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EXAMINATION OF THE URINARY SEDIMENT

Popovici Raluca*, Baldea Corina**

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: rugeraluca@yahoo.com
**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: corina68a@yahoo.com

Abstract

The urine, normally, freshly released, is usually perfectly transparent and only if it left for a while it can be observed in it a mild opalescence, with the form of a small cloud which under the microscope can be observed to be made of different salts, most of the time from urate, isolated leucocytes and epithelial desquamate cells from the urinary channels. For the healthy people is formed often a deposit in the saturated urine from the morning or after an intense transpiration. If the urine if strongly chilled, sometimes is being deposited an abundant sediment of urates. In pathologic conditions, either the urine is eliminated from the beginning cloudy, or after a while is created a sediment, that follows to be examined in detail under the microscope. The moment of formation of the deposit presents a great interest. Thus, if the appearance of the opalescence or the deposit of the sediment is made gradually in a urine which was clear in the beginning, it means the substances that are found in the urine in dissolved form have precipitated.

Key words: precipitate, cylinders, urinary sediment, urates

INTRODUCTION

The urine is a product of filtration, of reabsorption and excretion, representing the activity of the kidney function.

For the analysis of urine the collection is made from the first urine from the morning, in a clean recipient. The first urine from the morning is the most concentrated in elements and can deliver data regarding the presence of the eventual pathologic elements.

For quantitative chemical dosing from the urine it is necessary the collection of urine during the 24 hours. In the urine from the 24 hours it is necessary to be measured the volume of urine because the determinations that are made only in the urine of 24 hours, are reported to this volume.

For the uroculture the collection is made also in the morning, from the first urine, but with certain particularities. The collection is made in a sterile recipient called urine collector. The collection is made after the rigorous washing with water and soap. The first drops of urine, that are contaminated by the bacteria that is usually on the inferior segment of urethra, are eliminated in the toilet, and the urine from the medium jet is collected directly in the urine collector taking care not to touch its jet with

any object surrounding in order not to contaminate it with the existent germs.

The uroculture has to be performed before the beginning of the treatment with antibiotics, because the antibiotics destroy the microbial flora and the result of the uroculture will be negative even if the urinary infection exists.

For the preservation of the urine tests, especially when is working with the urine from 24 hours, for the prevention of the contamination with microbodies it can treated with toluene, thymol, xylene. The simplest possibility to protect the urine from alteration is the performing of the analysis mostly in 2-3 hours from the collection.

MATERIAL AND METHODS

The available methods for the examination of the urinary sediment are the microscopic exam and cytometry in flux with fluorescent with the following phases of detection:

1. after the dilution and coloring the sample of urine is injected in a channel, being protected by a liquid of transport (liquid covering);
2. the liquid covering elongates so much the suspension of cells that they are aligned one after the other;
3. the liquid covering will enter the cell of measuring;
4. the speed of flow is of the order of meters per second which leads to a high rate of enumeration (thousands of particles per second);
5. when the source of light from the red semiconductor laser meets in the measuring room a colored cell preliminary are generated 3 types of signals: the light dispersed frontally (Fsc) which give information regarding the dimension, the light dispersed laterally (Ssc) that delivers data about the surface and the internal complexity and the fluorescent signal (Fl) that indicates the degree of coloration of each particle;
6. the signals obtained are amplified and analyzed in an optical system;
7. the erythrocytes are identified based on a low fluorescent signal (corresponding to a low content of DNA) and of a Fsc signal also low (corresponding to small dimensions);
8. the leucocytes are analyzed based on the fluorescent signal of average intensity (given by the content of nucleic acids) and of the Fsc signal (average dimension of 10 μm);
9. the squamous epithelial cells generate a fluorescent signal and a strong Fsc signal.
10. finally are posted the values obtained for the respective parameters.

The recommendations for the determination of the urinary sediment are in case of the pathological conditions at the urine test on strip; the presence of a suggestive symptomatology for the kidney affections and of the urinary tube; the monitoring of such affections.

Thus are observed the following phases:

Preparing the patient – collection for the urine test is made from the first urine of the morning, the medium jet, after a previous local washing

Specimen collected – urine

Causes of rejecting the test – insufficient quantity of urine; unfit collecting and keeping.

Recipient of collection – recipient for the urine analysis

Collected quantity – 10 ml

Stability of the sample – after the collection, the samples are kept at the room temperature (18-25°C) and will be brought to the lab mostly in 2 hours. In case the transport to the lab can't be made in two hours, the sample is maintaining the stability refrigerated (4°C) for maximum 24 hours.

RESULTS AND DISCUSSIONS

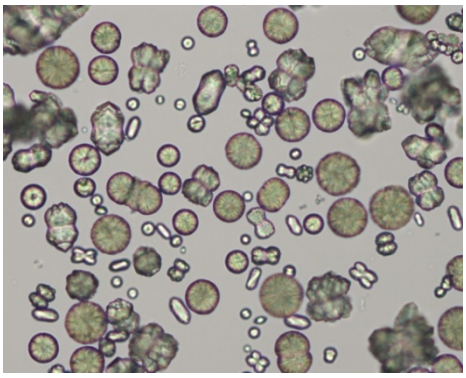

Fig. no.1. Microscopic exam. Non organized urinary sediment.
Crystals Calcium carbonate.
Source – www eclinpath.com

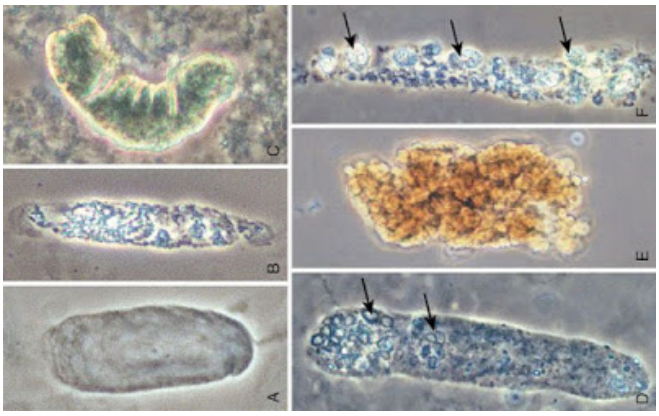

Fig. no. 2. Microscopic exam. Organized urinary sediment. Hyaline, cereous, granular, leukocytary cylinders.
Source – https://ro.pinterest.com/pin/493989271423984 97/?lp=true

The microscopic exam is made on the sediment of a fresh urine, mostly 4 hours from release. The test is agitated and then is centrifuged 10-15 mL urine at 2000 rpm for 5 min. If the volume of the test is too small to be centrifuged, is examined directly under the microscope, but is recorded in the final report of analysis that the result is referring to the non centrifuged urine[6]. Is eliminated the supernatant, leaving ~1 mL, and the sediment is suspended again and is examined under the microscope between the blade and lamella. Most of the authors recommend that the examination of the cells (leucocytes, erythrocytes, epithelial cells) to be done with the lens of 40x for the underlining of the morphologic details, and the examination of different types of cylinders and of the elements present only in few fields or to be made with the lens of 20x (or even with lens of smaller power) to observe better the ensemble of sediment. The numbering of the structure from the urine is made on 10-15 fields; for the reporting of the cylinders, of the epithelial cells, of the leucocytes, erythrocytes are used the following ways of expressing the results: „rare", „relatively frequent", „frequent", „very frequent". In case of the crystals is reported only their presence or the abundant presence.

Beside the microscopic exam, in some laboratories is available also an automatic method, based on the principle of cytometry in flux with fluorescence that allows the quantitative detection of the following particles of non centrifuged urine: leucocytes, erythrocytes, squamous epithelial cells, cylinders and bacteria. The analyzer can post also the parameters of "research": crystals, small round cells (in which are included the epithelial cells of transition and those renal tubular), cells similar to yeasts, pathologic cylinders, mucus and spermatozoids; in these situations the analyzer will

give messages of warning and the samples will be examined again by the conventional microscopic technique.

The Erythrocytes have the form of a biconcave disk, don't contain nucleus, are perfectly delineated and are found in very reduced number in the normal urine. In the acid or hypertonic urines can be contracted becoming piriform or crenelated, simulating the granulations, and in the alkaline or hypotonic (diluted) urines can be inflated becoming round and can be lysated[5].

The leucocytes have the aspect of some granulated spherical globules, of different sizes, greater than the erythrocytes; they can appear isolated or grouped; they are mainly neutrophils and can be recognized by the characteristic granulations and the lobulated nucleus. In the normal urine there is a small number of leucocytes. The leucocytes are reduced in size in the hypertonic urine; are inflated and are lysated in alkaline or hypotonic urine (in alkaline or hypotonic urine the leucocytes decrease with 50% in one hour, at the room temperature).

The epithelial cells from urine can have the origin in any part of the urogenital tube, beginning with the proximal tubes up to the urethra or vagina. Normally are met in urine as a consequence of the physiological desquamation of the senescent cells. A significant increase indicates inflammations in the area of the urinary tube from which are derived these cells. It can be reported 3 types of epithelial cells: renal tubular, transitional and squamous.

• The renal tubular epithelial cells are oval, a bit larger than leucocytes and are different by the large round nucleus. Their presence has a diagnosis significance, indicating tubular injuries associated with pyelonephritis, acute tubular necrosis, intoxication with salicylate and rejection of the renal graft.

• The transitional epithelial cells are round, piriform or in a column form, 2-4 times larger than leucocytes and can contain occasionally 2 nuclei. The come from the epithelia that seals the urinary tube, from pelvis up to the two proximal thirds of the urethra.

• The squamous epithelial cells are large, flat, with irregular form and contain a central small nucleus.

The crystals are not found usually in the fresh released urine, but they can appear after it stayed a long time at the room temperature. The crystals are formed when the urine is supra saturated with a certain crystalline compound or when its properties of solubility are modified. In case the precipitation appears on the level of the kidney or the urinary tube, the consequence if the forming of the urinary calculi.

The crystals can be identifies by the aspect, or if it is needed, by their properties of solubility; urinary pH influences strongly the crystals formation.

The most frequently met crystals in the acid urine are: uric acid, oxalate of Calcium and amorphous urates; rarely are present other types: Calcium sulphate, Sodium urates, hyppuric acid, cysteine, leucine, tyrosine, cholesterol.

The crystals of uric acid can be present in the normal urine, but can have also a pathologic significance (gout, accelerated purine metabolism, acute febrile conditions, chronic nephritis, Lesch-Nyhan syndrome).

The crystals of Calcium oxalate are frequently met in acid and neuter urine, but occasionally can appear also in the alkaline urine.

Amorphous urates are salts of Na, K, Mg, Ca and are found under the form of non crystalline form (the Sodium urate can appear also under the form of crystals); they don't have a clinical significance.

The presence of crystals of cholesterol in the urine indicates extended tissue destructions; these types of crystals are met in nephrites and nephrosis; also they appear in chyluria, which is the consequence of the abdominal or thoracic obstruction of the lymphatic drainage.

In *alkaline urine* are met these types of crystals: ammoniac-magnesium (triple phosphate), amorphous phosphates, Calcium carbonate, Calcium phosphates, ammonium biurates. The crystals of triple phosphate can be met in normal urine, but can form also urinary calculi; can be met in chronic cystitis and pyelitis, hypertrophy of prostate, the urine retention. The crystals of Calcium phosphate is associated also with the formation of urinary calculi.

The urinary cylinders**:** are formed in the lumen of the renal tubes following the precipitation of the Tamm-Horsfall mucoproteins (secreted by the renal tubes) or the agglutination of cells/other materials in a protein matrix; some cylinders (cereous cylinders) can contain serum proteins.

\The cylinders are classified based on the aspect and the cellular components from their composition. Sometimes they can be difficult to be differentiated due to the degeneration or of the mixed composition. The significance of the cylinders is different depending on their type.

The hyaline cylinders are the most frequent cylinders met in the urine; they are formed of gelificated Tamm-Horsfall proteins and can be found in mild kidney affections; in a small number can be present in the normal urine and in increased quantities after an intense physical effort or in conditions of dehydration.

The pure leucocytes cylinders are met rarely and their presence indicates acute pyelonephritis, interstitial nephritis, lupus nephritis,

glomerulonephritis. More frequently, the leucocytes are deposed on the cylinders of mucus, hyaline etc.

The erythrocytes cylinders can be formed from a reduced number of cells embedded in a protein matrix or from numerous cells tightly packed; if the cells are intact, are named erythrocytes cylinders, and if the cellular elements are degenerated, are named hematic cylinders or of hemoglobin.

The granular cylinders can be the result of the degeneration of the cellular cylinders or can result from the precipitation of the serum proteins in a matrix of Tamm-Horsfall mucoproteins. They appear in severe pathologic kidney processes, but can be present also transitory after an intense physical effort.

The epithelial cylinders are met very rarely and are formed as a consequent of the stasis and desquamation of the epithelial cells from the kidney tubes. They can be present in urine after the exposure to nephrotoxins or viruses (cytomegalic, hepatitis viruses), that produce tubular necrosis. Also, they can appear in severe chronic kidney diseases and in the rejection of the kidney graft.

The cereous cylinders result from the degeneration of the granulose cylinders; are met in severe chronic kidney deficiency, malign hypertension, kidney amyloidosis and diabetic nephropathies; also can be met in acute kidney diseases, the rejection of the kidney graft, the tubular inflammation and degenerescence.

The unctuous cylinders contain drops of fat and degenerated fat oval corpuscular, embedded in a protein matrix. The source of fat drops is usually an unctuous degenerescence of the tubular epithelia, and this type of cylinders is met in the nephritis syndrome, the diabetic glomerulosclerosis, lipoid nephrosis, chronic glomerulonephritis, lupus, kidney toxic.

Other structures that can be present in the urine include bacteria, yeasts, cylindroids, spermatozoa, mucus and fats.

Normally the urine is sterile up to the urinary vesicle, and the contamination can appear on the level of the urethra or the vagina or from other external sources. The bacteria (microbial flora) present in the fresh urine correctly collected and accompanied by a large number of leucocytes usually indicate and infection of the urinary tube.

The cylindroids have an aspect similar to the cylinders, are usually hyaline and because they appear together with the cylinders, they are considered as having the same significance as them.

The fat be present in the urine under the form of free drops, fat oval corpuscles or incorporated in cylinders.

CONCLUSIONS

In the refrigerated urine precipitates many crystals due to the alteration of the properties of solubility; also in the urine maintained for a long time at the room temperature the crystals can precipitate or can be dissolved.

The knowing of the artifacts is essential for the avoiding of the reporting of some incorrect results.

The drops of fat that appear in the urinary sediment following the contamination of oils, rests of suppositories or lubricants of the vesicle catheters, can be mistaken sometimes with erythrocytes. The granules of pollen can be interpreted as eggs of parasites. Also, the textile fibers or the hair threads can appear accidentally in the urine can be mistaken with cylinders and reported as such. Other artifacts from urine are: amylum crystals (coming from the powder), fragments of glass, air bubbles, fecal matter contaminants (vegetal, muscular fibers).

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