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DIAGNOSIS OF CONGENITAL HYDRONEPHROSIS IN CHILDREN

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ABSTRACT

All patients underwent a comprehensive ultrasound examination, which included assessment of the urinary tract using Doppler imaging and diuretic ultrasonography. Ultrasound examination served as the primary screening method. The use of modern ultrasound techniques made it possible to evaluate both the anatomical condition of the urinary system organs and their functional parameters, including blood flow characteristics and changes in renal function under diuretic load. At the same time, ultrasound findings were insufficient to establish a definitive diagnosis, which necessitated the use of additional radiological and laboratory diagnostic methods.

Keywords: Congenital hydronephrosis, diagnosis, children.

INTRODUCTION

Congenital hydronephrosis (CH) is a common condition in pediatric surgery, accounting for 50% of all obstructive uropathies [1, 7–9]. CH develops due to impaired intrauterine development. Malformations of the kidney and ureter tissue in the ureteral pelvis lead to the development of hydronephrotic transformation in the fetus. Renal pelvic reflux plays a significant role in the pathogenesis of hydronephrotic transformation of the organ [7, 10].

Commonly accepted methods for diagnosing hydronephrosis in children include ultrasound examination (US) of the kidneys and urinary tract, ultrasound Dopplerography (USDG) of the renal vessels, excretory urography (EU), infusion urography (IU), and dynamic nephroscintigraphy (DNSG). Despite their wide availability, these methods have a number of significant limitations. The advent of new technologies in the diagnosis and treatment of hydronephrosis has significantly improved the results of surgical treatment of patients in this group. Nevertheless, a high percentage of negative surgical results, the presence of postoperative complications and repeated interventions persist to this day, which requires a more in-depth study of possible ways to improve the effectiveness of diagnosis and treatment of hydronephrosis. The effectiveness of treatment of hydronephrosis is largely determined by the timing of diagnosis and timely surgical correction [4].

One of the pressing issues in modern pediatric urology is antenatal diagnosis and postnatal management of newborns and infants with severe hydronephrosis. Antenatal ultrasound is one of the effective and reproducible methods for assessing hydronephrosis. Prenatal diagnosis is aimed at preventing postnatal complications, such as urinary tract infections and subsequent renal impairment [2-6, 11].

OBJECTIVE OF THE STUDY

To analyze the diagnostic results congenital hydronephrosis in children.

MATERIAL AND METHODS

From 2015 to 2025, 62 patients with CH, aged 1 month to 12 years, were examined and treated at the clinical sites of the Departments of Pediatric Surgery, Urology, Pediatric Urology, Anesthesiology and Resuscitation, and Pediatric Anesthesiology and Resuscitation of the Tashkent State Medical University.

All patients with CH underwent clinical laboratory tests and instrumental research methods before and after surgical treatment.

RESULTS AND DISCUSSION

Ultrasound was the screening method for diagnosing CH. 62 patients underwent ultrasound examination of the urinary tract, assessing blood flow parameters and urinary tract dimensions. Ultrasound allowed us to observe the dynamics of changes in the size of the renal pelvis and an increase in the thickness of the renal parenchyma.

During ultrasound examination of renal hydronephrosis, we found **dilation of the renal pelvis** due to fluid accumulation, **thinning and atrophy of the renal parenchyma,** and an increase in the size of the kidney itself (Fig.1).

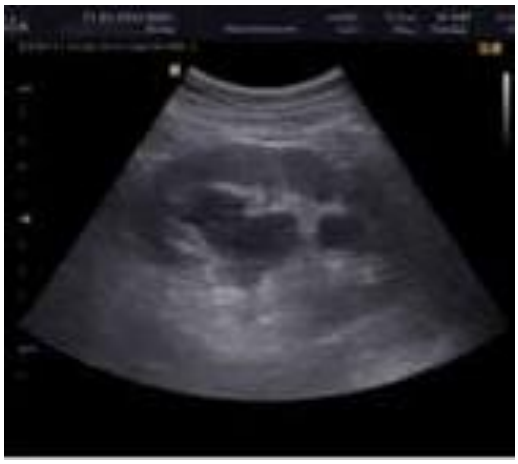

Fig. 1. Patient A. Ultrasound reveals dilation of the renal pelvis without thinning of the renal parenchyma with a slight increase in the size of the kidney itself.

Ultrasound revealed right-sided hydronephrosis in 41 (66,1%) children, left-sided hydronephrosis in 17 (27,4%), and bilateral hydronephrosis in 4 (6,5%). In 56.4% of patients, the main complaint was pain in the lumbar region; in 20.9% of cases, patients complained of an unexplained increase in body temperature; in the remaining cases, the disease was detected incidentally during ultrasound examinations for other conditions.

The degree of hydronephrosis was also determined during the scan. Grade I hydronephrosis was detected in 2 children (3,2%), grade II in 9 (14,5%), grade III in 38 (61,2%), and grade IV in 13 (20.9%).

When analyzing urinary sediment, leukocyturia was predominant in 21 (33,9%) children, erythrocyturia was present in 5 (8%), proteinuria in 3 children (4,8%), the presence of

epithelium in the urine in 12 (19.3%), mucus in 4 (6.4%) children, and the combination of these changes was present in 17 (27,4%) cases.

The disease was detected accidentally during an ultrasound examination for other diseases: during the diagnosis of pyelonephritis or urinary tract infection - in 14 (22,6%) children; during the diagnosis of acute appendicitis - in 3 (4,8%) children; in 8 (12,9%) cases, this defect was detected during a preventive examination by ultrasound of the abdominal organs and retroperitoneal space.

Prenatal diagnosis of CH was most often performed in the 3rd trimester of pregnancy, namely at 29-35 weeks using ultrasound in 7 (11,3%) cases.

In 58 (93,5%) of 62 patients, ultrasound dopplerography of the renal vessels was performed in addition to renal ultrasound. Reduced blood flow to the affected kidney was detected in 35 (60.3%) patients, and an aberrant vessel was visualized in 5 (8.6%) cases.

Diuretic ultrasound (DUS) was performed in 53 (85,4%) cases, and DUS demonstrated a weak renal response to furosemide administration: within 30 minutes after administration, the size of the ureteral pelvic junction (UPJ) continued to gradually increase. There was no decrease in the ureteral junction volume during the entire observation period (up to 1,5-2 hours), indicating an organic obstruction in the pyeloureteral junction.

Radiography of the urinary system was performed using both intravenous and intraureteral ultrasound. During intravenous ultrasound, impaired urine flow and retention of contrast material in the urinary tract were detected on delayed images, indicating obstruction at the level of the pyeloureteral segment (Fig. 2).

In the preoperative period, 38 out of 62 patients (61,3%) underwent X-ray imaging in the form of EU. In 22 patients, images were taken at the 5th, 12th, and 22nd minutes; in 10 patients, at the 7th, 15th, and 25th minutes; and in 6 patients, late images were taken at the 60th–90th minutes.

In 12 patients (1934%) with signs of chronic renal failure, the IU technique was used to improve urinary tract visualization. In six patients, X-rays were taken at the 22th, 35th, and 50th minutes, and in three patients, at the 30th, 45th, and 60th minutes. In three patients, late images were taken at 90th –110th minutes.

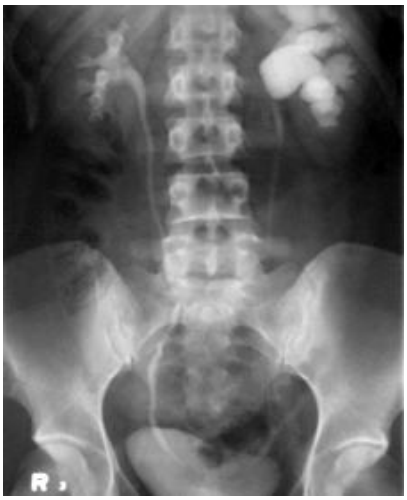

Fig. 2. Patient M. On the EU, expansion of the ventral joint and obstruction at the level of the pyeloureteral segment on the left are determined

According to the EU data, decreased renal function was noted in 29 cases (76,3%), and in 8 children with IU. In 24 patients (48%), the ureter was not contrast-enhanced or was unclear on some images. This indicated impaired renal evacuation function.

During the X-ray urological examination, 12 children had clinically significant abnormalities. Therefore, of the 62 children, MSCT-EU was performed in 12 (19,3%) children. The studies were performed using a Siemens tomograph. Somatom Emotion (Germany) with a section thickness of 16, which made it possible to clarify the causes of hydronephrosis, as well as the degree of expansion of the renal pelvis and the state of the renal parenchyma (Fig. 3).

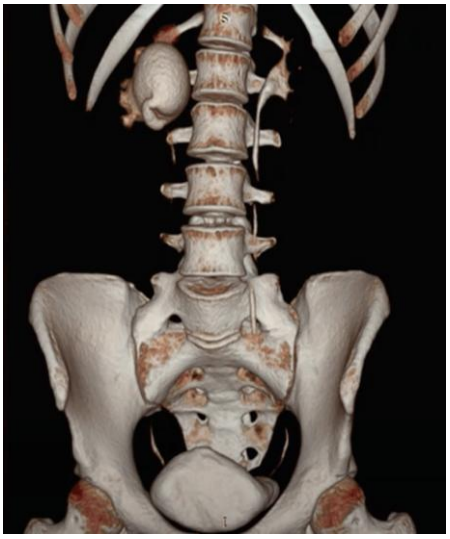

Fig. 3. MSCT- EU in 3D reconstruction. Patient I. Dilation of the renal pelvis, obstruction at the level of the pyeloureteral segment on the right, and lack of contrast in the ureter are detected.

At the same time, a decrease in the excretory function of the kidneys was revealed in 11 (91,6%) cases.

Thus, the correct diagnosis was established in 61 (98,4%) of 62 patients, who had previously been diagnosed with CH using ultrasound. The sensitivity and specificity of contrast-enhanced MSCT- EU for diagnosing CH was 98%.

As our studies have shown, X-ray and ultrasound methods do not always detect renal dysfunction. Therefore, DNSG is the most objective and effective method for identifying structural changes in the renal parenchyma in children with hydronephrosis. It revealed foci of renal nephrosclerosis in 17 children (27,4%), which is a sign of connective tissue dysplasia, as it is accompanied by collagen proliferation and impaired blood flow.

CONCLUSIONS

Ultrasound was the screening diagnostic method in the antenatal and postnatal periods. All patients underwent a comprehensive ultrasound of the urinary tract with Doppler ultrasonography and diuretic ultrasonography. In some cases, ultrasound data were insufficient for a reliable diagnosis, necessitating the use of additional methods (EU, IU, MSCT-EU, and laboratory tests).

The use of a comprehensive diagnostic approach allowed for a more accurate determination of the severity of hydronephrosis, which, in turn, facilitated an informed choice of treatment tactics and the optimal timing of surgical intervention.

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