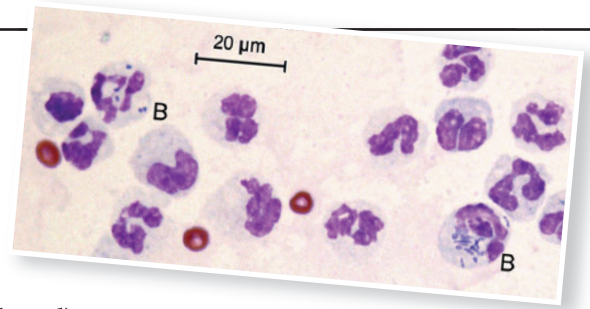
Staff Handout

Steps to Classifying Body Cavity Effusions



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Correctly classifying fluid accumulation provides guidance about its possible causes, and further analysis aids in developing a list of differentials and appropriate diagnostic and treatment plans.

1. Proper sample handling after collection

Fluid should be placed in an EDTA anticoagulant tube to prevent clotting. A portion of the fluid can be placed in a red top tube for microbiologic evaluation, if indicated. Similar to a blood film, slides should be made from the anticoagulated fluid soon after collection to prevent changes that may affect interpretation (eg, in vitro erythrophagia or cell degradation). Extra slides can be made (unstained) if laboratory review is desired.

2. Visual assessment & total protein measurement

The sample should be visually assessed for color and clarity. Increased cellularity, bacteria, fibrin, and chylomicrons can make the fluid cloudy. Color may be a useful indicator when certain conditions are suspected, such as bile peritonitis (yellow–green to brown) or hemoabdomen (dark red). Protein measurement is performed similarly to peripheral blood measurement: fluid is placed in a hematocrit tube, centrifuged, and the supernatant protein is measured using a refractometer. If the fluid is clear, centrifugation may be omitted. Protein content can also be evaluated via a serum chemistry analyzer.

3. Total nucleated cell count

One of the following methods can be used:

- *Automated cell count:* Relatively clear effusions (ie, samples are free from large clots or aggregates collected in an EDTA tube) can be run like a CBC in an automated hematology analyzer. Samples that are very turbid and flocculent should not be run through an analyzer because they can cause erroneous counts or create obstructions that may require analyzer maintenance. Slide estimation method should be used for these samples.
- *Slide estimation method:* Rough cell count estimates can be made from a stained slide. An area of the slide that is evenly spread should be selected for cell counting. The average number of cells in at least 10 representative fields is multiplied by the square of the objective used to perform the count: for example, an average of 4 cells/field using the 50× objective = $4 \times (50)^2 = 10{,}000$ cells/µL. This method is for direct preparations and cannot be used if the sample is concentrated via centrifugation before analysis.
- *Manual cell count:* Cells can be counted using a hemocytometer,[2] but this is often tedious and error-prone compared with an automated analyzer (eg, LaserCyte, ProCyte DX [idexx.com]).

4. Cytologic examination

The predominant cell type should be determined and the presence of infectious agents or neoplastic cells ascertained. For low cellularity fluids (<1000 cells/µL), it is useful to prepare a concentrated-direct preparation. Cells are pelleted by centrifugation (5 min at ~1000–1500 rpm [500 × g]). The supernatant fluid is discarded, and a direct smear of concentrated cells is prepared and air-dried. For fluids with higher total cell count (>1000 cells/µL), a direct thin-film smear should be prepared and air-dried. Examination and differential cell count should be performed in an area that is not too thick or thin, where cells are present in a monolayer (ie, cells are not present in 3-dimensional aggregates, nor stretched so thinly that they are lysed or distorted). Nucleated cells should be differentiated and ≥100 leukocytes counted and categorized by cell type: neutrophils, large mononuclear cells, lymphocytes, eosinophils, basophils, mast cells, or other. Cells present in large cohesive sheets (eg, mesothelial or carcinoma cells) or individualized mesothelial cells with a prominent, pink, fringed border are noted and described but not included in the differential leukocyte count.

5. Classify the fluid

Total protein, nucleated cell count, and predominant cell type can be used to classify the effusion (see **Classifying Effusions in Dogs & Cats**, next page).

Differential causes can be formulated with analysis results, clinical history, and examination findings. If cytologic abnormalities are unclear, stained and unstained slides with remaining fluid samples can be submitted to a laboratory. If fluid samples are not evaluated in-house, slides should be made at the time of collection and submitted with the fluid sample to a laboratory. It is critical that both the fluid sample and slides are submitted to ensure accurate interpretation.

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Table. Classifying Effusions in Dogs & Cats

Classification	Color/ Turbidity	Total Protein (g/dL)	Nucleated Cell Count (/µL)	Predominant Leukocyte	Other Features	Examples
Transudate	Colorless/clear	<2.5	<1000	Mononuclear	Minimally cellular	Hypoalbuminemia (with or without concurrent portal hypertension), acute uroabdomen
Modified Transudate	Light yellow/ clear to cloudy	≥2.5	1000–7000	Mononuclear	Variable cell types	Congestive heart failure, organ torsion, pancreatitis
Exudate (nonseptic)	Apricot to tan/ cloudy	>2.5	>5000	Neutrophils	Nondegenerate	Long-standing modified transudate, bile peritonitis, feline infectious peritonitis
Exudate (septic)	Apricot to tan/ cloudy	>2.5	>5000	Neutrophils	Degenerate with intracellular organisms	Traumatic puncture wound, intestinal perforation
Chylous	White/opaque	Not valid by refractometer	Variable	Small lymphocytes	If chronic, can have neutrophils, macrophages, eosinophils	Feline congestive heart failure, lymphangiectasia, mediastinal mass, idiopathic
Hemorrhagic	Pink to red/ cloudy	>2.5	Variable	Similar to peripheral blood	Erythrophagia or hemosiderin	Traumatic injury, anticoagulant rodenticide toxicity
Neoplastic	Light yellow/ clear to cloudy	>2.5	Variable	Variable	Neoplastic cells identified	Carcinoma, lymphoma