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Question

write a short note on urinalysis

Urinalysis is the examination of urine for certain physical properties, solutes, cells, casts, crystals, organisms, or particulate matter.

Approximately 10 ml of well-mixed urine is taken for microscopic examination. If the urine is alkaline, 1 ml of dilute acetic acid will help dissolve phosphates that may obscure formed elements. There is no "gold standard" for how fast or how long one should centrifuge urine. I have found 3000 rpm for 3 minutes to be convenient. Others have favored 2000 rpm for 5 minutes. After centrifugation, the supernatant is discarded; the sediment is resuspended in the few drops that remain. A drop of this is placed on a slide, covered with a coverslip, and examined microscopically. No stain is routinely needed, nor is phase contrast ordinarily required. The microscope is adjusted so that relatively low light is used, and the slide is scanned under low power (100×), high power (400×), and, when protein is present, polarizing light. Low-power examination serves to identify areas of interest, high power permits identification and quantification, and polarizing light aids in identification of doubly refractile fat bodies and certain crystals. While urine is being centrifuged, a macroscopic examination consisting of inspection and reagent strip testing should be done. The color and clarity of the urine are apparent on inspection.

The specific gravity of urine depends on a person's state of hydration, the integrity of the posterior pituitary, and the renal tubules. Normally, all urine leaving Henle's loop is dilute relative to plasma, and under forced hydration may contain as little as 50 mOsm/kg, roughly equivalent to a specific gravity of 1.001 or 1.002. Specific gravity of urine equals the weight of a given volume of urine divided by the weight of an equal volume of water:

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When a urinometer is used, a correction must be made for temperature when very exact results are needed such that 0.001 is added or subtracted for each 3°C change above or below the calibration temperature recorded on the instrument. When protein is present in large amounts, all common methods are affected. There is no convenient correction factor for reagent strips. For refractometers or urinometers, it is necessary to subtract 0.003 for every 1 g/dl of protein in urine to be accurate. When glucose is present in large amounts, reagent strips should not be affected. It is necessary to subtract 0.004 from refractometer or urinometer readings for every 1 g/dl of glucose to correct the value. Values above 1.032 suggest the presence of exogenous solutes such as mannitol or iodinated contrast media.

The reagent strip method commonly available has three principal components: polymethylvinyl ether/maleic acid, bromothymol blue, and buffers. When specific gravity is high, the pKa of the polyelectrolyte is decreased and pH falls, resulting in a color change of the indicator. Highly buffered alkaline urine may, therefore, result in a factitiously low apparent specific gravity.

Urinary pH is an expression of the proton concentration in urine. Although the number of free protons excreted contributes only a trivial fraction of the approximately 80 mEq of acid an average person excretes daily, the free protons determine the efficacy of the titratable acid mechanism and the ammonium excretion mechanism, which together account for the bulk of excreted acid. When urinary pH is high, there are few proton acceptors in urine and the non-ionic diffusion of NH_3, into the tubular lumen is relatively impeded. When pH is low, phosphates and other solutes efficiently accept protons and diffusion of NH_3 into the tubular lumen is facilitated. Normally, urine can be acidified to a pH value of 5.2 or less. Failure to do so in the face of systemic acidosis may indicate partial or complete renal tubular acidosis. Bacterial infection with urea-splitting organisms may produce an elevated urinary pH, so if fresh urine has leukocytes, bacteria, and an elevated pH, Proteus species would be suspected as the offending organism. (Other bacteria can split urea but are not as commonly responsible for urinary tract infection.)

Protein enters urine either because of altered glomerular permeability or because of tubular damage. Glomerular proteinuria always includes a large component of albumin. Tubular proteinuria is of low molecular weight, such as (β2-microglobulin. Reagent strip tests for protein are virtually (but not completely) specific for albumin, and depend upon the capacity of protein to change the color of an acid-base indicator at a constant pH maintained by a buffer in the strip section. Contrast media, tolbutamide, tolmetin, or penicillin, which may give false positive readings with heat and acetic acid, do not affect results with the reagent strip. Alkaline urine may give a false positive result with the reagent strip and a false negative result with acid precipitation techniques.

Glucose is normally present in human urine in small amounts. Glucose is usually not detectable because ketones, ascorbic acid, or other substances found in urine may cause false negative results by reagent strips even when urinary glucose approaches clearly abnormal values near 100 mg/dl. Copper reduction tests are not specific for glucose and may react with other hexoses, pentose, creatinine, uric acid, salicylates, and numerous other agents. When bacteria are present, glucose may be consumed, so a false negative could result from testing urine that is not fresh. When a hexokinase reagent strip is used, glucose concentrations below 2 mg/dl in morning urine from a fasting person correlate well with urinary tract infection. Large amounts of urinary glucose suggest diabetes mellitus, or, rarely, renal glycosuria.

Ketone bodies appear in urine as a consequence of accelerated fat metabolism. (β-Hydroxybutyric acid is quantitatively greatest, followed by acetoacetic acid and acetone. When large amounts are present, a fruity odor may be detectable. The commonly available tests for ketone bodies depend on the development of a purple compound in the presence of nitroprusside and alkali. Such tests will react with acetone or acetoacetic acid but not with β-hydroxybutyric acid. l-Dopa will give a false positive result with the nitroprusside-based tests. A ferric chloride method is available that gives false positive results for both l-dopa and salicylates. Ketone bodies are most likely to be present in the urine of an adult during diabetic ketoacidosis or when the patient has been fasting.

Bilirubin and urobilinogen appear in urine when there are abnormalities of bilirubin metabolism or liver function. Albumin-bound bilirubin (indirect bilirubin) is not water soluble and does not appear in the urine. Bilirubin conjugated with glucuronic or sulfuric acid is water soluble and appears in urine in amounts roughly correlated with the direct reacting serum bilirubin. The presence of conjugated bilirubin in detectable amounts (greater than 0.2 mg/dl) does not enable one confidently to distinguish between hepatocellular and obstructive jaundice, but does not commonly occur when hyperbilirubinemia is consequent to hemolysis. Reagent strips and tablets may give a false negative reaction when urine contains ascorbic acid. Phenothiazines may cause a false positive reaction in both cases.

When conjugated bilirubin reaches the bowel, bacterial action produces urobilinogen, which is reabsorbed into the portal circulation. Increased production of bilirubin or decreased hepatic clearance of urobilinogen from the portal circulation will increase the amount delivered to the kidney and excreted in the urine. Thus, hemolysis or hepatocellular dysfunction may increase urinary urobilinogen, while biliary obstruction will decrease delivery of conjugated bilirubin to the bowel, thereby reducing production of urobilinogen