



Comparison of early surgical and conservative therapy in children with ureteropelvic junction obstruction

Mahgol Sadghian¹ · Seyed Abdollah Mousavi² · Seyed Mohammad Abedi³ · Mahboubeh JafariSarouei² · Maedeh Gooran¹ · Paniz Balmeh¹ · Hamid Mohammadjafari²

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Abstract

Background Ureteropelvic junction obstruction is a relatively common urologic problem in children. Most cases present with pelvicalyceal dilatation in antenatal period. Historically most UPJO cases were treated with surgical procedures, but recently many of these children have been treated by nonsurgical observational plans. We compared the outcome of children with UPJO treated in surgical and observational ways.

Methods In a retrospective study, we assessed the medical history of patients diagnosed as UPJO, march 2011 to march 2021. The case definition was based on grade 3-4 hydronephrosis and obstructive pattern in dynamic renal isotopes scan. Patients were put into two groups; Group 1 children were treated with a surgical procedure, and group 2 patients without any surgical procedure for at least a six months' period after diagnosis. We assessed long-term events and improvement of obstruction.

Results Seventy-eight children (mean age 7.32mo., 80% male) enrolled in the study, 55 patients in group one and 23 as group 2. Severe hydronephrosis was the problem of 96% of all patients significantly led to 20% in group 1 and 9% in group 2 ($P < 0.001$). Severe kidney involvement was observed at 91% in group 1 and 83% in group 2, decreased to 15% and 6%, respectively ($P < 0.001$). There were no significant differences in sonographic and functional improvement between the two intervention groups. Long-term prognostic issues; growth, functional impairment, and hypertension were not different between the two groups, but group 1 children experienced more recurrence of UTI than group 2 patients.

Conclusion Conservative management is as effective as early surgical treatment in the management of infants with severe UPJO.

Keywords Ureteropelvic junction obstruction · UPJO · Hydronephrosis

Introduction

Ureteropelvic junction obstruction is a relatively common urologic problem in children [1]. Intrinsic congenital stenosis is the standard feature in pediatrics, but extrinsic compression is observed in some cases [2].

Most cases present with pelvicalyceal dilatation in the antenatal period. Approximately 1–2% of pregnant women have fetuses with mild to severe hydronephrosis [2]. Approximately 50% of antenatal hydronephrosis (AH) resolves spontaneously during the prenatal or early postnatal period; this condition is referred to as transient hydronephrosis [3]. Another persistent hydronephrosis may be caused by obstructive and nonobstructive entities such as ureteropelvic junction obstruction (UPJO), ureterovesical junction obstruction (UVJO), vesicoureteral reflux (VUR), posterior urethral valve (PUV), and some less common congenital anomalies. UPJO is the most common congenital anomaly of the kidney and urinary tract (CAKUT), presenting as antenatal hydronephrosis [1, 4]. Postnatal UPJO manifests as infection, pain, hematuria, hypertension, mass palpation, and renal damage [5].

✉ Hamid Mohammadjafari
hamidmjaafari@yahoo.com

¹ Department of Pediatrics, Mazandaran University of Medical Sciences, Sari, Iran

² Pediatric Infectious Diseases Research Center, Communicable Diseases Institute, Mazandaran University of Medical Sciences, Sari, Iran

³ Department of Radiology and Nuclear Medicine, Mazandaran University of Medical Sciences, Sari, Iran

UPJO diagnosis requires imaging studies. On ultrasound, UPJO is characterized by moderate to severe pelvicalyceal dilatation without ureteral or bladder changes [2]. The diagnosis is confirmed by dynamic studies that are functional isotope scans, such as mercaptoacetyltriglycine (MAG3) or diethylenetriamine pentaacetate (DTPA) and magnetic resonance urography (MRU). Delayed isotope washout indicates obstruction on an isotope scan, but cortical uptake and differential renal function are crucial in determining a treatment plan [6, 7].

Historically, most UPJO cases are treated with surgical procedures, but recently many of these children have been treated by nonsurgical observational plans [8]. In the present study, we compared the outcomes of surgical and observational treatment for UPJO in children.

Material and methods

In a retrospective study, we evaluated the medical history of patients diagnosed with UPJO at our tertiary care hospital in the north of Iran, Avesina hospital. The study period was from March 2011 to March 2021.

The inclusion criteria included patients diagnosed with UPJO under 18 years old. The clinical complaint of obstructive process or, more commonly, ultrasonographic findings on prenatal studies suggested the diagnosis. Moderate or severe hydronephrosis as grade 3 or 4 according to the Society for Fetal Urology (SFU) classification or anteroposterior pelvic diameter greater than 15 mm in prenatal or postnatal studies indicated a significant obstructive process. We defined UPJO as a significant delay in the excretion of isotope dye with a half-time greater than 20 min following furosemide injection in dynamic renal scintigraphy (DTPA or EC scan).

We performed conventional or isotope cystography to diagnose accompanied vesicoureteral reflux. Children with vesicoureteral reflux, neurogenic bladder, dysplastic kidney, and those with interrupted follow-up were excluded from the study. The proposed treatment plan was based on clinical and imaging findings. Clinically, we performed pyeloplasty on children with recurrent and severe obstruction symptoms, palpable abdominal mass, and a single functional kidney.

A severely obstructed kidney with diminished renal function on initial cortical uptake or less than 40% split function necessitates an immediate surgical intervention. In some children, however, surgery was delayed or canceled due to cultural or economic factors. We evaluated the long-term prognosis of patients who underwent surgically indicated treatment versus those for unsuccessful surgical treatment.

In a retrospective study, all children with UPJO who required surgery were enrolled in the study based on any of the above indications. Patients were placed into two separate

groups. Group one consisted of children who underwent a surgical procedure, while group two comprised patients who did not undergo surgery for at least six months after their diagnosis.

Recurrent UTI, hypertension, renal failure, death, and improvement of sonographic and scintigraphy findings were defined as long-term outcomes. Recurrent UTI was defined as three or more episodes of proven UTI and hypertension as systolic or diastolic blood pressure of more than 95th centile of blood pressure on at least two separate measurements. A glomerular filtration rate of less than 60 ml/min/1.73 m² was the cut-off for renal failure. The improvement in the imaging study was classified as worsening, no change, relative (equal or less than 50%) improvement, and complete (more than 50%) improvement.

Results

The retrospective study was approved by the Mazandaran University of medical sciences with an ethical code of IR.MAZUMS.REC.1398.1405.

Seventy-eight children with a diagnosis of UPJO enrolled in the study. The mean age of patients was 7.32 months, of which 80% were male. Group one comprised 55 patients treated with a standard surgical procedure within six months of diagnosis. Group 2 comprised 23 patients who had not undergone surgery within six months of their diagnosis. There were no significant differences between the two groups for age and gender (Table 1).

Table 2 shows the presentation of the disease; most patients in both groups were diagnosed with antenatal hydronephrosis. Sonography of the kidneys and urinary tract revealed that nearly all patients had grade 4 severe hydronephrosis, as classified by the SFU (Table 3). More than 80% of both groups' patients with obstruction and impaired kidney function were revealed by dynamic isotope studies (Table 4).

All patients in group one were treated with surgical pyeloplasty at a mean age of 10 months. Twenty-three children were not operated on surgically, and the clinical and Para clinical data for group 2 were evaluated and analyzed. Long-term clinical and imaging studies performed at a mean time of 57 months after diagnosis were documented (Tables 3 and 4).

The impact of treatment strategies on sonographic and functional items is shown in Tables 3 and 4. As revealed, both surgical and conservative treatment lead to significant improvement in anatomical and functional indices. Severe hydronephrosis was a problem for 96% of all patients, with 53(96%) in group 1 and 22 (96%) in group 2 ($P < 0.001$). Severe kidney involvement as delayed function and wash-out was observed in 91% of group 1 and 83% of group

Table 1 Some basic and demographic characteristics of two groups of patients with UPJO

Items		Group 1	Group 2	Total	<i>P</i> value
Sex	Male (%)	44 (80)	18 (78)	62 (80)	0.86*
	Female (%)	11(20)	5 (22)	16 (20)	
Age at diagnosis (months) Median(25–75percentile)		2(2–4)	3 (2–5)	3 (2–4)	0.096**
Birth weight (kg) mean ± SD		3.26 ± 0.47	3.37 ± 0.37	3.30 ± 0.44	0.324***
Height Z score at diagnosis median(25–75percentile)		0.44 (– 0.90–0.90)	0.62 (– 0.56–1.28)	0.46 (– 0.69–1.01)	0.109**
Involved kidneys	Right (%)	23 (42)	9 (39)	32 (41)	0.368*
	Left (%)	28 (51)	14 (61)	42 (54)	
	Both (%)	4 (7)	0	4 (5)	
Duration of follow-up (months) median(25–75percentile)		65 (24–87)	36 (17–82)	60 (24–83)	0.802**

* Chi-square

**Independent sample *T* test

***Mann–Whitney

Table 2 Presentation of two groups of patients with UPJO

Presentation	Group 1	Group 2	All patients
Antenatal hydronephrosis	49 (89)	22 (96)	71 (91)
Urinary tract infection	2 (4)	0	2 (3)
Pain	1 (2)	1 (4)	2 (3)
Accidental (asymptomatic)	3 (6)	0	3 (4)

2 before surgical or conservative therapy, respectively ($P < 0.001$). There were no significant sonographic or functional improvement differences between the two intervention groups.

The reduction in the severity of kidney involvement in imaging studies is shown in Table 5. Both treatment strategies led to significant improvement, but no significant difference existed between the two groups. There was no significant relation between pelvic AP diameter and rate of improvement in sonographic severity ($P = 0.22$ for group 1

and $P = 0.77$ for group 2). In the same manner, there was no significant relation between pelvic AP diameter and rate of improvement in isotop scan findings ($P = 0.32$ for group 1 and $P = 0.99$ for group 2). Table 6 presents some long-term prognostic issues, including growth, infection, functional impairment, and hypertension. The only difference was the rate of UTI recurrence; children treated surgically had a higher rate of UTI recurrence than group 2 patients. Other items exhibited no significant differences.

Discussion

The decision to treat high ureteral obstruction can be difficult at times. Is there a pressing need to remove the impediment? Could we offer a delay in the hope that the problem will be resolved spontaneously? Although it is unethical to postpone standard treatment, we examined retrospective data from patients who did not follow our recommendations for

Table 3 Basic and follow-up the severity of hydronephrosis on sonography of two groups of patients with UPJO

Classification	Severity	Group 1	Group 2	Total	<i>P</i> value	
SFU	Grade of hydronephrosis on Kidney ultrasound at diagnosis	Grade 2	1 (2)	0	1 (1)	0.662*
		Grade 3	1 (2)	1 (4)	2 (3)	
		Grade 4	53 (96)	22 (96)	75 (96)	
	Grade of hydronephrosis on Kidney ultrasound after six months of surgery or conservative therapy	normal	2 (4)	0	2 (3)	0.446*
		Grade 1	12 (22)	6 (26)	18 (23)	
		Grade 2	13 (24)	8 (35)	21 (27)	
		Grade 3	14 (26)	7 (30)	21 (27)	
		Grade 4	13 (24)	2 (9)	15 (20)	
		<i>P</i> value	<0.001	<0.001	<0.001	
	APD diameter (mm) median(25–75percentile)	At diagnosis	27 (23–35)	21 (18–26)	26 (21–33)	0.001**
after surgery or conservative therapy		12 (9–19)	11 (9–14)	12 (9–16)	0.124**	
<i>P</i> value		<0.001	<0.001	<0.001		

* ANOVA

**Mann–Whitney

Table 4 Basic and follow-up the severity of kidney obstruction and function on isotop scanning of two groups of patients with UPJO

		Group 1	Group 2	Total	P value
Severity of kidney involvement at diagnosis	Obstruction + good func	5(9)	4 (17)	9 (12)	0.295*
	Obstruction + Low func	50 (91)	19 (83)	69 (88)	
Severity of kidney involvement after six months of surgery or conservative therapy	Normal	13 (38)	7 (44)	20 (38)	0.432**
	Stasis	13 (38)	5 (31)	18 (36)	
	Obstruction + good func	3 (9)	3 (19)	6 (12)	
	Obstruction + Low func	5 (15)	1 (6)	6 (12)	
P value		<0.001	0.001	<0.001	
Split cortical uptake (%) median(25-75percentile)	At diagnosis	39 (32–42)	40 (38–43)	39 (36–42)	0.113***
Split cortical uptake (%) median(25-75percentile)	After surgery or conservative therapy	45 (33–48)	49 (47–52)	47 (42–49)	0.769***
P value		<0.001	0.001	<0.001	

*Chi-square

**ANOVA

***Mann–Whitney

Table 5 Reduction in grade of hydronephrosis and kidney involvement after surgery or conservative therapy

	Group 1	Group 2	Total	P value
Reduction in grade of sonography (SFU)	1.22 ± 1.10	1.32 ± 1.05	1.26 ± 1.08	0.61*
Reduction in grade of renal involvement on DTPA	2.57 ± 0.79	2.53 ± 1.07	2.56 ± 0.89	0.69*

*Independent sample T test

Table 6 Some prognostic data of two groups of patients with UPJO

	Group 1	Group 2	Total	P value
Height Z score [Median (25-75 percentile)]	0.43 (– 0.73–1.11)	0.56 (– 1.20–1.42)	0.48 (– 0.88–1.11)	0.225*
BUN (mg/dl) Mean ± SD	21.4 ± 9.1	23.7 ± 14.3	22.0 ± 10.7	0.830**
Cr (mg/dl) Mean SD	0.61 ± 0.13	0.60 ± 0.16	0.61 ± 0.14	0.532**
Hgb (g/dl) [Median (25-75percentile)]	11.87 (11.0–12.9)	10.8 (9.9–12.2)	11.7 (10.8–12.7)	0.194*
Renal failure , No(%)	4 (7)	1 (4)	5 (6)	0.631***
Hypertension , No(%)	1 (2)	1 (6)	2 (3)	0.47***
UTI, No(%)	21 (38)	5 (22)	26 (33)	0.160***
Recurrent UTI , No(%)	10 (19)	0	10 (13)	0.025***

*Mann–Whitney

**Independent sample T test

*** Chi-square

surgical treatment of severe obstruction. We show that conservative therapy, like surgical intervention, significantly improves anatomically and functional obstruction.

Pyeloplasty had dramatic results in any way. Chen analyzed retrospectively the clinical data of 122 young children with UPJO who underwent laparoscopic surgery ($n = 69$) or open surgery ($n = 53$). Laparoscopic disconnected pyeloplasty was 100% successful, and none of the patients required open surgery. The one-year follow-up revealed that the anterior and posterior diameters and the

glomerular filtration rate improved significantly from the preoperative period [9].

Silay compared 53 patients with UPJO treated with laparoscopic pyeloplasty ($n=27$) and robotic-assisted pyeloplasty ($n=26$) in a randomized controlled study. The preoperative pelvic diameter in the LP group was 18.33 ± 10.60 mm; in the Robotic-Assisted Laparoscopic Prostatectomy (RALP) group, it was 15.00 ± 7.31 mm. The respective postoperative pelvic diameters were 15.11 ± 9.88 mm and 11.24 ± 5.23 mm. The difference between preoperative and postoperative diameter was statistically significant in both groups. However, the two groups did not differ in preoperative and postoperative pelvic diameters [10].

Jenjitrant retrospectively reviewed 28 children with open-dismembered pyeloplasty ultrasound examinations that showed a diminished grade of HN and a decreased AP diameter of the renal pelvis. The overall success rate was 93.5% [11].

We performed open pyeloplasty on 55 children; 91% had a severe obstruction and diminished function. After surgery, only 15% of patients were found to have severe obstruction. This indicates that the surgical method is significantly beneficial. However, the crucial question is, is it the only and inevitable treatment?

In a retrospective study, Arena assessed 38 patients affected by unilateral UPJO with good DRF and poor drainage. Surgical pyeloplasty was performed for 13, and 25 patients were followed conservatively. Overall, 63.2% of grade 3 and 33.3% of patients with grade 4 hydronephrosis did not require surgery and were treated conservatively, without loss of DRF or onset of symptoms related to UPJO. There was a significant relationship between the initial grade of hydronephrosis and the possibility of efficient, conservative management [12].

Koc retrospectively compared the surgical and nonsurgical follow-up results of ureteropelvic junction obstruction without diuretic response. Twenty-nine children were enrolled in the study, 11 received surgical treatment, and 18 were followed conservatively. During the period of follow-up, all surgical patients achieved total recovery. Furthermore, 39% of the patients in the follow-up group recovered, five had stable disease, and six had additional pathologies. The study concluded that in the absence of UPJO, surgery is the preferred treatment option [13].

Bajpai followed 16 patients (32 kidneys) with prenatally diagnosed moderate to severe bilateral hydronephrosis non-operatively. Pyeloplasty was only performed when there was evidence of function deterioration, and only unilateral surgery was performed when required. Four kidneys (12.5%) required pyeloplasty during a mean follow-up of 36 months. The final half-time was less than 20 min, and hydronephrosis resolved or improved in 78% of those

observed non-operatively. The study concluded that initial non-operative observation appears safe in all cases of moderate to severe bilateral neonatal hydronephrosis [14].

Vemulakondain published a PURSUIT network study of clinical outcomes and established best practices for congenital anomalies of the kidney and urinary tract (CAKUT). Patients ($n=197$) with isolated unilateral SFU grade 3–4 hydronephrosis and no ureteral dilation on initial postnatal US imaging were evaluated. Overall, 19.3% underwent pyeloplasty. Imaging studies showed that 37% of infants with pyeloplasty and 51% without surgery exhibited improvement in ultra-sonographic findings; the improvement rate in the MAG3 study was 43–58% for pyeloplasty and non-surgery groups, respectively. The lower response was due to a higher level of obstruction in pyeloplasty patients. This study compared two dissimilar groups; infants with severe obstruction were treated surgically [15].

Although some similarities were observed, our research methodology differed from these works. We evaluated kidneys with severe obstruction and a clinical indication for surgical intervention. To this end, two recent studies had comparable subjects.

In an interventional study, Tabari considered 56 asymptomatic infants with grade 3–4 hydronephroses and more than 40% split renal function determined by the renal functional scan. They defined two separate groups based on consulting parents. Group 1 consisted of infants who opted for early pyeloplasty, while group 2 received only conservative treatment. Late pyeloplasty was performed on five patients of two groups during follow-up. Both groups showed a significant improvement in SFU scores and APD one year after the start of management. At six months, the ESP group had a significantly lower SFU score than the CM group, but this difference was not observed at 12 months for APD [16].

Deng analyzed two groups of 80 asymptomatic infants less than two months of age with UPJO-induced severe hydronephrosis: early surgical treatment (EST) and conservative treatment (CT). SFU grade of hydronephrosis decreased from 4 in both groups to a mean of 2.02 in the EST group and 2.88 in the CT group; differential renal function increased from 35 to 47% in the EST group and from 37 to 43% in the CT group, with statistically significant differences. The study concluded that EST hastens the recovery of renal morphological and functional indices in neonates and infants with severe hydronephrosis [17].

Similar to Tabari, we observed no discernible distinction between the two policies. An early surgical approach to UPJO is an attractive option for the stressful conditions of the first month. Is there any risk of deteriorating function and drainage of the kidney? We demonstrate that conservative treatment does not impair the functional and anatomical integrity of the kidney. During the first six months following

a diagnosis, the conservative treatment also significantly improves compared to surgical treatment. The finding provides helpful information for the first few months following a diagnosis. As UPJO tends to improve on its own, at least during the first year of life, early surgical treatment may be ineffective. Our findings indicate that delaying EST for six months is reasonable. The delay period should be shorter to aid in selecting a more appropriate and less aggressive therapeutic strategy.

Our study was limited by the fact that we could not ethically recommend CM to patients with surgical indications. Therefore, we only followed patients with a different decision; we were unable to match cases. Obviously, the two groups shared similar demographics and backgrounds.

Conclusion

This study demonstrated that conservative management of infants with severe UPJO is as effective as early surgical treatment.

Authors' contributions MS, HM, MA and SAM have given substantial contributions to the conception or the design of the manuscript. MJ, MG and PB to acquisition, analysis and interpretation of the data. All authors have participated in drafting the manuscript, HM revised it critically. All authors read and approved the final version of the manuscript.

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Declarations

Conflict of interest The authors declare no competing interests. The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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