

Results of Endoscopic Correction of Refluxing Ureterovesical Segment Anomalies in Children

Rakhmatullaev Akmal Abadbekovich, Aliev Makhmud Muslimovich

Tashkent Pediatric Medical Institute

Republican Specialized Scientific and Practical Medical Center of Pediatrics

Abstract

The article presents the early and late postoperative outcomes of endoscopic transurethral correction of refluxive anomalies of ureterovesical segment (UVS) in 230 children aged from 3 months to 15 years. According to the research data, bolus methods of endoscopic correction of VUR can be used for all degrees of severity of refluxing UVS anomalies, and the degree of severity of urodynamic disorders and anatomical features of UVS anomalies should be taken into account when choosing STING, HIT 1 or HIT 2 methods.

Keywords: children refluxing ureteral anomalies, ureterovesical segment, transurethral correction.

At present, treatment of ureterovesical segment (UVS) anomalies in children remains one of the unresolved problems of pediatric surgery [Aliyev M.M., Rakhmatullaev A.A. et al. 2015, Zorkin S.N. 2001, Khoury AE. 2012, Jun Nyung Lee et al 2016].

These anomalies are based on disturbances in urothelial cell architectonics, hypertrophy, muscle hyperplasia, collagen hypertrophy of the submucosal layer or the entire ureteral wall thickness, hypertrophy of elastic fibers, pathology on the part of the urinary triangle, arterial vessels, and adventitia of submucosal veins [Aliyev M.M, Rakhmatullaev A.A. and others 2015, Brakeman P. 2008, Lee J.H., Son C.H., Lee M.S. et al. 2006, Ling Leung, Ivy Hau Yee Chan.

Due to the difficulty in determining the peculiarities of UVS function impairment, there is a real need to find criteria to reliably determine the degree of UVS safety and loss of UVS functions. Solution of these problems will allow to improve diagnostics of UVS anomalies and to objectify the choice of rational method of surgical treatment [Aliev M.M., Rakhmatullaev A.A. and others 2015, Zorkin S.N. 2001, Chertin B. et al. 2007.].

A number of studies have developed new methods of introducing a polymer under the ureteral orifice at

severe degrees of refluxing anomalies in children depending on the age-related peculiarities of the anomalies. [Aliev M.M., Rakhmatullaev A.A. 2015, Aubert D. 2010, Chertin B. 2007, Ling Leung, Ivy Hau Yee Chan. 2017, Te-Lu Yap, Yong Chen. 2016r].

Thus, improvement of the results of surgical treatment of patients with refluxing UVS anomalies by developing modern methods of treatment of this pathology with the use of endoscopic techniques is one of the actual directions.

To study the results of endoscopic transurethral correction of refluxing UVS anomalies in children.

Material and methods. We examined 230 children with refluxing abnormalities of UVS, who were hospitalized in the surgical departments of the Republican Specialized Scientific-Practical Medical Center of Pediatrics and the clinic of the Tashkent Pediatric Medical Institute. Patients are aged between 3 months and 15 years. Postoperative stay of patients in the hospital averaged 1.93 ± 0.32 days.

Endoscopic transurethral correction of refluxing anomalies (RA) of UVS was carried out at all three severity degrees: mild, moderate and severe according to the research algorithm developed by us (Table 1).

Table 1

Endoscopic interventions performed

In children with refluxing anomalies of UVS

Grade of severity of RA UVS	Endoscopic treatment methods			Total
	STING	HIT I	HIT II	
Light	24 (35)	-	-	24 (35)
medium	84 (122)	29 (37)	12 (13)	125 (172)
Severe	21 (30)	16 (19)	44 (46)	81 (95)
Total	129 (187)	45 (56)	56 (59)	230 (302)

Note: The number of ureterns is indicated in parentheses.

Patients were prescribed with a recommendation for an abundant drinking regimen and uroseptic intake. Dynamics of bowel and ureter emptying

was assessed under the control of ultrasound, which was carried out one month after the correction. Repeated hospitalization was carried out after 3-6

months, depending on the preservation or management of clinical signs of the disease. To evaluate the effectiveness of the correction method, excretory urography and voiding cystography were used.

Results and discussion. During the diagnostic cystoscopy with profile pressure measurement of UVS in patients with RA, special attention was paid to the

position and shape of ureteral orifices, the degree of ureteral dilation and ureteral vision, length, tone and wall thickness of ureteral submucosal areas. The analysis of the frequency of various forms of ureteral orifices, depending on the degree of reflux, has shown that the slit-shaped and horseshoe-shaped forms are inherent in light degrees of reflux, and the oval, funnel-shaped and star-shaped forms are more typical for severe degrees of reflux.

Table 2

Pathogenetic criteria for assessing the severity of UVS antireflux mechanism disorders

Criteria DAM		Option (scores)		
		0	1	2
1	Location	trigonal	lateralization	Caudal, cranial ectopia
2	Configuration	Slit-shaped.	Horseshoe, oval.	Funnel-shaped, stellar
3	Shortening the submucosal part of the ureter	Up to 25%	25-50 %.	More 50%
4	Decrease of pressure gradient in UVS*	Up to 25%	25-50 %.	50-100%
5	Hydro dilation	H0, H1	H2	H3
6	By the nature of the condition of the bladder mucosa	Normal or slightly hyperemic	Subatrophy and atrophy	Bullseed or trabecular changes

(*-decrease relative to the age norm)

The analysis of the factors influencing ureteral antireflux protection allowed to specify their role in the pathogenesis of VUR and to develop objective criteria for evaluating the degree of severity of disturbance of antireflux mechanism (DAM) UVS in

scores. According to the sum of the folded scores, the following degrees of DAM of UVS can be distinguished, which can be used in the choice of treatment method and analysis of treatment results: moderate (I), corresponding to 0-4 scores, medium (II)

- 5-8 scores, severe (III) - 9-12 scores (Table 2).

A study of the dependence of the degree of VUR on the severity of the submucosal ureter's UVS showed a strong positive correlation ($r=0,84$). Thus, the first degree of VUR corresponded to the mild degree of DAM, the second and third degrees of VUR - to the light and medium degrees of DAM, the fourth degree of VUR - to both the medium and heavy degrees of DAM, the fifth degree of VUR - to the severe degree of DAM. The developed UVS criteria reflect the severity of the pathology and can be used to select the treatment method and evaluate the results.

In the initial stages of the study, for all degrees of severity RA UVS were

used using the STING method, which, as experience has shown, does not always provide a positive result, especially in the medium and severe degree of VUR. Later, at the average and severe degrees of RA UVS endoscopic correction was carried out using the HIT I and HIT II methods.

The results of our studies have shown that in 23% of cases in the nearest postoperative period the increased transient complications (exacerbation of cystitis and pyelonephritis, dysuria) were eliminated by conservative measures with the use of antibiotics of a wide spectrum of action (cephalosporins of II and III generations) and uroseptics (kanefron, tutukon), as well as selective antispasmodics (Oxybutynin), effectively relaxing detrusors. (Table 3).

Table 3

Complications of the nearest period after endoscopic correction at refluxing UVS anomaly

Endoscopic correction methods	Types of complications		
	Leukocyturia (in sight)	Proteinuria (g/l)	Dysuria
STING n=24	15,3±0,75	0,18±0,9	7 (33,3%)
HIT I n=14	27,1±0,69	0,05±0,1	8 (33,3%)
HIT II n=12	28,3±0,52	0,07±0,07	4 (50%)

Note: $P<0.05$.

As it can be seen from Table 3, the most frequently observed complications of the nearest postoperative period are exacerbation of pyelonephritis and cystitis in HIT I and HIT II with hydrodilation. These complications were observed at the early stages of mastering the technique, before the introduction of long-term preoperative treatment with broad-spectrum antibiotics (up to 2 weeks) and diuretic therapy (within 3-5 days).

In 3-6 months after correction by the STING method all 129 patients (187 ureteri) underwent excretory urography and a mix cystogram. The excretory urography did not show enlargement of upper urinary tract (UUT) in all patients. In 148 (79%) cases, the results were positive for mild and moderate RA UVS in the case of mix cystography. On 31 (16,7%) ureter the reduction of reflux severity by 1 degree on the average was registered, in 8 (4,3%) - without changes, i.e. the degree of reflux remained unchanged.

When evaluating the results of HIT 1 correction in 3-6 months after the average RA treatment, in all 45 patients (56 ureters) the excretory urography did not show UUT expansion. On 47 (83,9%)

ureters the positive result was registered, on 6 (10,7%) the decrease of reflux degree on 1-2 degrees, on 3 (5,4%) - without changes, i.e. the degree of reflux remained.

The best results of endoscopic correction of RA were achieved during HIT II operation in patients with moderate and severe degree. Positive results in the terms of 3-6 months after the intervention were marked on 52 (88,1%) ureter, on 5 (8,4%) - reduction of reflux degree only on one degree, in 2 (3,9%) observations the severe degree of reflux remained.

Urodynamic characteristics of positive results after endoscopic correction of RA UVS during 3-6 months indicated a clear dependence of treatment results on the method of bolus formation in the area of UVS: in case of mild RA severity the method of STING was effective, in case of moderate RA severity - HIT I and in case of severe RA - HIT II (Table 4). Thus, Doppler evaluation of uretero-bladder urine ejection showed almost the same characteristics. Only 2 children after HIT I and 3 patients after HIT II had urine diversion.

Table 4

Urodynamic characteristics of the results of endoscopic correction of UVS refluxing anomalies

Endoscopic correction methods	Number of ureters	Doppler of ureteral discharge			Transformational echopyeloscopy		
		Emission frequency in min..	T _c (sec)	V _{max} (M/s)	T _{max} (min)	P _{max} (%)	T _i (min)
STING	187	2,3±0,47	1,45±0,17	0,34±0,04	9,3±0,67	29,6±0,37	34,4±0,89
HIT 1	56	2,5±0,36	1,37±0,2	0,33±0,02	8,6±0,75	26,5±0,87	31,2±0,78
HIT 2	59	2,6±0,27	1,28±0,16	0,36±0,04	7,4±0,34	28,7±0,47	37,6±0,69

Note: T_c - time of duration of one urine release; V_{max} - maximum urine release rate; T_{max} - time of reaching the maximum expansion of the PLC (min); P_{max} - maximum expansion of the PLC (%); T_i - time of return (reduction time) of the PLC size to the initial values (min); - P<0.01

The analysis of transformational echopyeloscopy has shown that the UUT expansion is not expressed after correction of VUR by STING and HIT 1. Maximal expansion of the distal ureteral region (25-30%) was observed by 7-10 minutes of the study from the initial sizes and restoration of the initial sizes occurred by 30-40 minutes. In the long term, ureteral dilation did not exceed 1.0 cm in diameter, which indicated adequate permeability of UVS.

Secondary VUR of II-IV degree, caused by anomalies of UVS development, after endoscopic correction (302 ureters) was diagnosed in 47 observations (15,6%). At control cystoscopy insufficiency of UVS was revealed, decrease of profile pressure

gradient up to 40-50%. 34 (11,3%) VUR recurrence occurred after STING correction, which was caused by the paste evacuation until the end of its encapsulation and displacement of the formed bolus.

The reason for 8 (2,6%) recurrences of VUR of III degree after HIT I correction was insufficient introduction of the generating substance which did not provide tight closure of ureteral mouth.

The cause of 5 (1,6%) VUR recurrences after HIT II correction was swelling of the ureteral mucosa and bladder, which resulted in the evacuation of the paste until the end of its encapsulation.

At endoscopic correction of VUR in patients with severe structural-anatomical abnormalities of UVS, such as severe lateralization or ectopy of the ureter's estuary, extravescicalization of the ureter's estuary, absence of the submucosal ureter's estuary, there were certain difficulties in the precise placement of the implant, which caused a recurrence of VUR. Six patients underwent frequent exacerbations of pyelonephritis and were operated on 6 months after the initial correction. The remaining 41 patients were operated on again in the period from 12 to 48 months. After 2 and 3 attempts of repeated endoscopic intervention according to HIT II it was not possible to change the configuration of UVS on 6 ureteri and the patients were subjected to open surgical correction: 4 - Politano-Leadbetter and 2 - Lich-Gregoir surgeries. One VUR relapse after Politano-Leadbetter operation and 1 VUR relapse after Lich-Gregoir operation were eliminated by endoscopic correction.

Conclusions. The results of the carried out researches have shown that at all degrees of refluxive anomalies severity the bolus methods of endoscopic correction of UVS can be used and for a choice of methods STING, HIT 1 or HIT 2 it is necessary to take into account a degree of severity of disturbances of

urodynamics and anatomical features of anomalies of UVS.

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