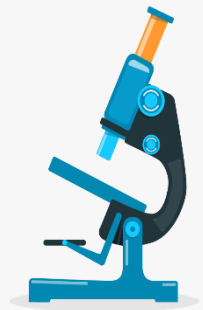




Characterising Tumours on Cytology



Neoplastic growths are typically characterised by their biologic behaviour as benign or malignant, and their cytomorphology as: round cell, epithelial, mesenchymal, or naked nuclei.

Characterisation of tumours according to cytomorphology

Round Cell

Round cells are usually rounded, have discrete cell borders and exist as individual cells. They may be found in groups or sheet-like arrangements. Examples of round cell tumours include histiocytic (Figure 1) and haematopoietic tumours, such as lymphoma.

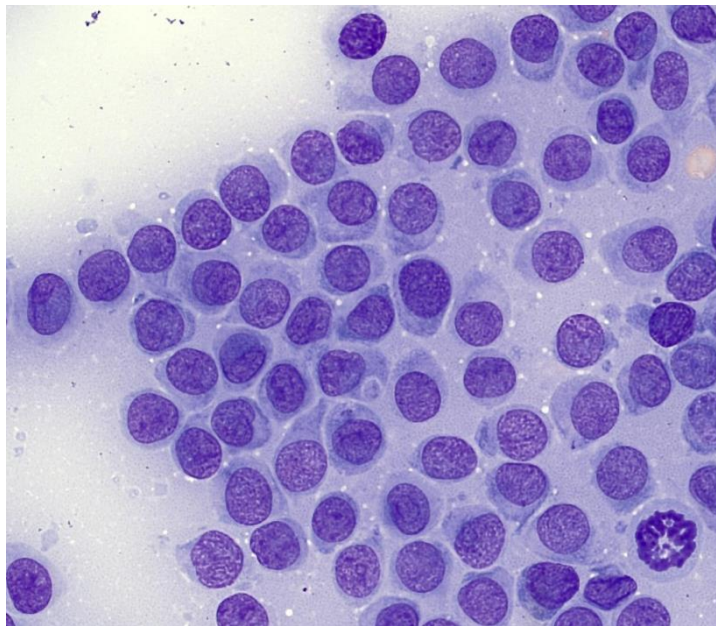


Figure 1. Cytology of a dog histiocytoma. This a common type of round cell tumour in dogs. Nuclei are usually round to oval, but reniform nuclei may be seen. Mitoses may be present (bottom right corner). Wright's stain 60x.

Epithelial

Epithelial cells tend to be cuboidal to polygonal or columnar in shape. They usually have distinct cell border, form clusters or sheets, and can show trabecular (Figure 2), spherical, or

papillary arrangements. Epithelial cells may also have cytoplasmic vacuoles, suggesting a glandular origin.

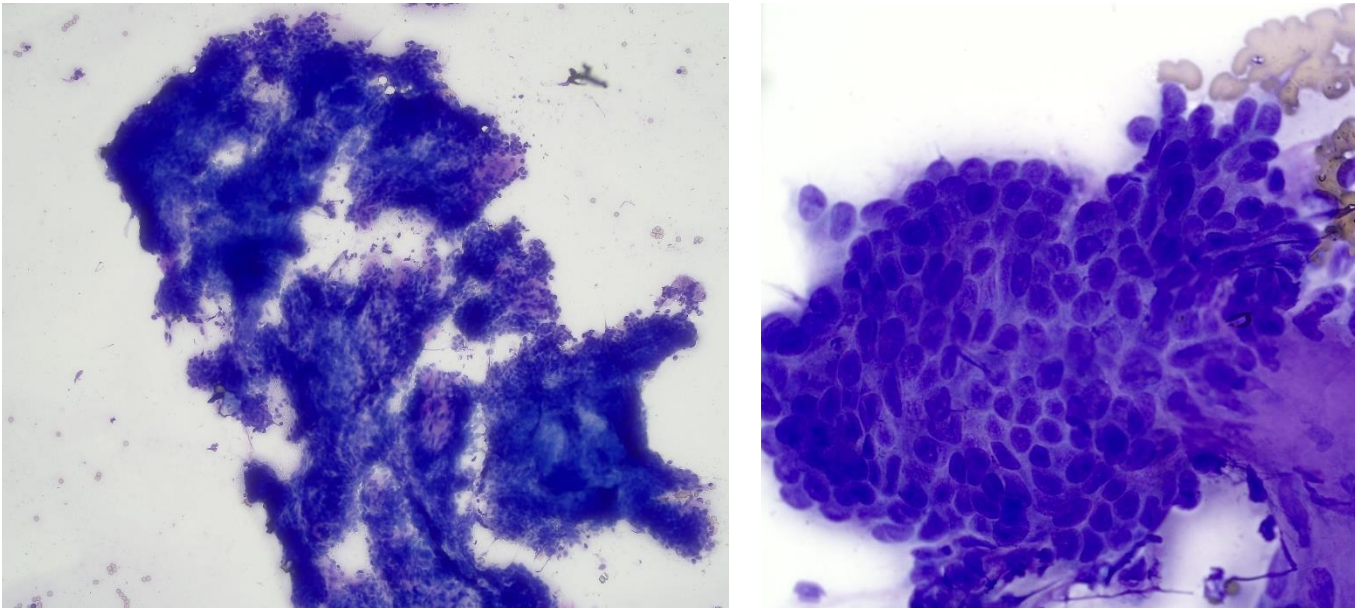


Figure 2. Left, Cytology of a dog hair follicle tumour (Trichoblastoma). These tumours show clusters to often cord-like arrangements of cuboidal epithelial cells. Wright's stain, 10x
Right, Closer view of the same tumour. Extracellular matrix consisting of basement membrane may be seen. Wright's stain, 60x.

Mesenchymal

Mesenchymal cells typically have a spindle or stellate shape. Cell borders tend to be indistinct and often fade into the background. Mesenchymal cells are generally individualised (with no cell-to-cell adhesion), seen in aggregates, and are often held together by extracellular matrix.

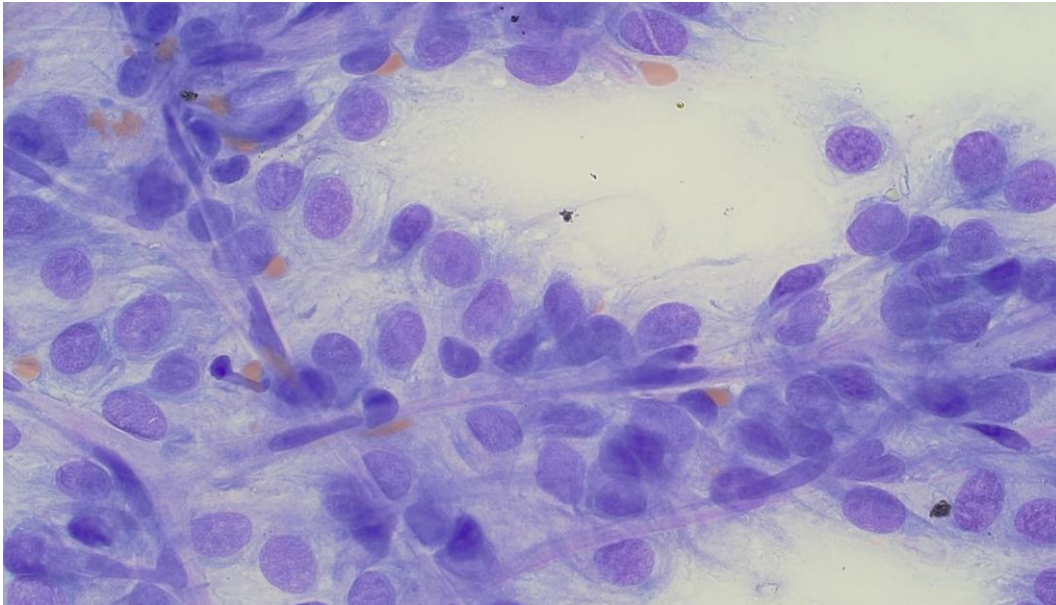


Figure 3. Cytology of a dog soft tissue sarcoma. The cells borders are difficult to discern and cells are spindled to stellate. The cells show a perivascular arrangement most supportive of a perivascular wall tumour such as haemangiopericytoma. Wright's stain, 60x.

Naked Nuclei

Neuroendocrine or endocrine tumours will often exfoliate well but tend to be fragile. Aspirates of these tumours will typically show packets of bare nuclei from ruptured cells and are referred to as "naked nuclei". Many naked nuclei tumours show bland features on cytology, although they are biologically aggressive.

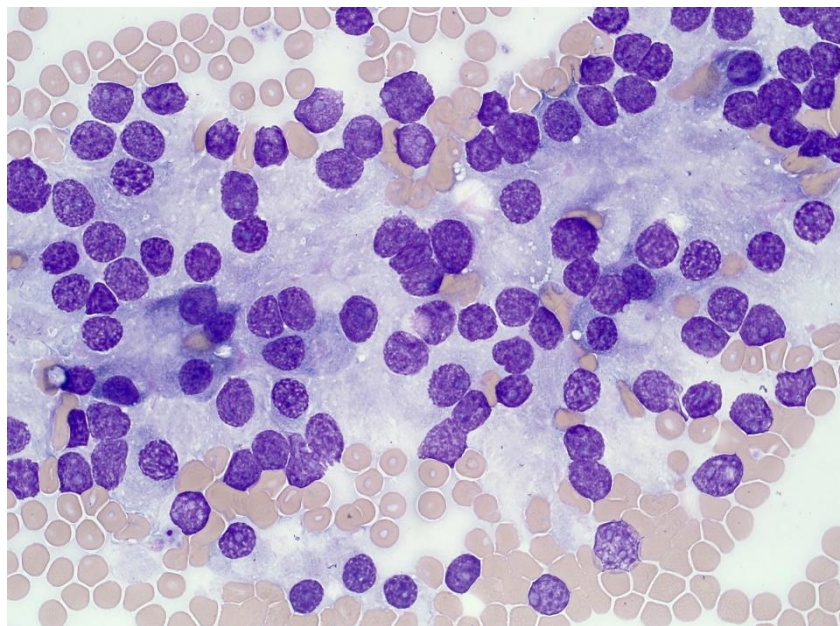


Figure 4. Cytology of a dog thyroid tumour. Although the cells do not display criteria of malignancy, most thyroid tumours in dogs consist of thyroid follicular adenocarcinomas. Wright's stain, 60x.

Characterisation of tumours according to biologic behaviour

Malignant

Malignant tumours are cancerous and are typically invasive with the potential to spread around the body (metastasise). Cytomorphologic criteria of malignancy is divided into cellular and nuclear criteria. Malignant tumours usually display 4 or more of these criteria:

Cellular criteria of malignancy:

1. Anisocytosis: variation in the size of cells.

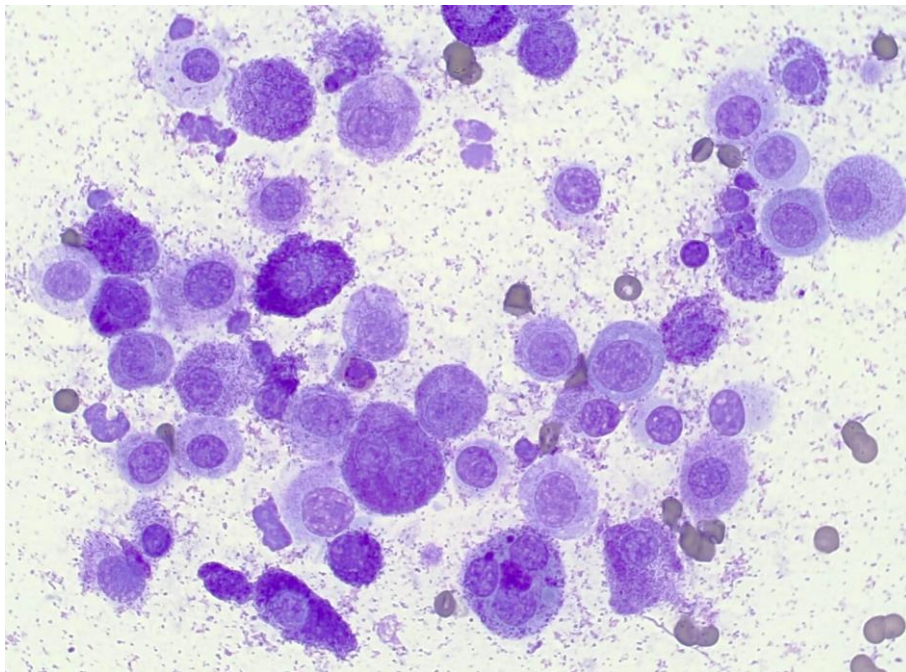


Figure 5. Note the cell size variation among the neoplastic cells. Cat, mast cell tumour (Wright's stain, 60x).

2. Macrocytosis: increase in the size of cells (cells larger than the "normal" counterparts).

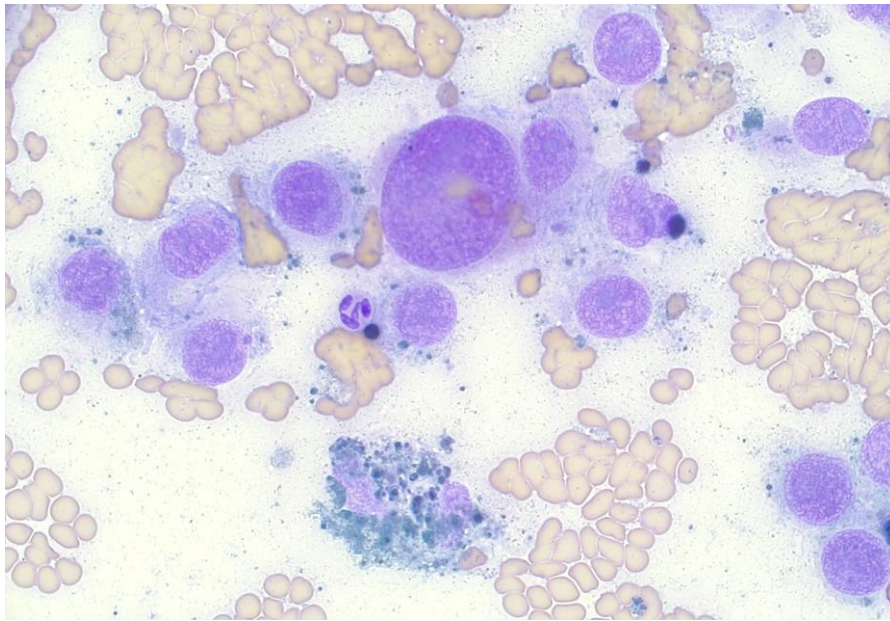


Figure 6. There is marked anisocytosis and a macrocytic cell with a very large nucleus. Cat, melanoma (Wright's stain, 60x).

3. Pleomorphism: variation in the size and shape of a particular cell type.

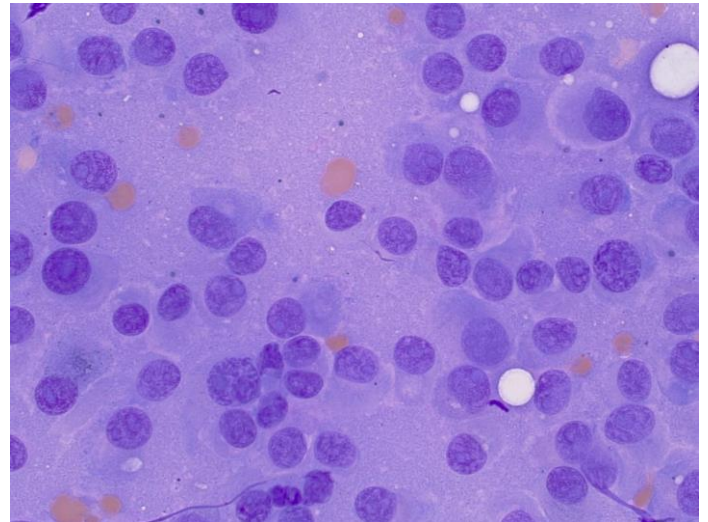
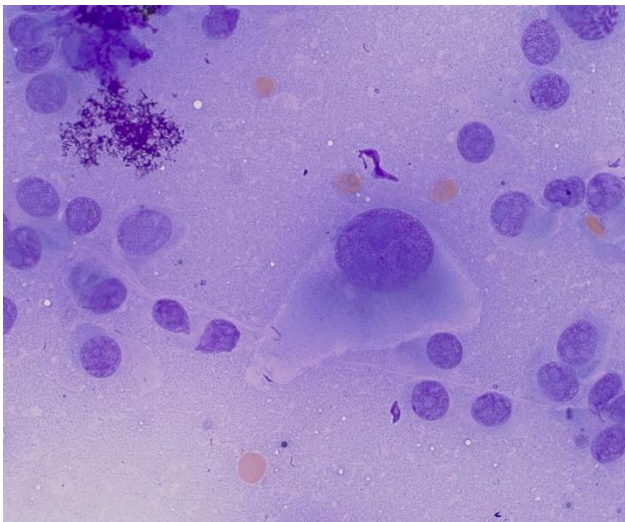


Figure 7. There is moderate to marked anisocytosis. Neoplastic cells are round to oval, and rarely, stellate. Dog, melanoma (Wright's stain, 60x).

Nuclear criteria of malignancy:

1. Increased nuclear to cytoplasmic ratio (N:C ratio): increase in the size of the nuclei compared to the cytoplasm.

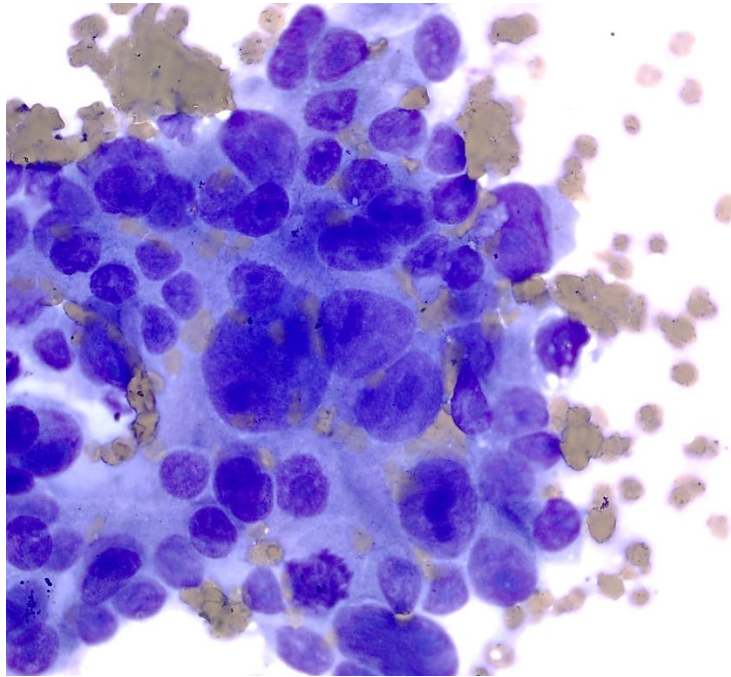


Figure 8. Epithelial neoplastic cells show small amounts of blue cytoplasm. Cat, pancreatic adenocarcinoma (Wright's stain, 60x).

2. Macrokaryosis: increase in the size of the nuclei. Nuclei larger than a neutrophil suggest malignancy.

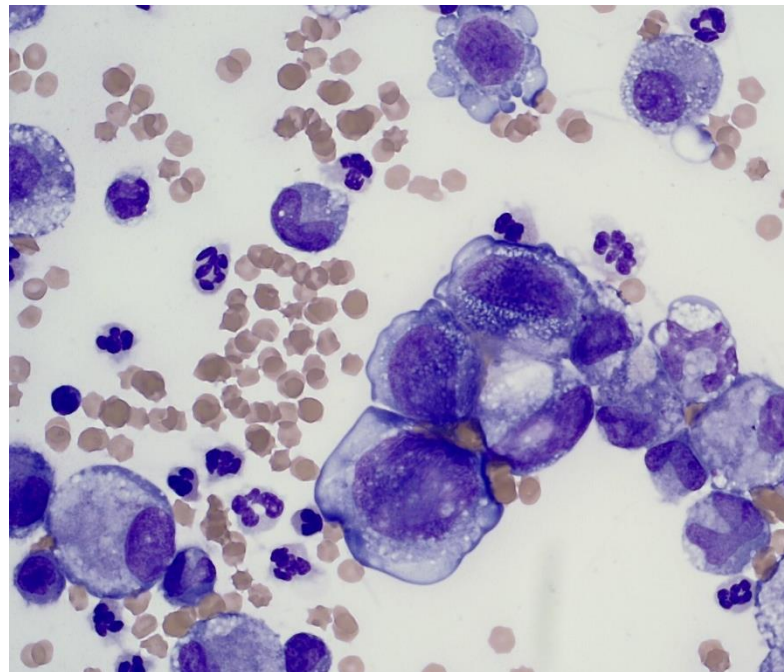


Figure 9. The cohesive cells show macrokaryosis with nuclei up to 3.5x the size of a neutrophil. Cat, carcinoma (Wright's stain, 60x)

3. Multinucleation: multiple nuclei are present in a single cell.

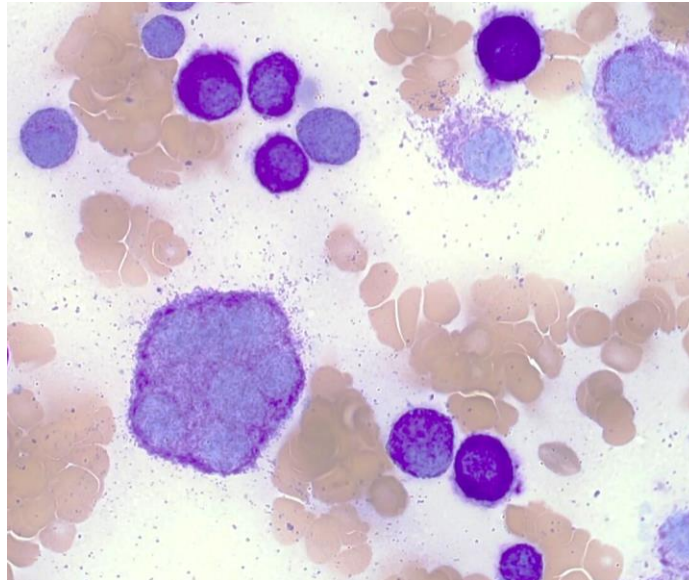


Figure 10. Multinucleate neoplastic mast cells are shown. Dog, mast cell tumour (Wright's stain, 60x).

4. Anisokaryosis: variation in the size of nuclei.

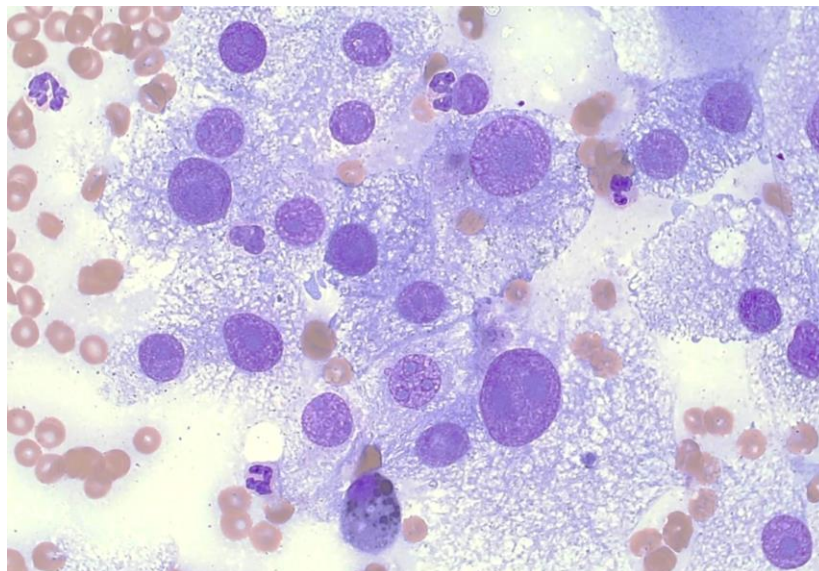


Figure 11. Anisokaryosis marked among cells. Additionally there is anisokaryosis in binucleate cell (top left corner). Dog, balloon cell melanoma (Wright's stain, 60x).

5. Nuclear moulding: the nucleus of one cell is moulded and distorted by the nucleus of another cell.

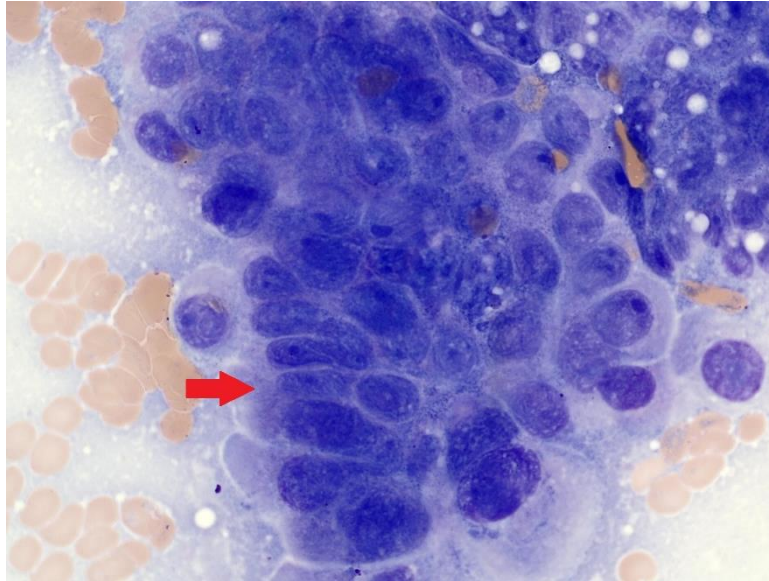


Figure 12. Nuclear moulding is evident, red arrow. Dog, carcinoma (Wright's stain, 60x).

6. Macronucleoli: increases in the size of the nucleoli ($\geq 5 \mu\text{m}$).

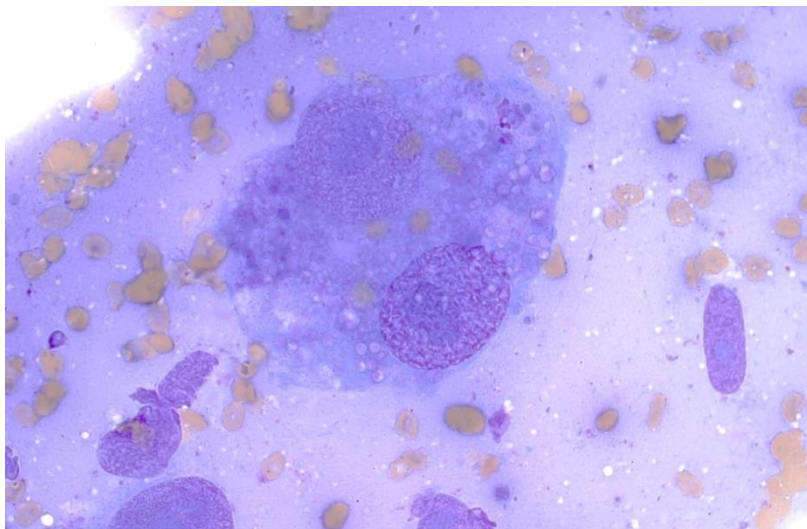


Figure 13. Note the larger than a red cell nucleoli in this neoplastic binucleate cell. Cat, anaplastic sarcoma with giant cells. For reference cat red cells are 5-6 μm . (Wright's stain, 60x).

7. Anisonucleoliosis: variation in the size and shape of the nucleoli.

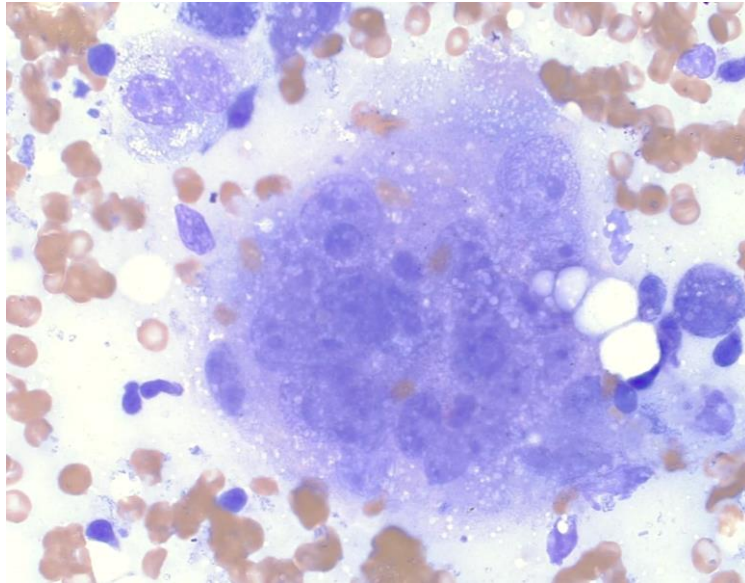


Figure 14. Multinucleate cell with intranuclear anisonucleoliosis. Dog, histiocytic sarcoma (Wright's stain, 60x).

8. Coarse chromatin pattern: the pattern of chromatin looks thicker/rougher.

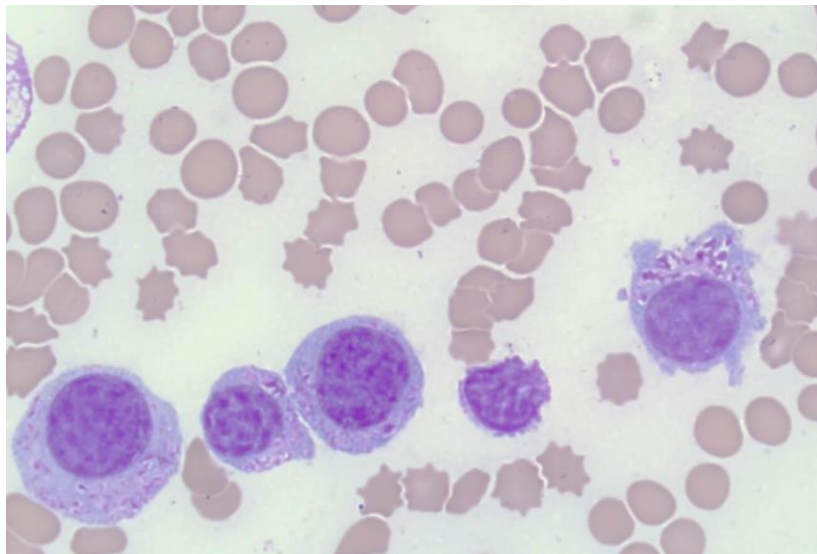


Figure 15. Nuclear chromatin appears chunky. Cat, round cell tumour: Mast cell tumour vs. lymphoma of granular lymphocytes (Wright's stain, 60x).

9. Increased mitotic figures: mitotic figures are present in the slide (usually you do not see them).
10. Abnormal mitotic figures: arrangement of the mitotic figures is abnormal.

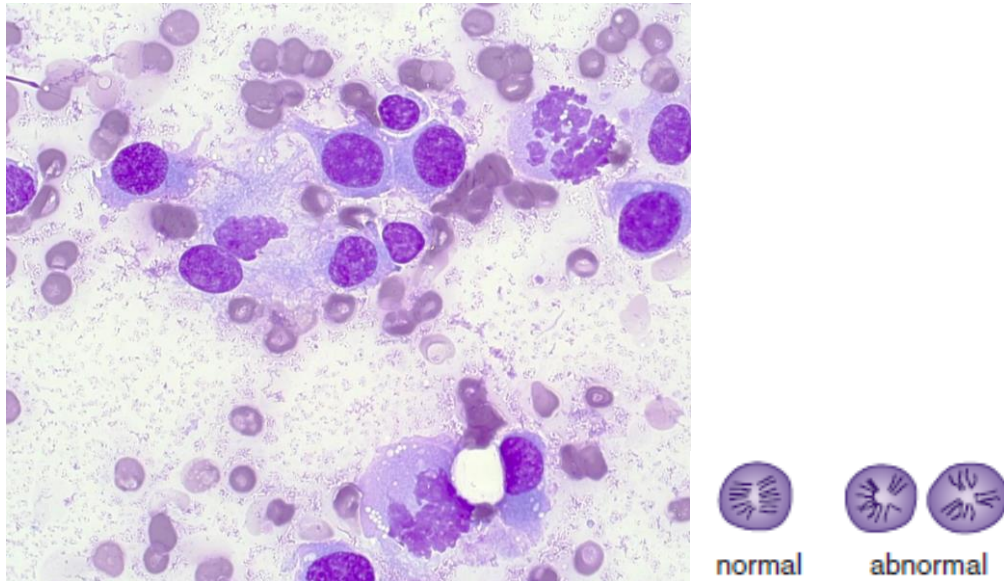


Figure 16. Frequent and atypical mitoses were seen in this case. Dog, osteosarcoma (Wright's stain, 60). Inset from Cowell & Tyler's Cytology & Haematology of the Dog & Cat.

Benign

Benign tumours lack many of the criteria of malignancy listed above. They are usually well differentiated, non-invasive, slow growing and well demarcated/encapsulated.

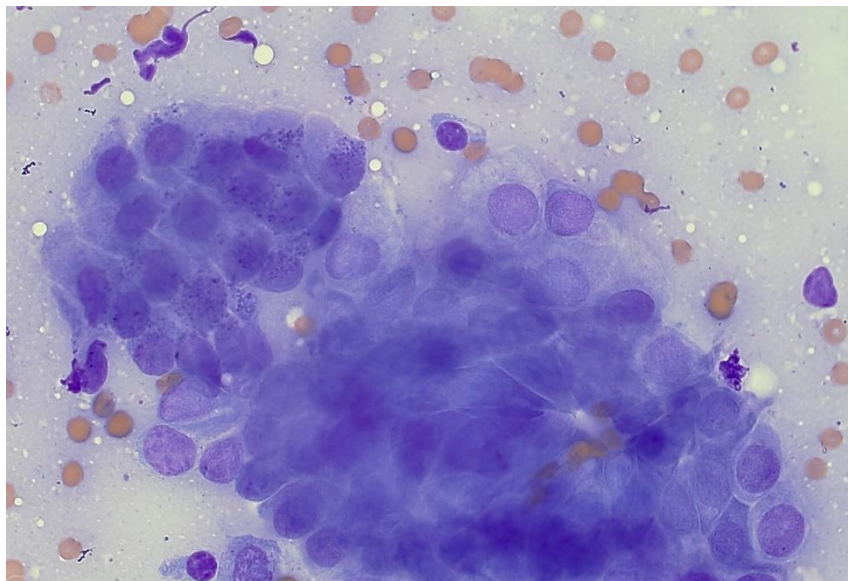
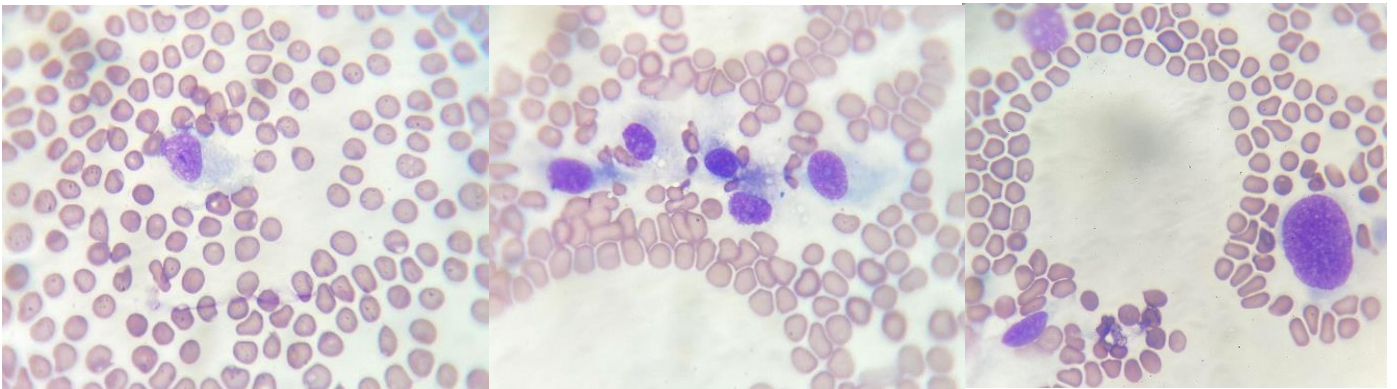


Figure 17. Epithelial cells are overall uniform cellular and nuclear size. Cat, ceruminous adenoma (Wright's stain, 60x).

Examples of a Malignant/Benign Tumour

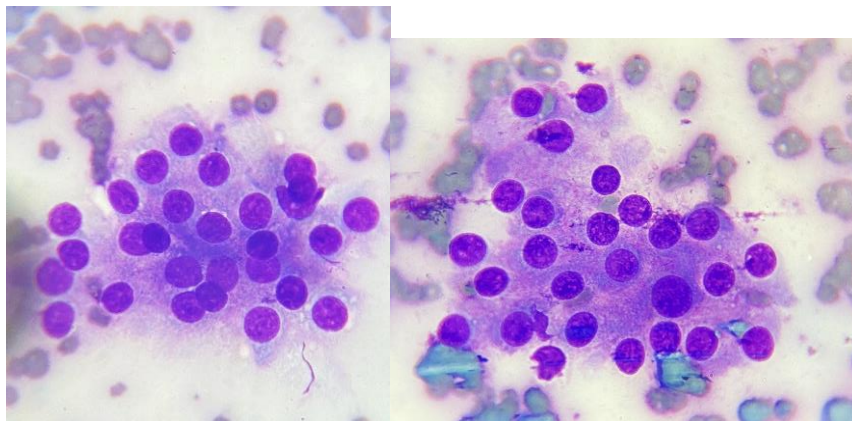
Malignant: Haemangiosarcoma (Renal mass, dog)



Criteria of malignancy present:

- Macrocytosis
- Anisocytosis
- Macrokaryosis
- Anisokaryosis
- Macronucleoli
- Anisonucleolosis
- Coarse nuclear chromatin

Benign: Thyroid adenoma (hyperthyroid cat)



Benign characteristics:

- Well differentiated cells
- Uniform cell and nuclear size
- Normal cytoplasmic and nuclear features
- Normal chromatin pattern



Please check out my online veterinary pathology interest community hosted on Reddit for more pathology fun by Alex Teh!

<https://www.reddit.com/r/veterinarypathology/>



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