Urine Luck: A Thorough Review of Urine Sediment
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Examination of Urine
Urine should be examined as soon as possible. Many things can change quickly in urine, chemically and within the sediment so if it cannot be examined immediately or if it is being sent out to a laboratory, refrigeration is recommended. These proceedings will focus only on the urine sediment, but urine concentration and chemistry are also important components to evaluate.

Urine sediment
After the urine chemistry and specific gravity are performed it’s time for the examination of the urine sediment. The urine should be centrifuged for 5 minutes. The supernatant is poured off and the sediment is resuspended in a few drops of the remaining supernatant. A drop of sediment is placed on a glass slide and is covered with a cover slip. The sediment is scanned at 10x (lpf) and then at high power or 40x. No oil is necessary for examination of urine sediment. If interesting cells or structures are examined in the sediment, the sample can be preserved by painting the edges of the cover slip with nail polish. Structures identified in the sediment include cells, crystals, casts, microorganisms and other structures. Several different cell types can be observed including epithelial cells (squamous, transitional and renal tubular), red blood cells and white blood cells. Squamous epithelial cells exfoliate from the distal urethra and vagina. The presence of these cells is not considered pathologic unless the morphology of the cells is unusual. Transitional epithelial cells can exfoliate from the proximal urethra, urinary bladder, ureters and renal pelvis. These cells may be observed in high numbers, even in clusters from catheterized samples. These cells do not necessarily indicate disease unless they appear morphologically abnormal. The presence of renal tubular epithelial cells in the urine indicates renal pathology. These cells are often accompanied by casts. Red and white blood cells are quantitated per high power field. >3-5 cells/hpf is considered abnormal and may indicate hemorrhage or inflammation. RBCs can be round or crenated depending on the specific gravity. If the specific gravity is too low, the RBCs may even lyse. WBCs can lyse in alkaline urine. The presence of increased numbers of WBCs indicates an inflammatory process within the urogenital tract.

Casts occur when there is damage to the nephron, primarily the renal tubule. If the tubule is damaged, it secretes a protein, called Tamm-Horsfall protein. This protein fills the tubule and encompasses any material that happens to be in the tubule at that time.
Casts are truly an imprint of the renal tubule and therefore should mimic the shape and the contents of the tubule. If there is inflammation or hemorrhage in the tubule white blood cell casts or red blood cell casts, respectively, may be observed in the sediment. If there is cellular debris within the tubule, granular casts will be observed. Casts are intermittently shed and therefore do not indicate severity of disease but the presence of waxy casts indicates chronicity. There are many different types of casts in addition to those already mentioned. Hyaline casts are pure protein and may be observed with glomerular disease and epithelial casts consist of renal tubular epithelial cells.

The most common microorganisms observed in urine sediment are bacteria. Bacteria observed in a free catch sample must be interpreted with caution unless there are many white blood cells present. Urine is considered sterile until the midurethra so a catheterized sample or cystocentesis is preferred for collecting a sample for culture. Fungal organisms are usually considered a contaminant however Blastomyces dermatitidis and Cryptococcus neoformans have been diagnosed in urine.

Formation of urine crystals is affected by a number of variables, including pH, temperature and medications given. Refrigeration can actually induce crystal formation. Presence of particular crystals can indicate very specific diseases. For instance, ammonium biurate crystals often indicate decreased hepatocellular function in most animals but may be normal for Dalmations. Tyrosine crystals can also indicate liver disease. Calcium oxylate dihydrate crystals may be normal in small animals but calcium oxylate monohydrate crystals are associated with ethylene glycol toxicity. Calcium carbonate crystals are considered normal in the horse and the rabbit. Certain medications are known to induce crystal formation such as sulfonamides, allopurinol and ampicillin.

It is not uncommon to identify other structures in urine sediment. Fat droplets are very common and can be challenging to differentiate from red blood cells. Plant material or pollen grains can mimic microorganisms or parasite eggs so it is important to identify these structures as contaminants.

In conclusion, the urine is packed with useful information that is essential for diagnosis. Sediment evaluation is an inexpensive, convenient test that can easily be run as an “in-house” test.

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