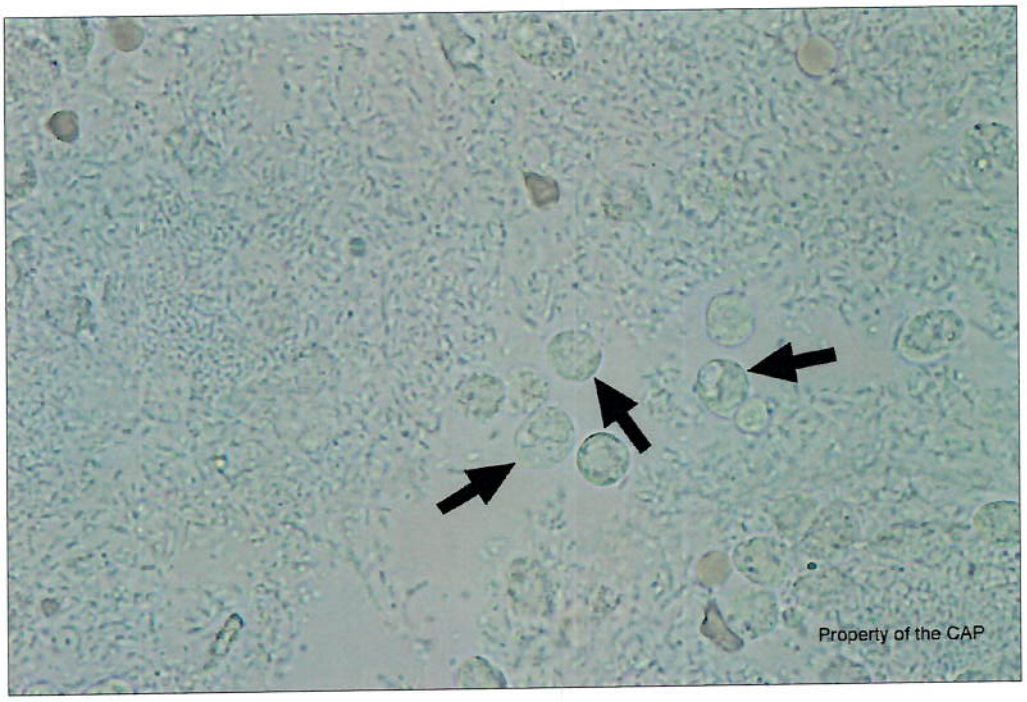
Urine Sediment Photographs

Case History CMP-04 through CMP-06

This urine sample is obtained from a 65-year-old man presenting with pyelonephritis. Laboratory data include: specific gravity = 1.026; pH = 8.5; protein and leukocyte esterase = positive; glucose, ketone, bilirubin, blood, nitrite, and urobilinogen = negative. Identify the arrowed object(s) on each image.

(URINE, UNSTAINED, HIGH POWER)

CMP-04

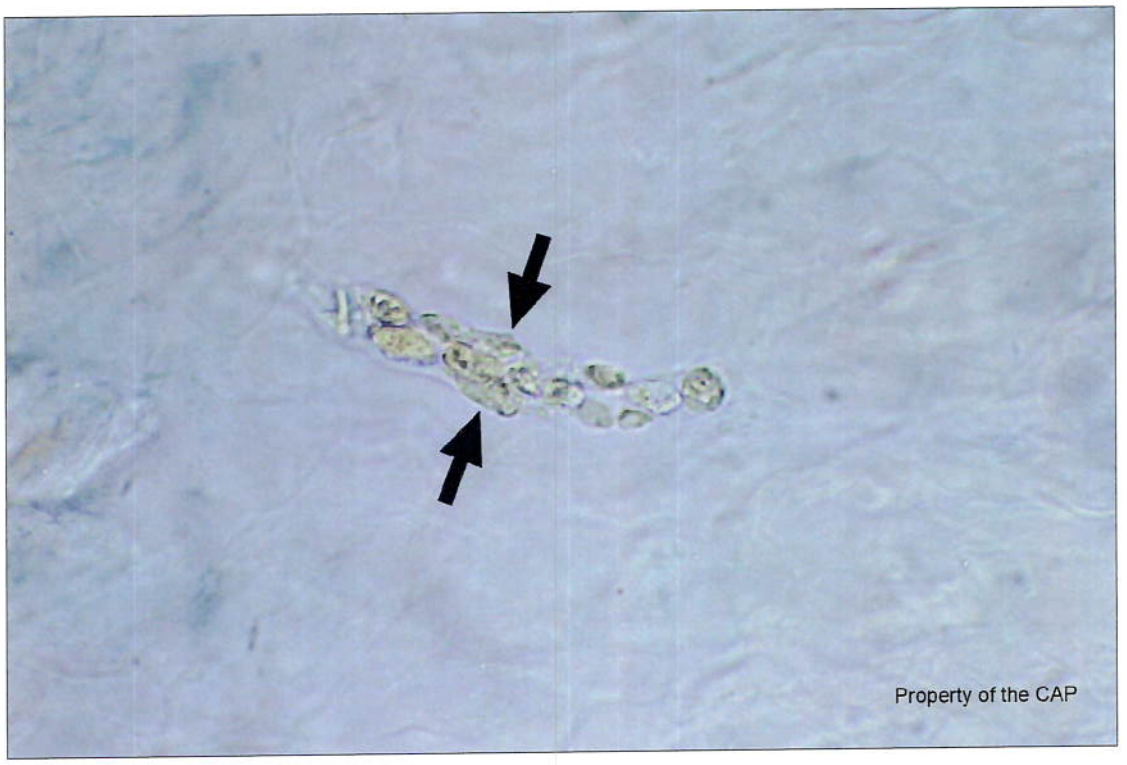


Identification	Participants Freq	%	Evaluation
Leukocyte (neutrophil, eosinophil, lymphocyte)	5676	95.8	Good

The arrowed cells are leukocytes, as correctly identified by 95.8% of participants. Increased numbers of leukocytes in the urine greater than five per high power field are a characteristic feature of urinary tract infections (UTI) but other disorders will also cause pyuria. Reflex urine cultures are often used to distinguish between infections and other causes of increased urinary white blood cells.

Urine Sediment Photographs

CMP-05

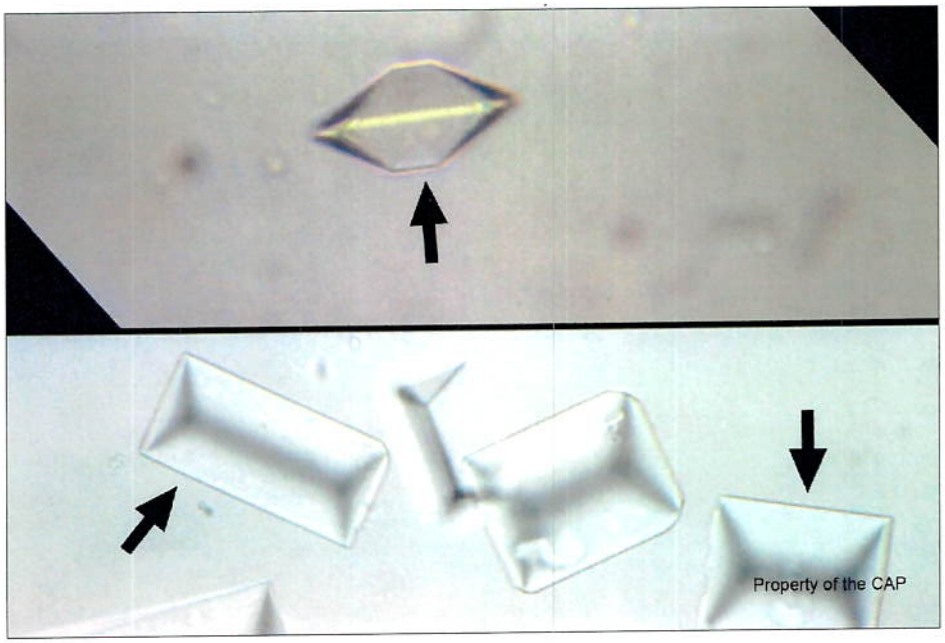


Identification	Participants Freq	%	Evaluation
Cellular cast (neutrophil and/or RTE)	5730	96.7	Good

The arrowed object is a cellular cast, as correctly identified by 96.7% of participants. A cellular cast may consist of any of the cells found in the urine sediment, such as RBC, WBC, or renal tubular epithelial cell. Often the specific cell type of a cellular cast cannot be determined, and the casts are reported as "Cellular Casts" without specifying the cell type. The cast may be crowded with cells or have only a few clearly defined cells present in the matrix, often at one end.

Urine Sediment Photographs

CMP-06



Identification	Participants Freq	%	Evaluation
Ammonium magnesium (triple) phosphate crystals	5806	98.6	Good

The arrowed objects are magnesium ammonium (triple) phosphate crystals, as correctly identified by 98.6% of participants. They are often colorless, rectangular prisms, with a "coffin-lid" appearance. Triple phosphate crystals assume a characteristic four-armed, feathery appearance as they dissolve. They are birefringent and are often accompanied by amorous phosphates and bacteria. They can be found in normal urine; however, the presence of magnesium ammonium (triple) phosphate crystals may suggest the presence of urea-splitting bacteria in the urine and typically coincide with a urinary tract infection (UTI).

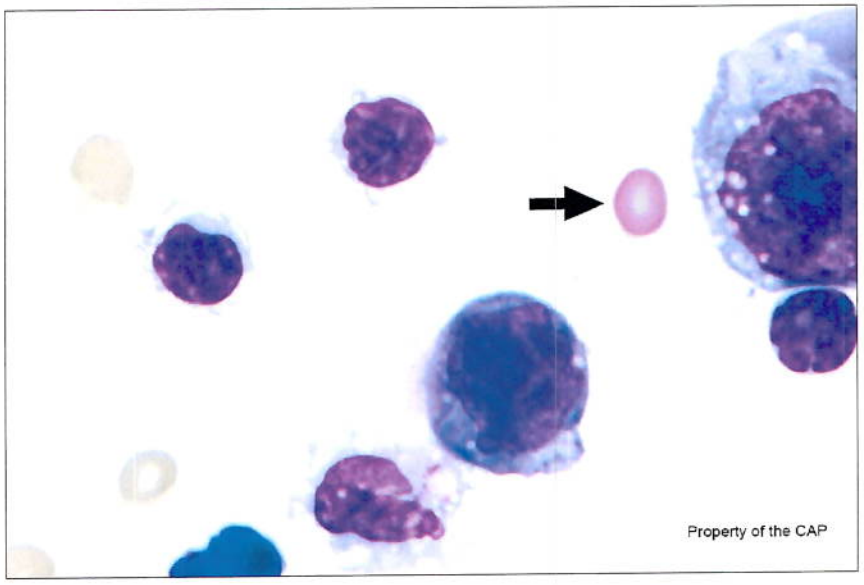
Body Fluid Photographs

Case History CMP-07 through CMP-09

This patient is a 61-year-old woman with rapidly progressive shortness of breath and decreasing oxygen saturations. Pleural fluid sample laboratory findings include: WBC = 7842/µL (7.842× 10E3/µL); RBC = 3365/µL (3.365 × 10E3/µL). Identify the arrowed object(s) on each image.

(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

CMP-07

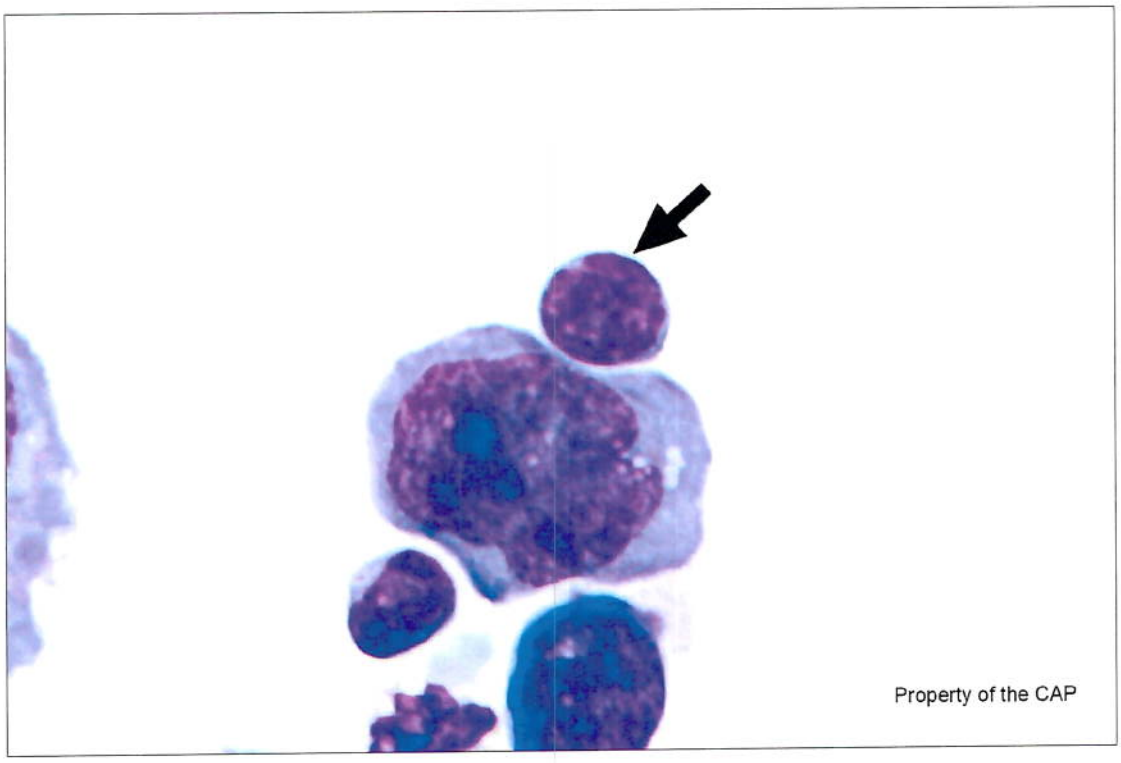


Identification	Participants Freq	%	Evaluation
Erythrocyte	3659	99.9	Good

The arrowed cell is an erythrocyte, as correctly identified by 99.9% of participants. An erythrocyte is a mature, non-nucleated biconcave disc-shaped cell of fairly uniform diameter (6.7 to 7.8 µm). Their morphologic appearance in body fluid samples is similar to their appearance in peripheral blood. These cells are found uncommonly in body fluids and are usually derived from peripheral blood and reflect hemorrhage or traumatic contamination.

Body Fluid Photographs

CMP-08



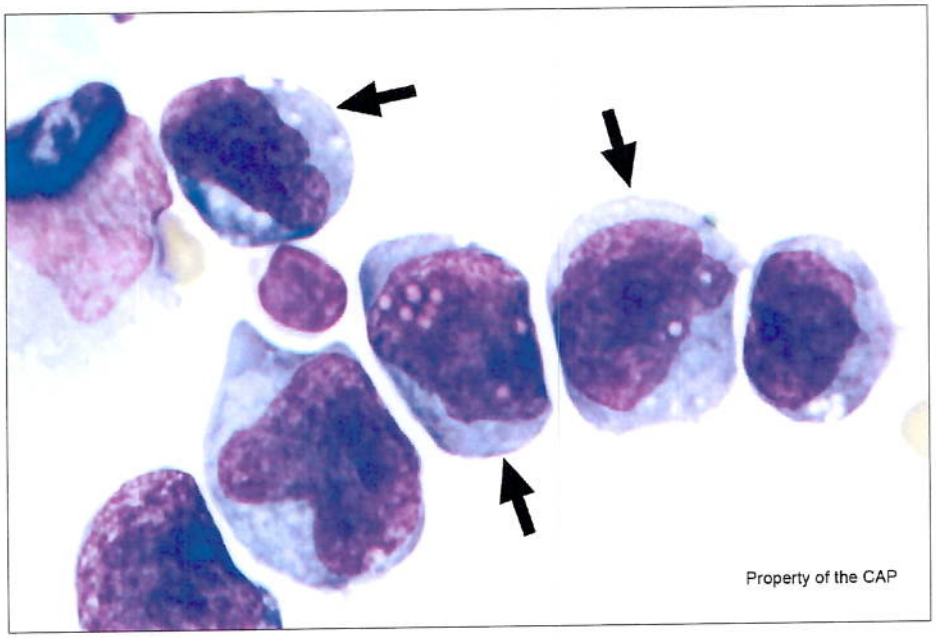
Identification	Participants Freq	%	Evaluation
Lymphocyte	3613	98.6	Good

The arrowed cell is a lymphocyte, as correctly identified by 98.6% of participants. Lymphocytes are small, round to ovoid cells ranging in size from 7 to 15 µm with an N:C ratio ranging from 5:1 to 2:1. Most lymphocytes have round to oval nuclei that may be slightly indented or notched. The chromatin is diffusely dense or coarse and clumped. Nucleoli are not visible, although some cells may exhibit a small, pale chromocenter that may be mistaken for a nucleolus. Most lymphocytes have a scant amount of pale blue to moderately basophilic, agranular cytoplasm. Occasionally, the edges may be slightly frayed or pointed due to artifacts induced during smear preparation. Occasional lymphocytes will have a small clear zone, or hof, adjacent to one side of the nucleus.

The cytologic features of lymphocytes from body fluids prepared by cytocentrifugation may differ from those in blood smears. Changes induced by cytocentrifugation may include cytoplasmic spreading, nuclear convolutions and nucleolar prominence. The mature or quiescent lymphocyte appears slightly larger than its counterpart on blood smears, often with more abundant cytoplasm but usually smaller than neutrophils and monocytes. Because of the high speed used in cytocentrifugation, a small nucleolus may be seen, and this should not be interpreted as indicative of lymphoma or immaturity. A few azurophilic granules may be noted in the lymphocytes on slides prepared by cytocentrifugation and do not by themselves denote an abnormality.

Body Fluid Photographs

CMP-09



Identification	Referees Freq	Referees %	Participants Freq	Participants %	Evaluation
Macrophage/monocyte	42	70.0	2824	77.4	Non-consensus
Lymphoma cells	10	16.7	391	10.7	Non-consensus
Malignant cell, non-hematopoietic	4	6.7	185	5.1	Non-consensus

The arrowed cells are lymphoma cells, as correctly identified by 16.7% of referees and 10.7% of participants. Lymphoma cells can exhibit a variety of appearances depending on the lymphoma subtype, and definitive diagnosis can be difficult. These cells can exhibit a variety of sizes, shapes, and nuclear and cytoplasmic characteristics. Cell size ranges from 8 to 30 µm and the N:C ratio varies from 7:1 to 3:1. Supplemental studies, such as immunophenotyping, are often necessary to arrive at a diagnosis. The most important distinction between these cells is the difference in their N:C ratios. The N:C ratio tends to be low in reactive lymphocytes, while it is high in lymphoma cells. In addition, reactive lymphocytes are characterized by their wide range of morphologic appearances within the same blood smear. While lymphoma cells can exhibit a wide range of morphologic appearances, any individual case tends to show a more monotonous population of the abnormal cells. In this case, the lymphoma cells are much larger than normal lymphocytes (also present in the image and CMP-08 for comparison), with irregular nuclear contours, somewhat condensed chromatin, and a moderate amount of cytoplasm. These cells are also singly dispersed while non-hematopoietic malignant cells are often in clusters.

70.0% of referees and 77.4% of participants incorrectly identified the arrowed cells as monocytes/macrophages including lipophages. While both monocyte/macrophages and the arrowed lymphoma cells are larger than a normal lymphocyte, the abnormal features of the cells are not consistent with monocytes/macrophages. The arrowed lymphoma cells have a higher nuclear-to-cytoplasmic ratio

and much more irregular nuclear contours than a typical monocyte/macrophage which has round to ovoid to kidney bean shaped nuclei with abundant cytoplasm.

6.7% of referees and 5.1% of participants incorrectly identified the arrowed cells as malignant cells. The arrowed lymphoma cells are present singly without clustering or nuclear molding. While malignant cells may rarely appear as single cells, they most often from clusters and frequently demonstrate nuclear molding. Occasionally, a cell cluster may recapitulate an organoid structure, such as pseudo-gland formation with adenocarcinoma. The discohesive appearance of these single cells is much more typical of a hematopoietic neoplasm than a malignant, non-hematopoietic neoplasm.

Clinical Presentation:
This patient is a 61-year-old woman with rapidly progressive shortness of breath and decreasing oxygen saturations. Pleural fluid sample laboratory findings include: WBC = 7842/µL (7.842× 10E3/µL); RBC = 3365/µL (3.365 × 10E3/µL).

(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

CASE DISCUSSION: Large B-cell lymphoma in pleural fluid

The abnormal cells in this case are very large (much larger than the normal lymphocyte shown for comparison) with high nuclear-to-cytoplasmic ratios, irregular nuclear contours, condensed chromatin, and a minimal to moderate amount of cytoplasm, with cytoplasmic vacuoles. These are large atypical lymphoid cells, morphologically compatible with a large cell lymphoma.

Lymphomas are often clinically divided into two types: Hodgkin and non-Hodgkin lymphoma. Non-Hodgkin lymphoma encompasses a wide variety of disorders, the most common of which is diffuse large B-cell lymphoma (DLBCL). Only rarely do certain subtypes of large cell lymphomas manifest solely as effusion-based lymphoma, such as primary effusion lymphoma, which is mostly seen in immunocompromised patients. More commonly, patients with DLBCL involving lymph nodes can develop pleural effusions with lymphomatous involvement, which has been reported in up to 20% of cases. The presence of a malignant effusion in DLBCL is associated with a worse prognosis.

While the cells in this case are morphologically suggestive of a large cell lymphoma, additional studies such as flow cytometry would be needed to further classify them. Alternatively, immunostains can be performed on cytopathology specimens for further evaluation. These studies will identify the cells as abnormal B cells and aid in definitive diagnosis and classification. They are also important in preventing misclassification of these cells as non-hematopoietic tumor cells.

Involvement of pleural fluid by small B-cell lymphomas can be more challenging to morphologically distinguish from reactive lymphocytoses as the cells tend to be more similar to normal lymphocytes. In such cases, flow cytometry and/or immunocytochemical stains, as well as molecular testing, are essential in confirming that the cells are malignant.

Erika M. Moore, MD, FCAP
Mina L. Xu, MD, FCAP
Hematology and Clinical Microscopy Committee

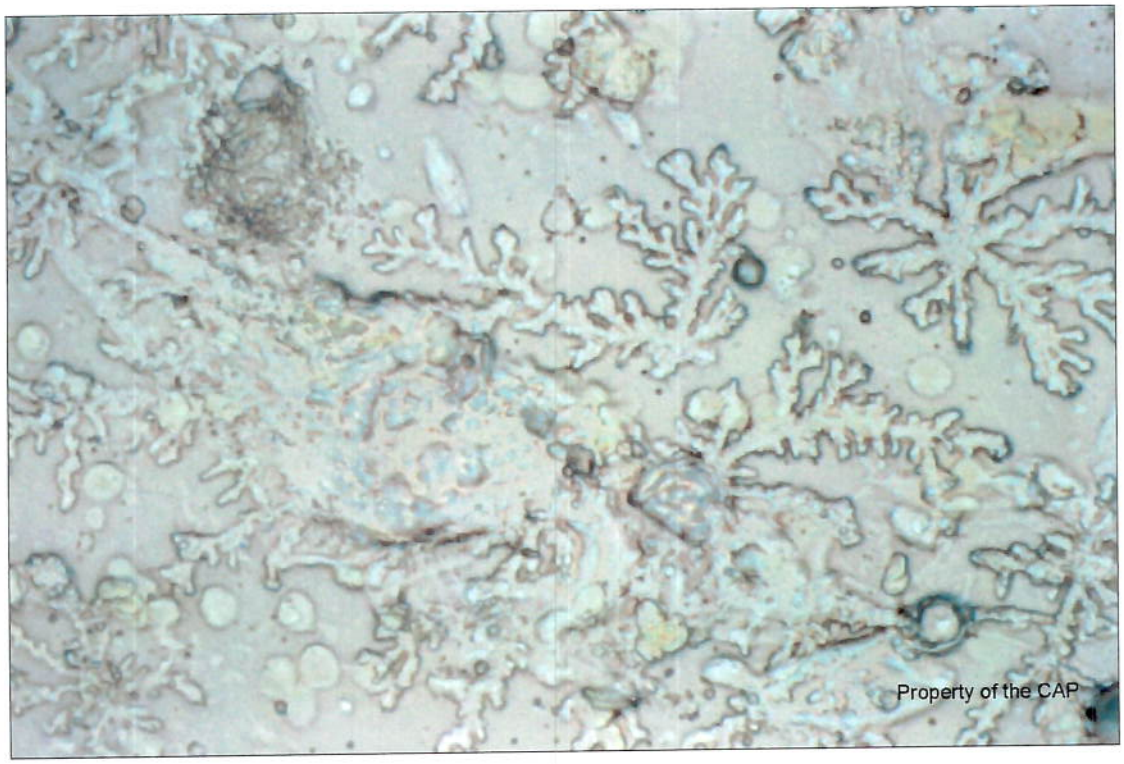
References:

1. Chen YP, Huang HY, Lin KP, Medeiros LJ, Chen TY, Chang KC. Malignant effusions correlate with poorer prognosis in patients with diffuse large B-cell lymphoma. *Am J Clin Pathol.* 2015;143(5):707-715.
2. Das DK. Serous effusions in malignant lymphomas: a review. *Diagn Cytopathol.* 2006;34(5):335-347.
3. WHO Classification of Tumours Editorial Board. *Haematolymphoid tumours.* International Agency for Research on Cancer. 2024. (WHO classification of tumours series, 5th ed.; vol. 11).

CMMP – Clinical Microscopy Miscellaneous Photographs

(VAGINAL, UNSTAINED)

CMMP-20



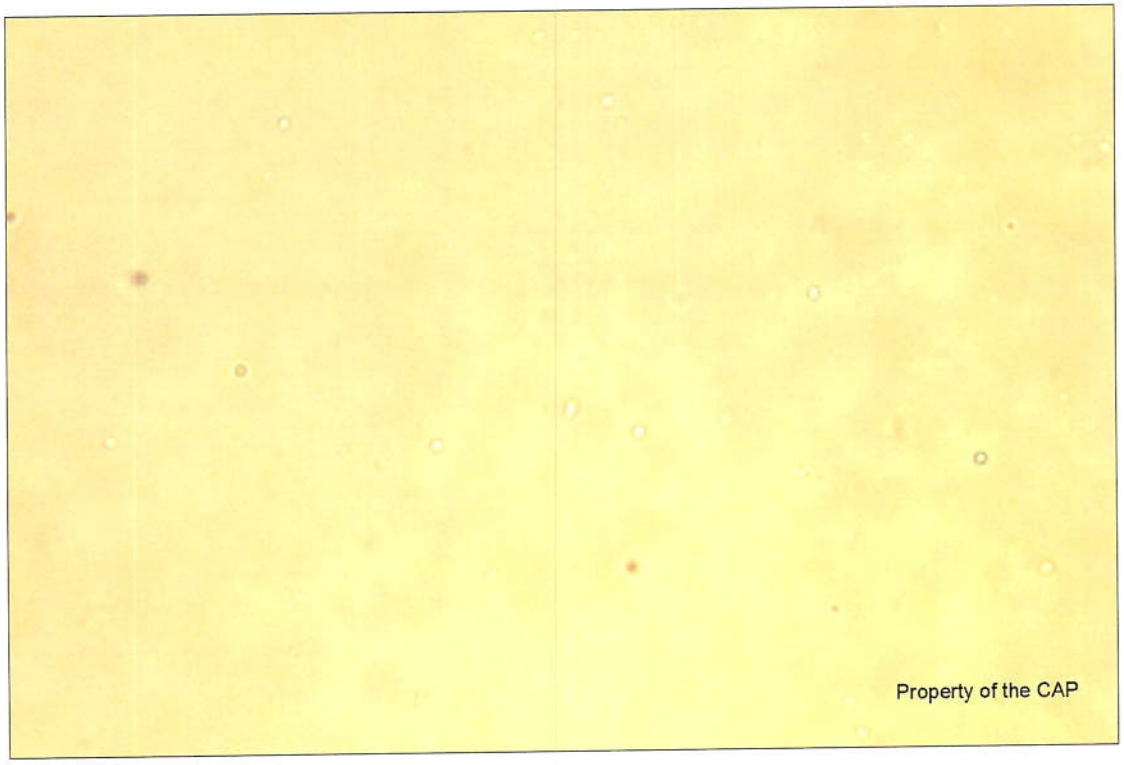
Identification	Participants Freq	%	Evaluation
Ferning is present	1639	99.4	Good

This vaginal wet preparation exhibits ferning. The fern test is used to detect ruptured amniotic membranes and the early onset of labor. A vaginal pool sample is collected and the fluid is allowed to air dry on a glass slide. The slide is examined using a microscope to detect ferning, an elaborate arborized crystallization pattern. Ferning, in conjunction with the nitrazine test and the medical history, is highly sensitive for the detection of ruptured membranes.

CMMP – Clinical Microscopy Miscellaneous Photographs

(SKIN, KOH)

CMMP-21



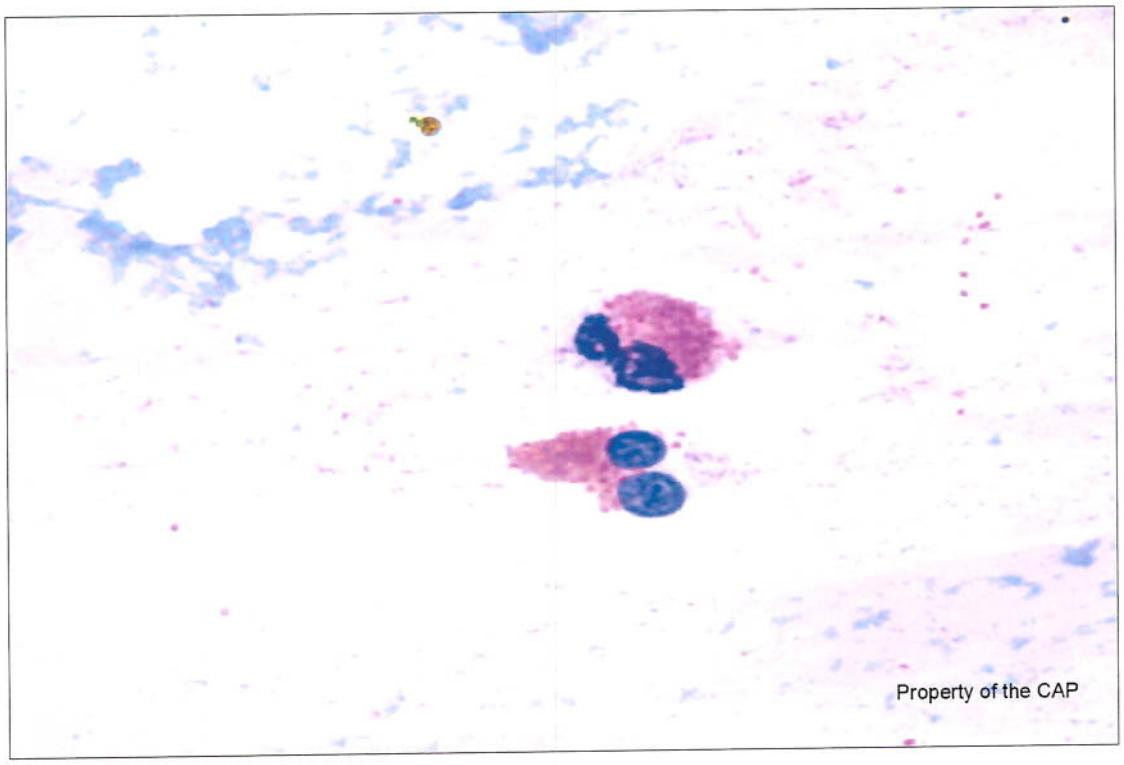
Identification	Participants Freq	%	Evaluation
Yeast/fungi are absent	2247	86.6	Good

This KOH wet preparation is negative for the presence of yeast/fungi.

CMMP – Clinical Microscopy Miscellaneous Photographs

(NASAL, WRIGHT-GIEMSA)

CMMP-22



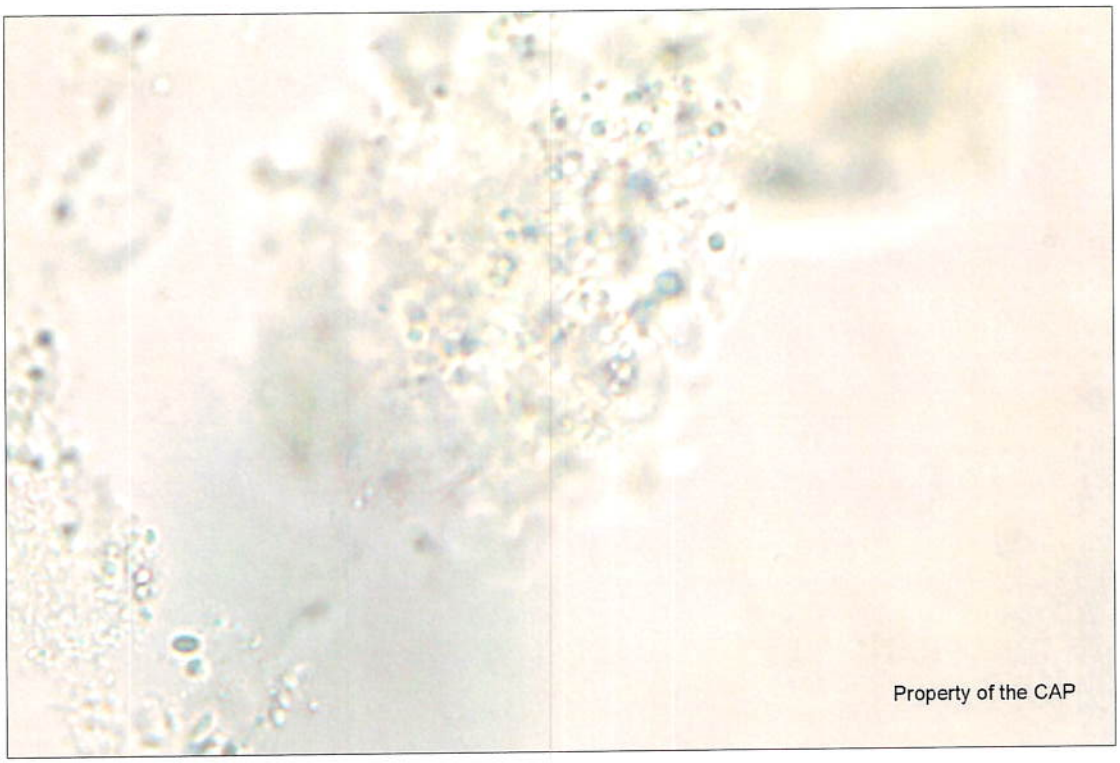
Identification	Participants Freq	%	Evaluation
Eosinophils are present	1601	99.9	Good

Eosinophils are present on this nasal smear preparation. The finding of nasal eosinophils is supportive of the diagnosis of allergic rhinitis. The slide is prepared by having the patient blow their nose in a nonabsorbent material (eg waxed paper or plastic wrap). A swab is used to transfer the mucus to a glass slide. After the slide is air dried, it can be stained with either Wright-Giemsa or Hansel stain and then evaluated.

CMMP – Clinical Microscopy Miscellaneous Photographs

(PINWORM PREP, UNSTAINED, 66X)

CMMP-23



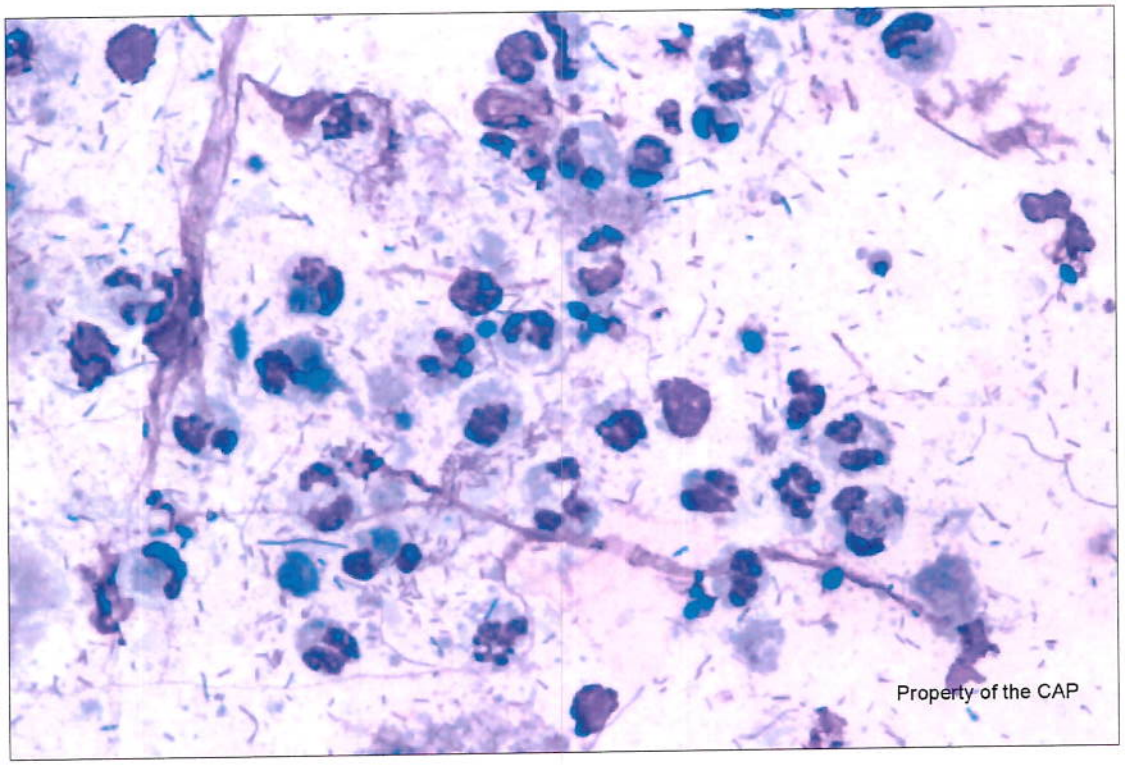
Identification	Participants Freq	%	Evaluation
Pinworm/pinworm eggs are absent	1715	99.2	Good

This stool smear exhibits cellular debris and is negative for pinworm (*Enterobius vermicularis*). Pinworm infection is seen in children ages 5 - 14 years who present with anal pruritus. To exclude pinworm infection, either cellophane tape collection or an anal swab collection onto a glass slide is acceptable for microscopic examination.

CMMP – Clinical Microscopy Miscellaneous Photographs

(STOOL, WRIGHT-GIEMSA)

CMMP-24



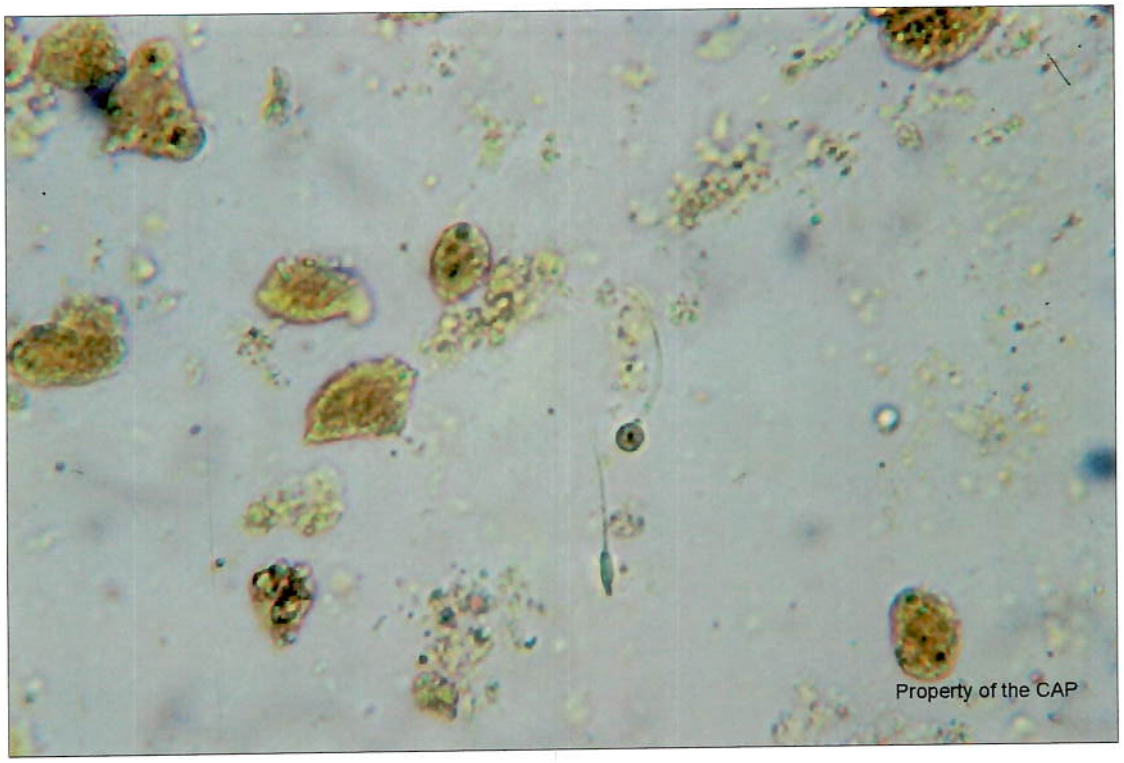
Identification	Participants Freq	%	Evaluation
Leukocytes are present	1781	99.9	Good

The stool specimen Wright-Giemsa stain exhibits neutrophils, some which exhibit degeneration. Leukocytes may be detected in stool smears from patients with enteric pathogens, although this test is considered neither very specific nor sensitive for the detection of enteric pathogens. Fecal leukocytes are more likely to be detected in patients infected with *Shigella, Salmonella*, or *Campylobacter* organisms. If the patient is suspected of having an enteric pathogen, a stool culture should be performed.

CMMP – Clinical Microscopy Miscellaneous Photographs

(VAGINAL, UNSTAINED)

CMMP-25



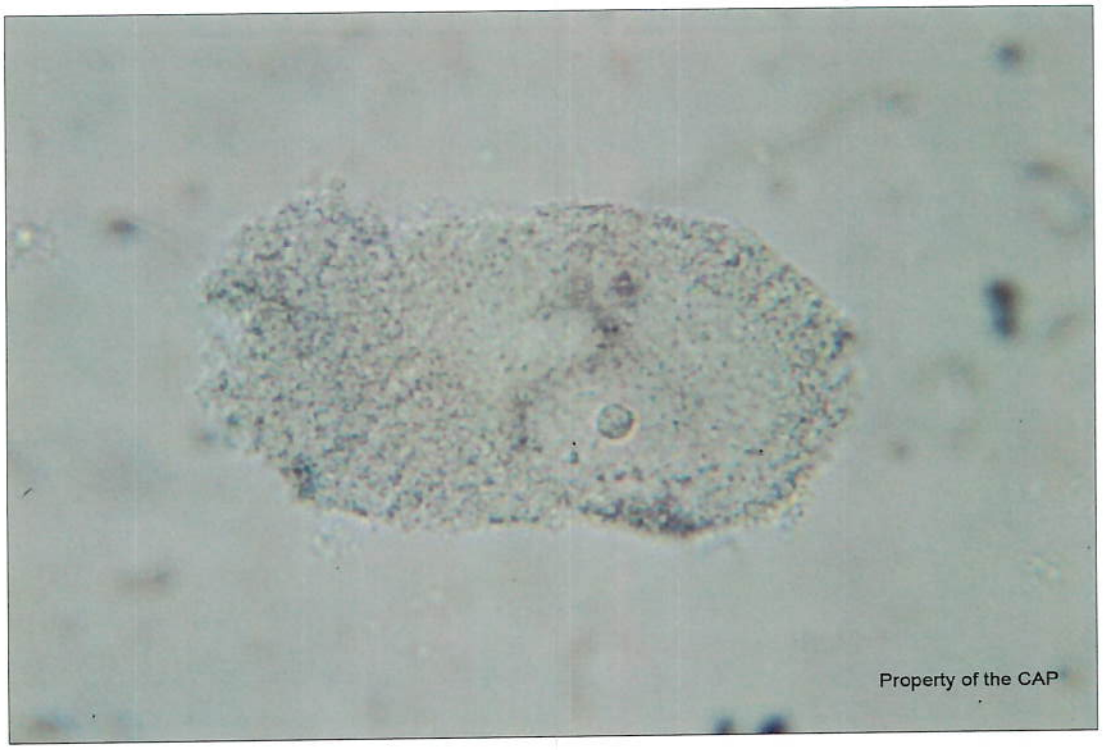
Identification	Participants Freq	%	Evaluation
Spermatozoa are present	2204	99.6	Good

Sperm are present on this vaginal wet preparation. In wet preparations, the sperm head is 4 - 6 mm long and usually tapers anteriorly. Slender tails are 40 - 60 mm long. A vaginal secretion specimen is collected from the posterior vaginal pool by a speculum that has not been lubricated with petroleum jelly. The secretions are collected on a cotton or dacron-tipped swab and are mixed with a few drops of saline on a slide. The slide is studied with brightfield or phase microscopy.

CMMP – Clinical Microscopy Miscellaneous Photographs

(VAGINAL, UNSTAINED)

CMMP-26



Identification	Participants Freq	%	Evaluation
Clue cell(s) (squamous epithelial cell with adherent bacteria) are present	3148	97.3	Good

Vaginal wet prep secretions can be examined to diagnose causes of vaginal discharge. In this wet preparation a clue cell (squamous epithelial cells which contain bacteria) is present. Clue cells are large (30 - 50 µm) and are derived from the lining of the female vagina and cervix. Squamous epithelial cells which have a stippled or granular, very refractile cytoplasm with shaggy borders due to the presence of numerous coccobacillary bacteria are known as clue cells. Clue cells are one diagnostic finding seen in bacterial vaginosis. The confirmation of bacterial vaginosis requires 3 of the following symptoms or signs: the presence of clue cells on microscopic examination, a homogeneous, white, non-inflammatory discharge, a pH of vaginal fluid > 4.5, and/or a fishy odor of vaginal discharge before or after addition of 10% KOH. Bacterial vaginosis is a clinical syndrome resulting from replacement of the normal Lactobacillus species in the vagina with high concentrations of anaerobic bacteria, *Gardnerella vaginalis* and *Mycoplasma hominis*.

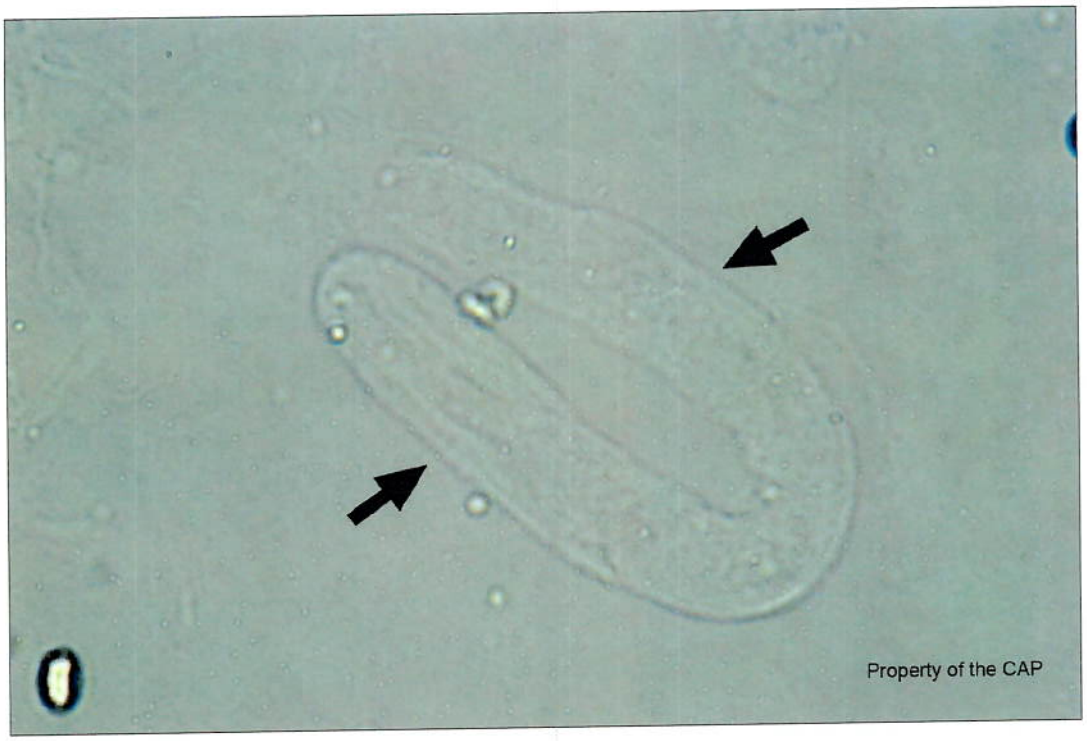
Urine Sediment Color Photographs

Case History USP-01 through USP-03

This urine sample is obtained from a 53-year-old man with a history of hypertension. Laboratory data include: specific gravity = 1.015; pH = 7.0; protein = positive; glucose, ketone, bilirubin, blood, leukocyte esterase, nitrite, and urobilinogen = negative. Identify the arrowed object(s) on each image.

(URINE, UNSTAINED, HIGH POWER)

USP-01

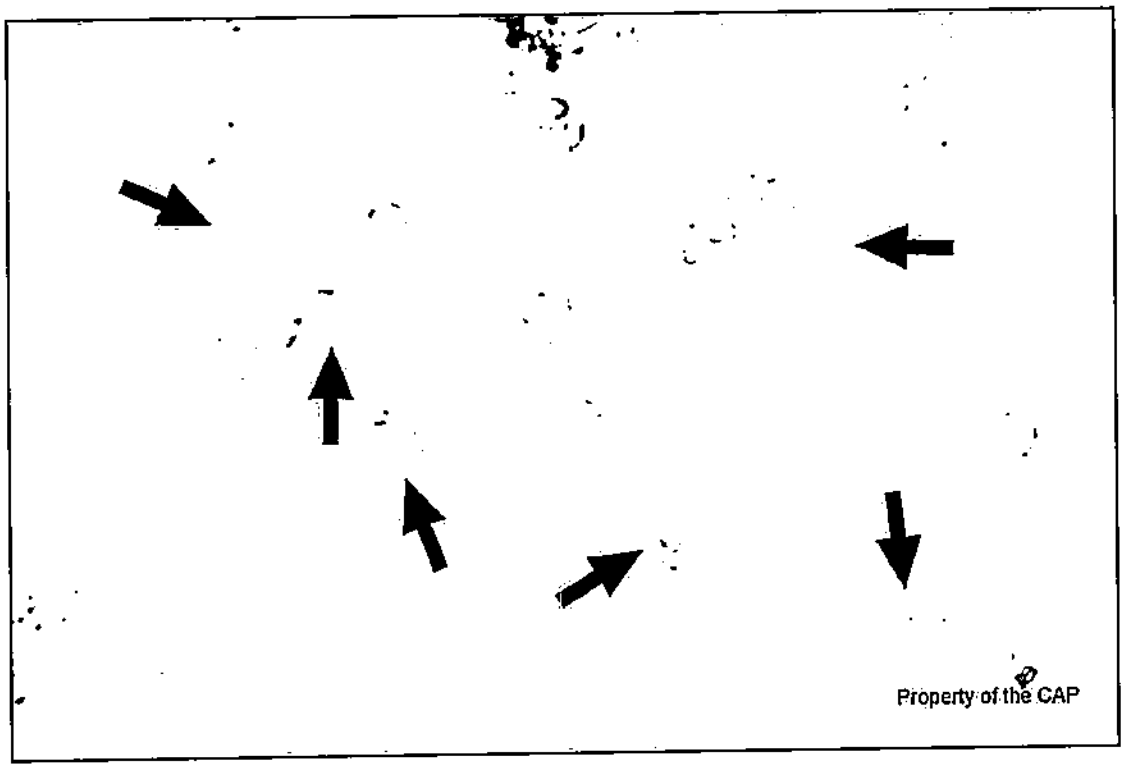


Identification	Participants Freq	%	Evaluation
Hyaline cast	3488	95.7	Good

The arrowed object is a hyaline cast, as correctly identified by 95.7% of participants. Hyaline casts are colorless, homogeneous, and translucent, and they have a low refractive index. They have a smooth or finely wrinkled surface and may appear tortuous or coiled. Inclusion granules may occasionally be seen in the cast matrix. These casts are usually present in small numbers in normal urine, but they may be more prevalent after strenuous physical exercise or physiological stress. Large quantities of pigmented material may be absorbed into the cast matrix, transforming urobilinogen to a yellow color. This type of cast is called a pigmented cast (non-hemoglobin pigmented).

Urine Sediment Photographs

USP-02

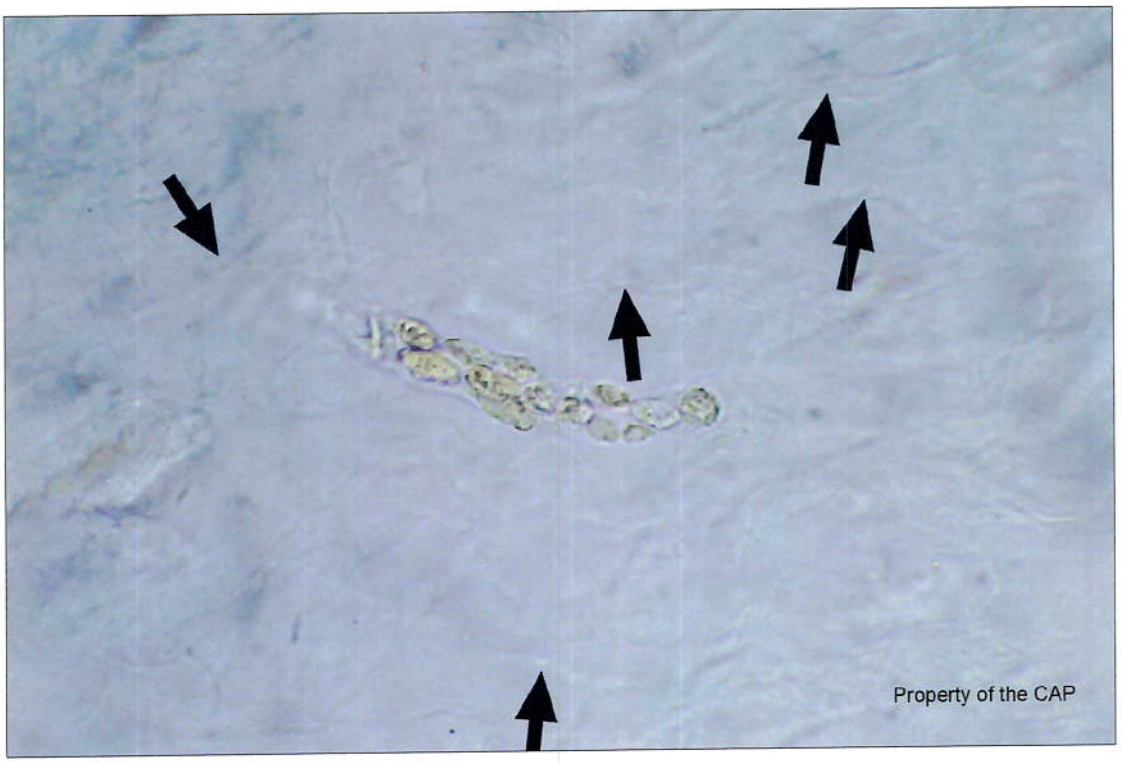


Identification	Participants Freq	%	Evaluation
Leukocyte (neutrophil, eosinophil, lymphocyte)	3203	87.8	Good

The arrowed cells are leukocytes, as correctly identified by 87.8% of participants. The white blood cells in this unstained wet preparation are identified as nucleated round cells with the nucleus clearly demarcated in one of the cells. These leukocytes appear shrunken and smaller than expected due to dehydration in hypertonic urine. Many of the leukocytes are shrunken to a degree than obscures nuclear detail, a feature often observed in urine with high specific gravity. Increased numbers of leukocytes in the urine greater than five per high power field are a characteristic feature of urinary tract infections (UTI) but other disorders will also cause pyuria. Reflex urine cultures are often used to distinguish between infections and other causes of increased urinary white blood cells.

Urine Sediment Photographs

USP-03



Identification	Participants Freq	%	Evaluation
Mucus strands	3487	95.6	Good

The arrowed objects are mucus strands, as correctly identified by 95.6% of participants. The mucus strands in this unstained wet prep are identified by their long wavy translucent strands that aggregate and intertwine. Mucus strands are threads of mucus arising from glands in the lower urinary and vaginal tracts and are frequently found in urinary sediments. The finding of mucus has no clinical significance and is considered background material. In the absence of specific clinical meaning, one approach a laboratory may take is to not report mucus as part of the urinalysis. Mucus is widely considered an artifact just like starch, hair, glass, and other fibers.