

Criteria For Prediction Of The Functional State Of The Kidneys In Children After Congenital Upper Urinary Tract Obstruction In Children After Surgical Treatment

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1. RELEVANCE.

The quality of life of children with obstructive uropathy and the prognosis of obstructive uropathy are determined by the degree of involvement in the pathological process and the nature of kidney damage. In severe cases, obstructive uropathy is accompanied by a decrease and even loss of renal function with the subsequent formation of renal failure and disability of the child. In everyday clinical practice, the question constantly arises why, with the same type of uropathy, in some children, renal function after surgical treatment is rather quickly restored, while in others it continues to progressively decrease. This circumstance dictates the need to search for prognostic markers of the functional state of the kidneys and the progression of these diseases in children.

2. GOAL.

In order to search for criteria for predicting the course and outcome of congenital obstructive uropathies to prevent the development of nephrosclerosis and chronic renal failure in children, we studied the results of surgical treatment of congenital OU depending on the initial morphological and functional state of the kidneys and ureters.

3. MATERIAL AND METHODS.

For the convenience of mathematical analysis, the mean values of ultrasound and roentgenoplinimetry in children with II and III degree of obstruction in congenital OU were compared before the operation with the data of children examined up to 3 years old and after 3 years of follow-up examination.

4. RESULTS.

After reconstructive plastic surgeries, during follow-up examination, a comparison of the ultrasound data, depending on the morphological picture of the LMS and MPS, showed: the average urinary rate of the URV in children with hypoplastic changes is significantly higher ($p \leq 0.001$) than in children who had sclerotic changes before surgery in the urodynamic nodes of the upper urinary tract (table 1). The duration of one urine ejection in children without

sclerotic and decompensatory-atrophic changes in the ureteral wall differed less significantly ($p \leq 0.05$), but confidently (Table 1).

Table 1

Ultrasound indicators in children with congenital uropathies before and after surgery (p / o) depending on the morphological picture

	TPP (mm)	Average velocity of urine SSV (m / s)	Prolong. one urine SSV per minute (sec)	IR paren. renal blood flow
Before surgery	11,9±1,4 (n-212)	0,1±0,02 (n-145)	2,1±0,8 (n-145)	0,77±0,03 (n-36)
P / o - sclerosis, atrophy	13,2±1,5 (n-87)	0,15±0,02 (n-49)	3,2±0,4 (n-49)	0,73±0,03 (n-11)
P / o hypoplasia	19,8±1,4 *** (n-125)	0,22±0,01 *** (n-64)	4,3±0,34 * (n-64)	0,70±0,02 * (n-18)

$p \leq 0,05^*$, $p \leq 0,001^{***}$

After reconstruction of the upper urinary tract, during the follow-up examination, comparison of the data of TPP on ultrasound and CDC, depending on the morphological picture of the biopsy material of the parenchyma of the affected kidney, showed the following. If, according to the data of morphological examination, hypoplasia was determined in the kidney tissue before the operation against the background of glomeruli of a normal structure, then in the follow-up after the operation, an increase in TPP was noted on ultrasound, and with CDC - a significant improvement ($p \leq 0.05$) of renal blood flow (Table 6.1). If, before the operation, protein dystrophy and focal necrosis were noted in the epithelium of the convoluted tubules, then the recovery of renal hemodynamics in the postoperative period was insignificant, i.e. at the same time, there was no significant difference between the indicators of TPP and CDC at different periods of the follow-up examination (Table 1).

The data of the mathematical analysis of EI after surgery differ significantly from the data before the operation. When analyzing the indicators of X-ray planimetric indicators, depending on the histological picture in the ureter and the renal parenchyma, data were obtained that had significant differences between themselves (table 2).

Table 2

X-ray plan metric parameters in children with congenital OU before and after surgery, depending on the morphological picture of LMS, MPS and renal parenchyma

Children under 3 years old				
	RKI	PI	VMO	RMO
Before surgery (compare values)	0,42±0,03 (n-31)	1,4±0,2 (n-31)	37,7±2,9 (n-23)	1,1±0,1 (n-23)
After surgery, depending on the degree of damage				
Sclerosis and atrophy	0,38±0,02 (n-7)	1,7±0,2 (n-7)	15,2±3,7*** (n-4)	0,8±0,04** (n-4)
Hypoplasia and	0,31±0,03**	2,3±0,03***	7,2±2,4***	0,4±0,09***

dysplasia	(n-7)	(n-7)	(n-4)	(n-4)
3-7 yearsold				
Before surgery (compare values)	0,46±0,04 (n-33)	1,3±0,2 (n-33)	44,6±2,5 (n-22)	1,3±0,1 (n-22)
After surgery, depending on the degree of damage				
Sclerosis and atrophy	0,41±0,04 (n-8)	1,5±0,2 (n-8)	16,8±1,4*** (n-4)	1,0±0,04** (n-4)
Hypoplasia and dysplasia	0,28±0,03*** (n-5)	2,6±0,3*** (n-5)	8,8±1,9*** (n-4)	0,35±0,03*** (n-4)
7-11 yearsold				
Before surgery (compare values)	0,45±0,04 (n-30)	1,4±0,02 (n-30)	57,4±2,8 (n-18)	11,1±0,1 (n-18)
After surgery, depending on the degree of damage				
Sclerosis and atrophy	0,39±0,03 (n-8)	1,9±0,2** (n-8)	20,6±3,4*** (n-4)	0,85±0,03*** (n-4)
Hypoplasia and dysplasia	0,28±0,03*** (n-4)	2,6±0,3 (n-4) ***	9,7±2,6*** (n-5)	0,48±0,01*** (n-5)
11-15 yearsold				
Before surgery (compare values)	0,48±0,02 (n-25)	1,2±0,02 (n-25)	65,5±0,02 (n-11)	1,1±0,1 (n-11)
After surgery, depending on the degree of damage				
Sclerosis and atrophy	0,34±0,03*** (n-7)	2,1±0,2*** (n-7)	28,3±2,4*** (n-5)	0,9±0,02*** (n-5)
Hypoplasia and dysplasia	0,22±0,04*** (n-7)	3,4±0,4*** (n-7)	11,7±1,3*** (n-4)	0,55±0,01*** (n-4)

p≤0,01**, p≤0,001***

In IUD, after the restoration of urodynamics at the level of the ureterovesical segment, the upper urinary tract contracts. Depending on the histological picture of the resected ureterovesical segment, the X-ray planimetric parameters had a significant difference (p≤0.001) (Table 2). As can be seen from Table 2, after the operation, the degree of decrease in the volume and radius of the ureter in patients with hypo and dysplastic changes is much more pronounced in comparison with patients with atrophic and sclerotic lesions of the wall of the ureterovesical segment.

For dynamic control over the restoration of the integral and local viability of the renal parenchyma, before and after surgical results of renal scintigraphy were compared with the determination of the integral uptake index of the DMSA radiopharmaceutical - Technetium-99m. (table 3).

Table 3.

IIH indices in children with congenital OU, depending on the cause and degree of obstruction

	Refluxing mega ureter	Obstructive mega ureter	Congenital hydronephrosis
Before surgery			
IIS at 2 degrees	45,7±2,2 (n-3)	47,8±2,4 (n-4)	49,1±2,6 (n-8)

IIS at 3 degrees	35,6±2,4 (n-9)	37,4±3,6 (n-3)	40,2±2,9(n-17)
After operation			
IIS at 2 degrees	47,2±1,7 (n-3)	49,3±1,6 (n-4)	52,4±1,3 (n-8)
IIS at 3 degrees	38,2±1,4 (n-9)	40,4±2,8 (n-3)	43,1±3,9(n-17)

When analyzing the data of radiological studies of children with congenital obstructive uropathy, various variants of deviations were revealed. As can be seen from the table, the most profound lesion of the nephrons was observed in grade III obstruction of the upper urinary tract, regardless of the level and cause. After the operation, the dynamics of restoration of the functional volume of the kidney was not observed.

We compared the level of urinary TGF β and interleukin-10 values in children with congenital OU before and after surgical treatment, depending on the presence of nephrosclerosis (Table 4). The scatter of data on the level of the analyzed parameters depending on the cause of congenital OU was significant. So, in children with WMD without signs of nephrosclerosis before and after the operational data with standard values practically did not differ.

Table 4.
Immunological parameters of urine in children with congenital OU
before and aftersurgery

	IL-10 (pg / ml) before surgery	IL-10 (pg / ml) after surgery	TGF-(pg / ml) before surgery	TGF-(pg / ml) after surgery
VH withnephrosclerosis (n-28)	28,3 ± 5,4	20,6±5,3	39,2 ± 5,9	33,2±3,4
VH withoutnephrosclerosis (n-22)	22,7 ±3,3	12,3±3,8 *	31,1 ± 5,9	15,8±2,9 *
WMD withnephrosclerosis (n-18)	14,0 ±3,2	11,2±2,8	9,9 ± 3,5	7,8±2,3
WMD withoutnephrosclerosis (n-3)	8,21	8,21	1,16	1,16
RMU withnephrosclerosis (n-29)	33,4±4,5	31,2±3,6	36,6 ± 4,5	32,9±3,7
RMU withoutnephrosclerosis (n-10)	28,9± 3,3	19,9±2,7 *	30,1±3,5	22,3±2,9 *

$p \leq 0,05^*$

In case of GV in children with signs of nephrosclerosis, the interleukin-10 and TGF-indices one year after surgery do not differ significantly compared to those before surgery. In patients without nephrosclerosis, interleukin - 10 values significantly decrease and approach the normative data ($p \leq 0.05$). The TGF-values also decrease significantly, but remain significantly higher than the normative indicators.

In RMU, attention is drawn to the high levels of TGF-- and interleukin - 10 both before and after the operation. After surgical correction, only interleukin-10 values significantly decrease in children with RMU without nephrosclerosis ($p \leq 0.05$), but remain much higher than the normative data.

5. DISCUSSION.

Reconstructive plastic surgery for congenital obstructive uropathies in children helps to restore urodynamics, reduce hydronephrotic transformation, grow and develop renal parenchyma from the affected side.

Comparison of the results of X-ray planimetric and Doppler studies with the data of histological examination proved: the less pronounced sclerosis, atrophy in the ureteral wall and dystrophy with focal necrosis of the renal parenchyma, the faster and better the recovery of urodynamics and function of the affected kidney in the postoperative period, due to normally formed nephrons.

The data of histological studies allow us to speak of the irreversibility of pathomorphological changes in the renal parenchyma, which arose as a result of a violation of the formation of a part of the nephrons in embryogenesis. When studying kidney biopsies in children with congenital obstructive uropathies, a dual effect of pathology was noted - interference with nephrogenesis and irreversible tubulointerstitial damage. Therefore, during static nephroscintigraphy, the determination of the integral capture of the DMSA radiopharmaceutical - Technetium-99m in the volume of viable renal tissue in dynamics before and after the operation did not reveal significant differences.

Consequently, after the restoration of urodynamics, the growth and development of the renal parenchyma according to ultrasound and X-ray planimetry results from unaffected or secondarily altered areas of normally formed nephrons.

TGF-B, which promotes interstitial fibrosis and is responsible for renal disorders, was found in children with severe sclerotic renal changes in all studied variants of obstructive uropathies. The presence of congenital dysplastic and atrophic changes in the kidney activates the increased secretion of TGF-even after elimination of uro-obstruction.

Restoration of urodynamics and complex therapy in children with CH and WMD without nephrosclerosis made it possible to arrest the inflammatory process in the kidneys and the upper urinary tract. This fact is confirmed by a significant decrease in the anti-inflammatory cytokine interleukin 10 and the approach of its values to the normative data. In RMU, VH, and WMD against the background of sclerotic and atrophic changes in the renal parenchyma, a high level of IL-10 confirms the assumption of a constantly ongoing inflammatory process.

6. CONCLUSIONS

. Thus, the morphological characteristics of changes in kidney biopsy specimens in children with congenital obstructive uropathies allows not only to draw a conclusion about the depth of preoperative structural abnormalities in the renal tissue, but also to predict the course of the postoperative period and the success of surgical treatment.

Static kidney scintigraphy with the determination of the integral uptake of the radiopharmaceutical DMSA - Technetium-99m in dynamics is a minimally invasive, reliable, reproducible and gentle method in relation to radiation exposure for the determination and dynamic control of the integral and local viability of the renal parenchyma. A decrease in this indicator less than 40 indicates a decrease in the volume of viable renal tissue.

An increase in interleukin-10 values in children with congenital OU is a criterion for predicting the development of chronic obstructive pyelonephritis, the severe forms of which predetermine the formation of nephrosclerosis and secondary renal wrinkling.

An increased level of urinary TGF β in patients with congenital obstructive uropathy is an indicator of dysplastic and nephrosclerotic renal changes. Indicators of transforming growth factor TGF β in urine in children with CH, WMD and RMU are prognostic markers of the development and progression of nephrosclerosis in congenital obstructive uropathies.