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Main chemical and microscopic indicators in urine, useful for pathologiesdiagnosis

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ABSTRACT: *The diagnosis of pathologies through the urine is a fundamental tool for the clinical area, in the sense of evaluating the patient in conjunction with their symptoms, as well as the evolution of the pharmacological treatment to which they are subjected, because said liquid of corporal excresión is a filtrate of the sanguineous torrent that in addition to evaluating the renal function can evaluate under certain criteria the homeostasis of an individual under appropriate criteria, derivative that is a type of sample that by its nature, chemical parameters are evaluated (pH, blood, nitrates, crystals) microscopic (bacteria, mucus, cells, sediment) both physical (density, color, viscocity, volume) that contribute to the interpretation of physiological processes, therefore the study of indicators in the urine, are an important study source that complements a patient's medical history.*

KEYWORDS*:Clinical tool, renal system.*

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I. INTRODUCTION

The Clinical Analysis Laboratory is part of the auxiliary departments for the diagnosis of diseases, treatment of the patient and is one of the areas of support of medical services whose results allow closer to more accurate diagnoses for the administration of appropriate treatments to the patient, as well as meeting the requirements for studies and research by resident physicians[2].

The main function of the Clinical Analysis Laboratory is to generate timely, reliable and high quality results to meet the demand of the areas of external consultation, emergency and hospitalization that request them. The uroanálsis is a set of tests that give a general idea about the urine from the physical, chemical and microscopic point of view, in this way it allows to obtain a general idea of the state of health of the organism The General Urinalysis allows to detect and measure the presence of various compounds that, in turn, reflect the state of health. The analysis of urine allows to study the functional state of the kidneys, the regulation of body fluids, the presence of microorganisms (bacteria) that can be indicative of infections, the concentration of lasts and other organic substances that, being altered, would be indicative of alterations or diseases. Its objective is to facilitate the diagnosis of urinary tract infections, as part of a routine medical examination, to detect the initial signs of various conditions, when the person shows signs of kidney disease or diabetes, or to monitor the results of treatment aimed at treat such ailments and finally to confirm hematuria or blood in the urine, which may be due to conditions in the bladder, kidneys or prostate[5, 20].

II. GENERAL URINE TEST

General urine test also called uroanalysis is one of the most important cabinet tests in determining the patient's health status, since this analysis can determine metabolic pathologies and some characteristics of functioning in various internal organs[1].

The study of urine can be considered from two points of view:

1. The diagnosis and treatment of kidney or urinary tract diseases[2].
2. The detection of metabolic diseases not directly related to the urinary system[2].

Geneal urine test can provide a wide variety of clinical data concerning the kidney and the metabolic diseases that affect this excretory organ. Detects structural (anatomical) and functional (physiological) disorders of the kidney and lower urinary tract [1, 15, 21], through a physical, chemical and microscopic examination[14].

The main of performing a general urinalysis is: to facilitate the diagnosis of urinary tract infections, as part of a routine medical examination (it allows detecting the initial signs of various conditions), when the person presents manifestations of kidney disease or diabetes, also for monitor the results of the treatment aimed at

treating such ailments, as well as to confirm hematuria or blood in the urine, which may be due to conditions in the bladder, kidneys or prostate[3, 16].

III. PHYSIC TEST

General urine test is a test that consists in determining the physical, chemical and microscopic exam[13]. Each of the activities that must be performed in a urinary study will be defined[17].

Appearance: Normal urine is usually clear but may become cloudy by precipitation of amorphous phosphate particles in alkaline urine, or amorphous urate in acidic urine. As well as the presence of leukocytes, epithelial cells, bacteria, erythrocytes and the fats that give it a white color, all these elements can be confirmed by microscopic examination of the sediment[5].

Color: Urine samples can vary in color (table 1), from pale yellow to dark amber. The color of normal urine is mainly due to urochrome (pigment found in the diet that is formed by the metabolism of bile). Due to the presence of abnormal pigments the color of urine changes in many pathological states[7].

Table 1.Clinical significance of urine color[5,17,18,19]

Color	Cause	Clinical meaning
Colorless of clear yellow	Very dilute urine	Polyuria, diabetes insipidus, abundant fluid intake
Yellow orange	Concentrated urine	Dehydratation, fever
Amber	Bilirrubin, biliverdin	Hepatopathies
Reddish	Hemoglobin	Paroxysmal nocturnal hemoglobinuria, gait hemoglobinuria, glucose deficiency 6-P dehydrogenase, clostridial infections and Plasmodium falciparum
	Myoglobin	Paroxysmal and gait myoglobinuria, traumatism, infections
	Red Blood Cell (RBC)	Mentrual pollution, gomerular inflammation, renal failure
Purple red	Porphyrins	Porphyrias
Greenish blue	Chlorophyll	Mouth deodorants
	Pseudomonas	Bacterial infection

IV. CHEMICAL TEST

The chemical test of the urine is carried out through indicator strips, which reveal the presence, absence and even intervals of quantities of chemical components in the urine, such as:

pH: The pH values range between 5 and 6 with a range of 4.5 to 8.5. The urinary pH is used for the estimation of the body acid-base balance. The pH can help in determining the presence of certain crystals such as calcium phosphate that generally occur in alkaline pH, while cystine, calcium oxalate and uric acid are commonly found in acidic urine. Urinary tract infections usually caused by urea-reducing bacteria (Proteus) often make the alkaline pH[5].

Density: Indicates the relative amount of solutes that contains a defined volume of urine. 70% to 80% of these solutes correspond to urea. The concentration of solutes in urine varies with the intake of water and solutes, the status of tubular cells and the influence of antidiuretic hormone (ADH) on the reabsorption of water in the distal tubules. The inability to dilute or concentrate urine is an indication of ADH disease or deficit. Normally in the first urine of the morning is a value of 1.025 g/l, this due to the restriction of fluid intake that occurs during the hours of sleep[5].

Proteins: The presence of a high concentration of protein in the urine can be an important index of kidney disease. There are, however, physiological states such as exercise and fever that can lead to increased protein excretion in the urine in the absence of kidney disease. In the normal kidney only a small amount of low molecular weight protein is filtered in the glomerulus. The structure of the membrane prevents the passage of proteins of high molecular weight[5].

The proteinuria can be classified according to its etiology and the mechanism involved: it can be functional not associated with kidney disease (excess exercise, pregnancy or orthostatic proteinuria) and organic associated with systemic disease or renal pathology. The latter can be pre-renal (due to fever, renal hypoxia, hypertension, myxedema or Bence Jones protein), renal (glomerulonephritis, nephrotic syndrome or parenchymal lesions) and post-renal (infection of the pelvis and ureters, cystitis , urethritis or prostatitis)

Glucose: The amount of glucose that appears in the urine depends on the blood glucose level, the glomerular filtration rate and the degree of tubular reabsorption. There is usually no glucose in the urine until the blood glucose level does not exceed 160-180 mg / dL, which is the normal renal threshold for glucose. When the blood glucose value exceeds the renal threshold, the tubules can not reabsorb all the filtered glucose, and glycosuria occurs. There may be a small amount of glucose in the normal urine, but the fasting level of an adult is only about 2-20 mg of glucose per 100 ml of urine (Sister, 2008). Glucosuria can occur without hyperglycemia (pregnancy, kidney disease, congenital errors, among others) and with hyperglycemia (diabetes mellitus, tumors, Cushing's syndrome, among others).

Ketone: result from the metabolism of fatty acids. The excessive production of ketones in the urine (ketonuria) is accompanied mainly by diabetes. The investigation of ketones in the urine of diabetics can provide the key to the early diagnosis of ketoacidosis and diabetic coma[7].

Blood: When intact erythrocytes are found in the urine the term hematuria is used and indicates that somewhere in the urinary tract there is hemorrhage. Therefore, hematuria can be distinguished from haemoglobinuria by microscopic examination of the sediment in a freshly emitted urine sample. The use of the urine dipstick and microscopic examination provide complete clinical evaluation in terms of hemoglobinuria and hematuria. When the urine gives a positive test of blood, but in the microscopic examination erythrocytes are not observed in the sediment, myoglobinuria can be suspected. This is the urinary excretion of myoglobin, muscle protein, as a result of muscle injury due to trauma such as can occur in automobile accidents, soccer injuries or electric shock; muscular disorder such as arterial occlusion of a muscle or muscular dystrophy or some types of poisoning such as carbon monoxide or fish poisoning. Myoglobin must be distinguished from free hemoglobin in urine by chemical tests[7].

Bilirubin: Its presence corresponds to intra- or extra-hepato-biliary obstruction, or alteration of the hepatocyte. Bilirubin facilitates the early diagnosis of liver disorders, before jaundice and elevated serum bilirubin. It is detected in urine in obstructive or parenchymal jaundice and is usually not present in hemolytic jaundice. In jaundice due to cholestasis, produced by hepatotoxic drugs or patients exposed to chlorinated hydrocarbon compounds, bilirubin is present, before the icteric manifestation[11].

Urobilinogen: Normally in the urine are such small amounts ranging from 0.2 to 0.5 mg/dL, and when you get a concentration higher than 2 mg/dl, should be correlated with bilirubin. Urobilinogen levels are increased by any condition that increases the production of bilirubin[11].

Nitrites: Common organisms that cause urinary tract infection, such as Escherichia coli, Enterobacter, Citrobacter, Klebsiella and Proteus species, contain enzymes that reduce nitrate from urine to nitrite. The test should be done immediately after the urine is emitted, because if the sample is left at room temperature for several hours, contaminating organisms can develop and produce nitrite[7].

V. MICROSCOPIC TEST

The microscopic examination of urine is a non-substitutable procedure for the evaluation of a general urinalysis, since in the sedimentation process multiple components can be found that can yield data of a pathology in process, before even having symptoms19. The most common elements found in the microscopic evaluation are:

Erythrocytes: The erythrocytes are eliminated in a very small amount in the urine, even in normal people. In freshly emitted spontaneous urine they appear as round disks with a faint yellow-reddish color. In the hypotonic urine, the red blood cells swell forming the so-called blood shadows and in the hypertonic one they wrinkle into the form of estramonium. RBCs are sometimes confused with fungi, which have a different size, a slightly oval shape and simple borders[3].

Leukocytes: They appear as granulocytes and more rarely as lymphocytes, monocytes or eosinophils in inflammations of the kidney and urinary tract. Normal people eliminate between 0 to 5, in the different fields that are examined. The leukocyturia, which when acquired a massive macroscopic character is called pyuria, represents the fundamental symptom of acute or chronic pyelonephritis. In addition, this finding occurs in all inflammatory diseases of the descending urinary tract, such as urethritis, prostatitis, cystitis and tuberculosis. Glomerulonephritis can also present with leukocyturia, although as a rule, haematuria predominates[3].

Epithelial cells: The epithelial cells present in the urine can come from any site of the urinary tract, from the proximal convoluted tubules to the urethra, or from the vagina. A marked increase indicates inflammation of the portion of the urinary tract from which they come. In cases where the distinction is possible, three fundamental types of epithelial cells can be recognized: tubular, transitional and pavement cells[5].

Cylinders: hyaline and granular cylinders can be found in healthy people, especially after intense physical efforts. As a general rule, the cylinderururia occurs with proteinuria. The observation of abundant cylinders suggests a considerable proteinuria[3].

a) Granular cylinders: Granular cylinders are usually larger and wider than hyaline cylinders. Granular cylinders can appear in acute and chronic diseases of the kidney, especially in glomerulonephritis and more rarely in pyelonephritis[3].
b) Waxy cylinders: They are plasma proteins and are formed under certain conditions, inside the tubular lumen by the denaturation of these plasma proteins. They have a slightly yellowish hue as well as characteristic notches or thin grooves in the edges, which are directed to the longitudinal axis of the cylinder[3].
c) Hyaline cylinders. They are transparent, colorless, formed when proteins (Tamm-Horsfall) precipitate inside the tubules and form gel. In many hyaline cylinders are observed different types of inclusions that are trapped inside them, can be fine granules, nuclei, cell walls and blood cells[7].

d) Erythrocyte cylinders. They consist of more or less dense erythrocytes that adhere to a fundamental hyaline substance. Its color varies from yellowish red to brown, although they can be lighter and even colorless. As the erythrocyte cylinders degenerate, the limits disappear and the so-called red-yellowish blood cylinders originate[3].
e) Leukocyte cylinders. Compounds of leukocytes that adhere to cylinders with a different fundamental substance. They occur when an intense intrarenal exudation of leukocytes occurs and at the same time proteins are eliminated by the tubule[3].

Crystals: Among the factors that allow its formation are changes in pH, temperature and concentration. The crystals that are commonly found in acid urine are uric acid, calcium oxalate and amorphous urates. Less frequently there are crystals of calcium sulfate, sodium urates, hippuric acid, cystine, leucine, tyrosine, cholesterol and sulfonamide. The crystals that indicate some pathology are cystine, leucine, cholesterol and tyrosine[5].

Bacteria: Usually in the urine at the renal and bladder level there are no bacteria, but it can be contaminated by bacteria present in the urethra, in the vagina or from external sources. When a sample of fresh urine correctly collected contains a large number of bacteria, and especially when this is accompanied by many leukocytes, it is usually an index of urinary tract infection.

The presence of bacteria is reported according to their number (scarce, moderate amount, etc.), but in the routine examination no studies are done to identify the exact organism[5,21,22].

Fungi: Fungal cells are uniform, colorless, usually ovoid with a double-refractive wall. They can have different sizes and often show budding.

It is possible to find fungi in urinary tract infections, especially in diabetic patients. They may also be present due to cutaneous or vaginal contamination of the urine. Candida albicans is the fungus that most frequently appears in the urine[5].

Mucus: They are structures of acintada form, long, thin and undulating that can show tenuous longitudinal striations. They exist in normal urine in small amounts, but can be very abundant in cases of inflammation or irritation of the urinary tract. Thick mucus filaments tend to incorporate leukocytes[5].

VI. CONCLUSION

In the clinical field, the study of urine is an irreplaceable tool, since for the population it is important that there are professionals with the knowledge and experience necessary to assist in the diagnosis of different pathologies in the areas of urinalysis. The general examination of urine provides valuable information on the health status of a patient, since from chemical data such as pH, it can be related to the formation or existence of crystals, which can cause preventable pathologies, from the moment the patient manifests urine either acidic or basic, in the same way the presence of renal cells can be related to the state of the basic processes of urine formation (filtration, resorption, secression and excression) where the fundamental components of the renal system are involved, or some chronic degenerative pathology that can be detected prior to clinical manifestations, through the presence of solutes that should only be present in blood.

REFERENCES

[1]. Ruiz Reyes G. Examen de Orina en Diagnóstico Clínico. México 2004. 1ª edición. Editorial Panamericana.
[2]. Simerville, J.A., Maxted, W.C. Pahira, J.J. (2005).Urinalysis: A Comprehensive Review. American Family Physician, 71 (6), 1153-1162.
[3]. Althof S., Kindler J., Heintz R. El Sedimento Urinario. España 2007. 6ª edición. Editorial Panamericana.
[4]. Lozano-Triana , C.J. (2016) Examen general de orina: una prueba útil en niños. Revista de la Facultad de Medicina, 64(1), 137-147
[5]. Sister Laurine G. Análisis de Orina, Atlas Color. México 1987. 6a edición. Editorial Médica Panamericana, S.A. de C.V.
[6]. Patel, H.P. (2006). The Abnormal Urinalysis. Pediatric Clinics of North America, 53, 325-337
[7]. Frances Talaska F. Manual de Pruebas Diagnósticas. México 1999. 5a edición. Editorial McGraw-Hill / Interamericana de México.
[8]. Laso, M.C. (2002). Interpretación del análisis de orina. Arch.argent.pediatr., 100(2), 179-183 http://revistaamicac.com/estudio%20examen%20de%20orina.pdf. Consultado 16-09-16
[9]. Campuzano Maya, G., Arbeláez Gómez, M. (2007). El Uroanalisis: Un gran aliado del medico. RevistaUrologíaColombiana, XVI (1), 67-92.
[10]. Contreras García, R., García Perdomo, H.A., Herney, A. (2016). Diagnóstico, evaluación y seguimiento de la hematuria microscópica. Un enfoque al alcance de todos. RevistaUrologíaColombiana, 25(3), 231-238
[11]. Ángel Mejía G. Ángel Ramelli M. Interpretación clínica de laboratorio. Colombia 2006. 7a edición. Editorial Panamericana.
[12]. Baños Laredo, M.E., Nuñez Alvarez, C.A., Cabiedes, J. (2010). Análisis del sedimento urinario. Reumatología Clínica, 6(5), 268-272.
[13]. Escobedo Martha Medina; Villanueva Salha: Trujillo Efraín; Garrido Margarita: Escobedo Medina Carolina; Comparación entre las lecturas de las tiras reactivas; Hospital General "Agustín O' Harán" 76- 79; 2005.
[14]. John Bernard Henry; El laboratorio en el diagnostico clínico; ed. Marban, Volumen 1 y 2; 20ª edición; 2005.
[15]. Keith L. Moore; Arthur F. Dalley; Anatomía con orientación clínica; ed. Panamericana; 4ª edición; 2004.
[16]. Kumar/Cotan/Robbins; Patología humana; ed. interamericana + McGraw-hill, 5ª edición; 1995.
[17]. Laso María del Carmen; Interpretación del análisis de la orina; Pediatría Practica; 179- 183; 2002.
[18]. Martínez Elpidio; Hernández Ma. Eugenia; Insuficiencia renal aguda en el paciente critico; Medicina critica & terapia intensiva; 146- 149; 1998.

[19]. Stam, W.E; and S.R. Norby; Prevalence patterns of community based and nasocomal urinary tract infection caused by Escherichia coli; Journal of biological sciences; 494- 496; 2001.
[20]. Susan King Strasinger; Líquidos corporales y análisis de orina; ed. el manual moderno; 9ª edición; 1991.
[21]. De la Cruz López M. M., López Luna M. A., Nava Maldonado F. M., Gaytán Pacheco N., Infante Espinoza M. M., Flores de la Torre J. A., Antimicrobial Reistance in E. Coli isolated from the Biological Samples in Zacatecas Patients., Annals of Clinical and Laboratory Research, 6,1:215, 2018.
[22]. Garofalo CK, Hooton TM., Martin S., Stamm W., Palermo J., et al., Escherichia coli from urine of female patients with urinary tract infections is competent for intracellular bacterial community formation. Infect Inmun 75: 52-60, 2007.

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