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Feline thoracic and abdominal effusion evaluation: Common presentations

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Thoracic and abdominal fluid accumulation in animals can be associated with a chronic gradual or acute critical presentation. Characterization of the fluid becomes an essential component of the patient work-up to both help identify the mechanism of formation of the fluid and to guide therapeutic intervention. There are several commonly used categories for fluid characterization including transudate, modified transudate and exudate and there are general guidelines for these characterizations and the differential for the mechanism of these fluid formations are somewhat different and therefore provide some direction in limiting the clinical differential but there is significant overlapping of characteristics and similar mechanisms can result in different types of fluid formation, so this categorization has limited value. The categorization is primarily related to gross, chemical (primarily total protein content) and quantitative cytologic features; however, the microscopic characterization of the fluid regarding the types of cells present are an essential component to help identify the underlying cause of the fluid formation itself. Even if no protein content or quantitative cytologic assessment is performed, the microscopic evaluation of the types of cells present is something that can provide immediate information about the fluid and is the most important component of the fluid assessment. The different categories of fluid formation including what is considered normal for the dog and cat are characterized below.

Normal Findings: Pleural and peritoneal fluid collection is difficult in the normal dog and cat because of the limited volume present and the trapping of this fluid between thoracic and abdominal viscera. Protein content is typically much less than 30 g/L and the total cell count is generally less than 500x10^6/L. Cells present in normal pleural, pericardial, and peritoneal fluids include low numbers of mesothelial cells and occasionally seen inflammatory cells. Mesothelial cells are present in small clusters or as individuals. The inflammatory cells present in normal fluids have the morphology of normal peripheral blood leukocytes. The predominant leukocyte seen varies with the species. In dogs and horses, neutrophils are prevalent. In cats and cattle, lymphocytes predominate.

Transudate: Transudates are defined as excessive accumulations of fluid having normal characteristics. Transudates therefore have low total protein (less than 30 g/L) and low nucleated cell counts (less than 500 nucleated cells x10^6/L) for the dog and cat. These fluids are commonly the result of venous stasis and less frequently from hypoalbuminemia and lymphatic obstruction (congestive heart failure, liver failure, the nephrotic syndrome, and in some cases of neoplasia. It is emphasized that pleural and peritoneal effusions due solely to hypoalbuminemia will only occur when serum albumin levels fall below 10 g/L.

Modified transudates: The accumulation of transudative fluid in one of the body cavities causes increased pressure which is irritating to the mesothelial cells resulting in proliferation and sloughing into the effusion. With time these cells die and release chemoattractants drawing phagocytes into the effusion. The result is a mild increase in both total protein (30-50 g/L) and nucleated cell count (slightly more than 500x10^6/L). When this occurs, the fluid is known as a modified transudate.

Exudates: Exudates are defined as fluid accumulations which are abnormally high in total solids and/or nucleated cell count. Total proteins range between 30 and 70 g/L and total cell counts may be as high as 100,000x10^6/L. The vast majority of exudates are caused by inflammation; however, the common denominator of exudate formation is vascular damage. Consequently, both hemorrhage and chylous effusions are classified as exudates on the basis of physical characteristics and pathogenesis. Inflammatory exudates are classified like classic cytologic sample characterization. Because of local irritation, some degree of reactive mesothelial cell hyperplasia is present.

Several fluid formations that do not typically follow this classification system and should be considered separately are discussed below. In addition, there is an expanded discussion of a few of these effusions that are specific to the cat.

Feline infectious peritonitis (FIP): FIP is unique among most exudates in that the fluid which accumulates is of low cellularity. The presence of any fluid accumulation is dependent upon multiple variables; both “wet” and “dry” form of FIP have been described extensively in our literature. When significant fluid is formed, total protein content is typically extremely high, which is a reflection of a similar elevation in serum protein. Electrophoresis of either the effusion fluid or serum typically reveals a dramatic polyclonal gammapathy. Grossly, the FIP effusion is often clear and straw-colored and it may be present in both the pleural and peritoneal cavities. Even when collected in EDTA, the fluid often has clots or strands of fibrin and the fluid has a high degree of viscosity similar to synovial fluid. The cellular response is most commonly neutrophilic in character; non-degenerate neutrophils predominate. A prominent pink granular proteinaceous background surrounding the various nucleated cells is also quite common and highly supportive
of FIP or minimally a fluid with high protein content. Low
to sometimes significant numbers of normal small lympho-
cytes and macrophages may be seen also.

**Lymphocytic Effusions:** In most species, identification
of a prominent lymphocytic component to any effusion
demands an investigation into the possibility of a chylous
component to the effusion. Chylous effusions are the result
of leakage of lymph into the body cavity and may involve
either the pleural or peritoneal space. These fluids are often
described as opaque milky fluids; however, it should be
emphasized that depending on the lipid content and longevi-
ty of the fluid, they may be clear and colorless. Many cats
with prolonged anorexia will have this type of effusion even
though it is chylous in character. Unless a microscopic eval-
uation of the effusion is performed and significant numbers
of normal appearing small lymphocytes are observed, chy-
lous effusion is typically not considered. In many chylous
effusions, a high protein concentration (35-45 g/L) is
observed, but there is a relatively low cellularity. Intermixed
with the normal appearing small lymphocytes, variable num-
bers of mature nondegenerate neutrophils and activated
macrophages will often be seen. The degree of neutrophilic
infiltration is often directly related to the amount of lipid
material present since this material proves to be a significant
irritant resulting in the recruitment of neutrophils. Mesothel-
ial cell hyperplasia and exfoliation into the effusion will
occur if the fluid has any significant time duration. If a chy-
lous effusion is questioned, triglyceride concentration meas-
urement in the fluid should be considered. Triglyceride concen-
trations have proven to be one of the most objective
measures of a true chylous component to these effusions.
Triglyceride concentrations greater than 110 mg/dL (1.21
mmol/L) are highly supportive of a chylous effusion.

The second most common cause for a lymphocytic effu-
sion in the cat is feline cardiomyopathy. The mechanisms
behind this type of effusion have not been completely clari-
fied; however, it is well established that heart failure causes
venous and lymphatic stasis that increases pressure. In the
cat it appears that these circumstances predispose to lym-
phatic leakage and result in a secondary chylous effusion.
Many of the effusions associated with cardiomyopathy are
true chylous effusions. However, there is a subcategory of
feline cardiomyopathy cases that have significant lympho-
cytic effusions without other features of chylous effusions
(triglyceride concentrations less than 110 mg/dL).

A third cause for a lymphocytic effusion to be considered
is malignant lymphoma. With most malignant lymphoma
forms, the neoplastic cells are large and immature appear-
ing lymphocytes, but there are low numbers of cases of
small lymphocytic malignant lymphoma where the neoplas-
tic cells resemble normal small lymphocytes. These could
be misinterpreted as a simple chylous effusion. The advan-
tage we have in veterinary medicine is that this is much less
common a presentation, which limits our opportunity for a
missed diagnosis.

Regardless the cause for the lymphocytic effusion, diag-
nostic imaging becomes a critical component to the identifi-
cation of the underlying cause. Even with many of the true
chylous effusions, there is an associated space-occupying
lesion in the anterior mediastinal region associated with
lymphadenomegaly (lymphoid hyperplasia, inflammation or
neoplasia) or the presence of an inflammatory focus or neo-
plastic process (malignant lymphoma, Thymoma, etc.) or
there is imaging support for feline cardiomyopathy. Diag-
nostic imaging is important in routine feline thoracic effu-
son characterization.

### Selected References

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