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RATIONAL METHODS AND ALGORITHMS FOR DIAGNOSING KIDNEY DISEASES IN CHILDREN

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Abstract. The review presents the main and clarifying diagnostic methods used to verify kidney damage in children. In addition, the shortcomings of old and the possibilities of new diagnostic methods are shown. The work presents diagnostic algorithms that, based on data from new and old research methods, allow: firstly, to diagnose the levels of kidney damage; secondly, to determine the etiology of the disease and, thirdly, to assess the stage of renal dysfunction.

Keywords: kidney disease, diagnosis, symptoms of kidney damage, children.

INTRODUCTION

Congenital and acquired kidney diseases are common in childhood. About 10% of girls and 5% of boys under 18 suffer from one or more kidney diseases of various nosologies.

The outcome of chronic kidney diseases is terminal renal failure (TRF), which is a major therapeutic, economic and social problem. The mortality rate of patients with TRF is 10 times higher than that in the general population [1].

MATERIALS AND METHODS

The progress of modern diagnostic methods in pediatric nephrology allows us to improve nephrological care for children. New methods are usually very expensive and therefore should be used only according to strict indications. Routine studies are less expensive, but their capabilities are limited in obtaining complete information about the degree of kidney damage. In addition, unfortunately, their potential is often not fully utilized. Providing full nephrological care to children is possible with the use of standardized methods of laboratory diagnostics and treatment. It is important to remember that everything new and expensive is not always the best.

RESULTS AND DISCUSSION

Diagnostics in pediatric nephrology

In addition to a thorough collection of anamnesis and clinical examination of the patient, it is recommended to conduct [2].

- urine tests;
- blood tests;
- instrumental studies;
- kidney biopsy with morphological studies;
- monitoring of medications taken;
- molecular biological studies (biomarkers);
- molecular genetic studies.

The main extrarenal manifestations of kidney diseases include edema (the diagnostic algorithm is presented below) and arterial hypertension (AH). To identify AH, knowledge of age norms and daily monitoring of blood pressure are required.

For the study, it is important to use the middle portion of the second morning freshly voided urine without the use of stabilizers. However, if it is not possible to collect urine early in the morning, urine

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can be collected during the day. The use of stabilizers is justified in rare cases, for example, when collecting urine to determine the excretion of oxalates. Do not delay collecting urine, since this may be the last urine that the patient was able to excrete.

An inexpensive and accurate method of screening urine testing is the use of test strips (qualitative analysis). The strips can be used even in tropical conditions [3].In the absence of hematuria/hemoglobinuria or leukocyturia, proteinuria (PU), glucosuria, there is no need for microscopic examination of urine. If pathological findings are detected during testing with a test strip, further quantitative biochemical and microscopic studies are necessary. The unit of measurement of the content of chemicals in urine is liters (for example, the upper limit of normal for albumin in urine is 20 mg / l), and the number of cells is microliters. To level out different concentrations of substances in urine, it is recommended to use the ratio of their level to the level of a substance whose excretion is constant during the day. Such a substance is creatinine. The ratio of the level of the analyte to creatinine in urine can be expressed as mmol of the substance/mmol of creatinine, or as mg of the substance (e.g. protein/mmol of creatinine).

Most children over 2 years of age with normal drinking regimen have a urine creatinine level of 5 ± 4 mmol/l. There may be an error of "urine dilution", when urine creatinine is about 2 mmol/l or "urine concentration" at a concentration of about 12 mmol/l. Then the creatinine coefficient (CC) values differ from the true ones by 2-3 times. With an albumin concentration in urine of 1 g/l, that is, with a 50-fold increase, CC calculation is not required. CC of all substances in infants is higher than in older children. This is due not to their increased excretion, but to reduced creatinine excretion due to low muscle mass. The CC norm in newborns is 4 times higher than in older children. When determining CC, there is no need to determine the daily excretion of substances.

Particular attention should be paid to calcium excretion, since its increase is associated with a high risk of nephrocalcinosis and nephrolithiasis. Determination of the excretion of organic acids (citrates, oxalates, urates) is carried out if hyperoxaluria, hypo- or hypercitraturia, hypouricosuria are suspected. This study is performed in special laboratories (a very expensive method). Quantitative methods (determination of pH and osmolarity) are recommended to determine the pH and relative density of urine, since test strips are of little information in this case. Proteinuria (PU) is a sign of kidney disease and a marker of the localization and severity of kidney damage. In conditions such as fever, significant physical exertion, hematuria and urinary tract infection, there may be a transient increase in albumin in the urine. The study of protease activity in urine is also important for a nephrologist, but to exclude diagnostic errors it must be carried out as early as possible (a temperature of 8°C reduces their activity, so urine can be stored for several hours before the study).

To diagnose proteinuria, one can use the following parameters [3].

• total protein;
• protein markers: albumin, α1-microglobulin, transferrin, IgG;
• electrophoresis: cellulose acetate, SDS-PAGE (in polyacrylamide gel) [4;
• fermenturia: NAG (N-acetyl-β-glucosaminidase), AAP (alanine aminopeptidase), etc.;
• proteomics;
• biomarkers (enzymes, NGAL).

Note: a low-cost method for semi-quantitative determination of PU in children with nephrotic syndrome is using a 20% solution of sulfosalicylic acid (dilute 2 g of sulfosalicylic acid in 8 ml of distilled water): add 3-4 drops of the prepared solution to 2-3 ml of urine and stir well. Interpretation of results:

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• urine remains clear: negative result;
• slight turbidity (smoke in the room): 1+;
• moderate turbidity (milk with water): 2+;
• pronounced turbidity (cheese), sediment: 3+.

Determination of the urine protein/creatinine ratio has replaced 24-hour urine collection without loss of diagnostic sensitivity and specificity. Determination of the level of total protein in urine without marker proteins does not provide any information, in particular, it does not allow differentiation between glomerular and tubular PU, whereas new electrophoresis methods with separation of urine proteins depending on their molecular weight allow this to be done [3].

CONCLUSION

In recent years, indications for kidney biopsy have narrowed due to the wider use of informative noninvasive diagnostic methods. Therapeutic drug monitoring protects patients from insufficient or excessive dosage of medications during immunosuppressive therapy or renal failure. Molecular biological studies (in particular, determination of cytokines) are still at the development stage, and therefore are not available for widespread use. Molecular genetic studies allow the diagnosis of rare hereditary diseases, but they are not able to replace a thorough clinical and pathophysiological examination.

REFERENCES

1. Sarnak M.J. Cardiovascular disease and chronic renal disease: a new paradigm. Am. J. Kidney Dis. (2020) 35(Suppl. 1):S117–131.
2. Perico N., Codreanu I., Schieppatti A. and Remuzzi G. The future of renoprotection. Kidney International (2015) 68:S95–S101.
3. Campbell H., Duke T., Weber M. et al. Global initiatives for improving hospital care for children: State of art and future prospects. Pediatrics (2018) 121:984–992.
4. Ehrich J.H.H., El Gendi A.A., Drukker A. et al. Demography of pediatric renal care in Europe: organization and delivery. Nephrol Dial Transplant (2015) 20:297–305.
5. Soergel M., Kirschstein M., Busch C. et al. Oscillometric twenty-four-hour ambulatory blood pressure values in healthy children and adolescents: a multicenter trial including 1141 subjects. J. Pediatr. 2020