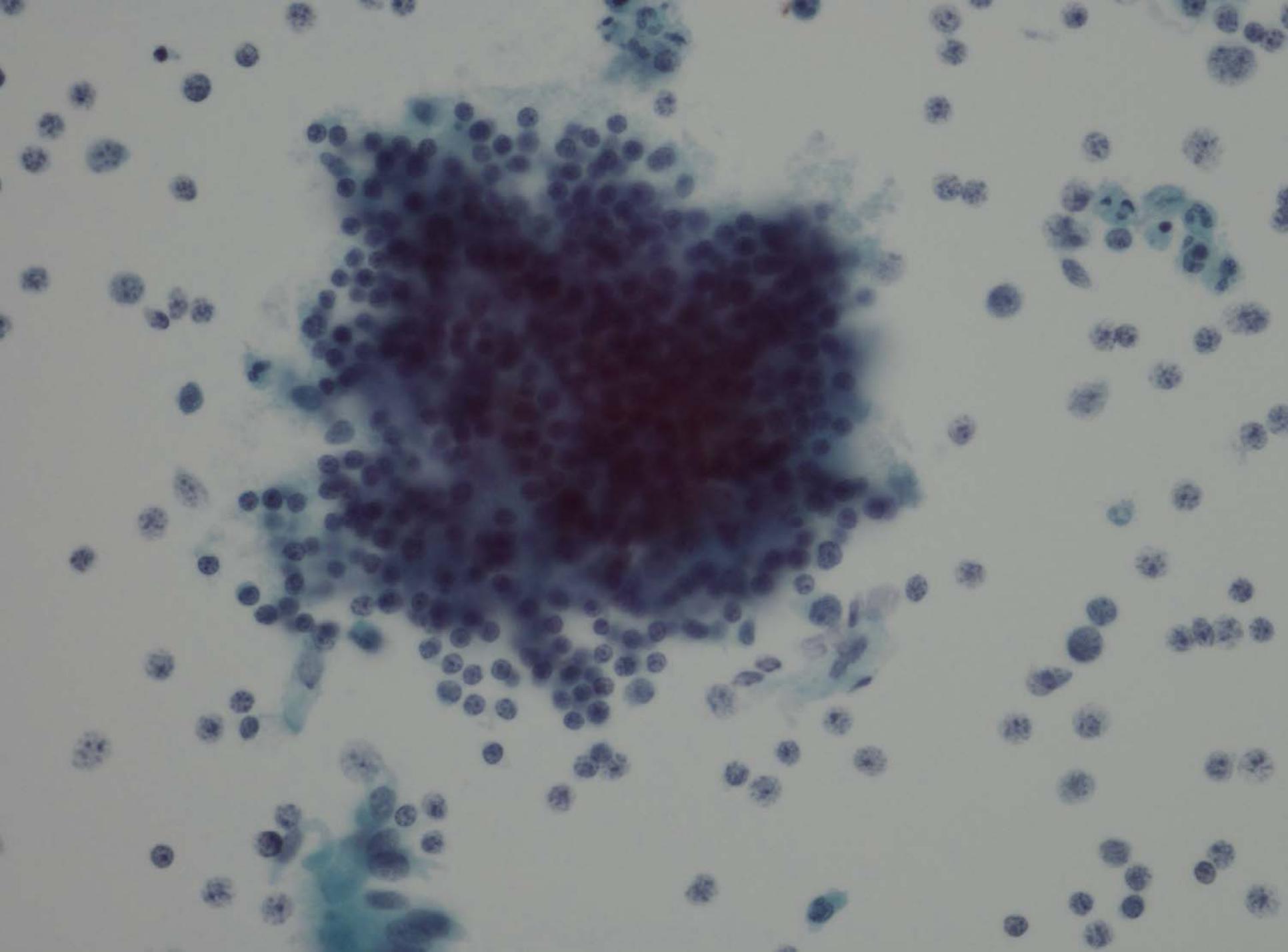
Case 14

- The patient is a 38 year old man who runs marathons. He began experiencing weakness and difficulty breathing. A chest CT showed an anterior mediastinal 4 cm mass and a 2 cm mass in the left lung
- A fine needle aspiration of the lung mass was performed









Case 13

- Original diagnosis: Atypical lymphoid cells, cannot rule out lymphoma

Case 14

- Criteria

- ?

- Patterns

- ?

Case 13

- Correct diagnosis: Thymoma
- Biases
 - ?

