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Original Research Article

Long term outcomes following pyeloplasty for unilateral pelviureteric junction obstruction in paediatric patients

Anusiri Inugala*

Department of of Pediatric Surgery, Niloufer Institute of Women and Child Health, Hyderabad, Telangana, India

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***Correspondence:**
Dr. Anusiri Inugala,
E-mail: anusirireddy@gmail.com

ABSTRACT

Background: Pelviureteric junction obstruction (PUJO) is the most common cause of pediatric hydronephrosis. The gold standard treatment for PUJO is Anderson hynes (AH) dismembered pyeloplasty. The parameters to assess the post-operative outcomes of pyeloplasty include reduction in the AP diameter of the pelvis and increase in parenchymal thickness. The aim of the study was to find out the long-term outcomes following pyeloplasty for Ureteropelvic junction obstruction (UPJO) in paediatric patients.
Methods: A prospective study was done from September, 2014 to January, 2019. All children above the age of 2 months who presented with unilateral PUJO were included in the study. All patients underwent ultrasound of the kidneys and diuretic renogram. All patients underwent AH dismembered pyeloplasty. Success was defined as both symptomatic relief and radiographic resolution of obstruction at the last follow-up visit.
Results: 60 patients with unilateral intrinsic PUJO were included in this study. Post-operatively split renal function (SRF) improved in 42 patients, remained stable in 13, and deteriorated in 5 cases. Post-operative renal drainage improved in 40 patients, remained stable in 15 and deteriorated in 5. The degree of hydronephrosis deteriorated in 5 cases but improved or was preserved in 55 cases. The renal parenchyma deteriorated in 7 cases. Overall success rate of AH dismembered pyeloplasty was 92%.
Conclusions: Dismembered pyeloplasty is a safe and effective treatment of PUJO in the pediatric population. Majority of the patients had an improved split renal function, renal drainage, cortical thickness, and decreased degree of hydronephrosis.

Keywords: Pelviureteric junction obstruction, Hydronephrosis, Anderson hyne's dismembered pyeloplasty, Diuretic renogram

INTRODUCTION

Pelviureteric junction obstruction (PUJO) is the most common cause of hydronephrosis in children, with an incidence of 1 per 1,000-2,000 newborns. Widespread use of antenatal ultrasonography and the advent of modern imaging techniques have resulted in earlier and more common diagnosis of hydronephrosis.[1,2] Prenatal diagnosis of hydronephrosis as a result of regular use of fetal ultrasound has become more common. Hydronephrosis is the most common sonographically observed fetal pathology, detected in 0.2-0.5% of fetuses, and can be diagnosed as early as 12-14 weeks of gestation. The most common presentation in other age groups is abdominal pain. It is not uncommon to see a patient who is asymptomatic, detected incidentally, with significant renal damage or a non-functioning kidney. The obstruction is usually functional and the bolus of urine is not effectively propelled across the pelviureteric junction.[3] Anderson hynes (AH) dismembered pyeloplasty is the gold standard surgical treatment for PUJO. The goal of pyeloplasty is to achieve a dependent, tension free,

anastomosis with good vascularity, which leads to the relief of the obstruction and is also helps in improving function of the kidney.[4]

There are certain parameters to assess the post-operative outcomes of pyeloplasty. The ultrasound parameters are the reduction in the AP diameter of the pelvis, calyceal diameters and increase in parenchyma thickness in a growing kidney. The definitive evidence of improved function is shown by an isotope renogram in the follow up period. It is useful to look for an objective improvement in GFR (Glomerular filtration rate) and the radiotracer clearance from the PCS (Pelvicalyceal system).

The aim of the study was to find out the postoperative long-term outcomes following pyeloplasty for unilateral pelviureteric junction obstruction in paediatric patients.

METHODS

A prospective study was done over a period of five years from September, 2014 to January, 2019 at Niloufer Institute for Women and Child Health, Hyderabad, Telangana, India. All children above the age of 2 months who presented to our department with unilateral pelviureteric junction obstruction were included in the study. Children with bilateral pelviureteric junction obstruction, children with associated other renal anomalies such as intra renal pelvis, duplex system, horseshoe kidney, solitary kidney, recurrent PUJO were excluded. Approval was taken from the Institutional Ethics Committee prior to starting the study.

Non-probability sampling method of convenience sampling was used to include the patients in the study. 60 patients with unilateral pelviureteric junction obstruction were included in this study. 50 were male and 10 were female. The age of the patients ranged from 2 months to 8 years. The patients' histories were taken and physical examination done. Blood investigations done included haemoglobin, blood urea and creatinine. Complete urine examination and urine culture and sensitivity were done. Ultrasound of the kidneys was done to see the anteroposterior diameter of the renal pelvis and the cortical thickness; and the ureter. Voiding cystourethrogram was done to rule out vesicoureteral reflux. Diuretic renogram with DTPA was done to look for the function and drainage pattern of the kidneys. All patients underwent AH dismembered pyeloplasty.

The patients were followed up clinically and radiologically at regular intervals. Follow-up examinations included serial ultrasound and diuretic renography for the assessment of both the morphological and functional outcome. Success was defined as both symptomatic relief and radiographic resolution of obstruction at the last follow-up visit. Six months post-operatively the patients were evaluated with an ultrasound of the kidneys to look for changes in AP diameter and cortical thickness and a diuretic renogram to look for the improvement in drainage and function.

Drainage was classified as good if T1/2 was <20 min; fair if T1/2 was >20 min and the drainage curve was descending; or poor if T1/2 could not be counted and there was an increasing drainage curve. Kidney function was classified as good when SRF (split renal function) was ≥40%, or poor when it was <40%. A reduction of SRF of more than 5% of the previous value was considered as deterioration, an increase of more than 5% was defined as improvement, and changes within 5% were considered as preservation. The degree of hydronephrosis was classified according to the classification of the Society for Fetal Urology (SFU), with grade 0- indicating a normal kidney with an intact renal sinus, grade 1- indicating a slightly dilated renal pelvis without caliectasis, grade 2- indicating a moderately dilated renal pelvis with mild caliectasis, grade 3- indicating a large renal pelvis and dilated calyces, and grade 4- indicating a large renal pelvis with large dilated calyces. An improvement of hydronephrosis was defined as a reduction by at least 1 SFU grade.

Statistical analysis was done using Microsoft excel and SPSS software.

RESULTS

60 patients with unilateral intrinsic pelviureteric junction obstruction were included in this study. There were 50 male and 10 female patients. The age of the patients ranged from 2 months to 8 years (Table 1). 27 patients had right sided and 33 had left sided pelviureteric junction obstruction. Sixteen patients presented with urinary tract infections, 11 presented with an abdominal mass, 35 patients presented with fever, 4 presented with pain abdomen. 31 patients were antenatally detected to have hydronephrosis. All cases underwent AH dismembered pyeloplasty.

Post-operative changes in ultrasound and diuretic renogram are mentioned in Table 2. According to the findings on renography, postoperative SRF improved in 42 patients (70%), remained stable in 13 (21.7%), and deteriorated in 5 cases (8.3%). Post-operative renal drainage improved in 40 patients (66.7%), remained stable in 15 (25%) and deteriorated in 5 (8.3%). The degree of hydronephrosis deteriorated in 5 (8.3%) cases but improved or was preserved in 55 (91.7%) cases. The renal parenchyma deteriorated in 7 (11.7%) cases. Overall success rate of AH dismembered pyeloplasty was 92%. Redo pyeloplasty was done in 5 patients.

When studying the effects of the patient's age, the affected side, clinical presentation, ultrasound findings and pre-operative SRF on the functional outcome of dismembered pyeloplasty, no statistically significant correlation (p value>0.05) was found between these factors and the success of pyeloplasty (Table 3).

Table 1: Age distribution.

Age (years)	Number of patients (n=60)	
	N	Percentage
0-1	43	72
1-2	4	7
2-3	7	11
3-8	6	10

Table 2: Post-operative changes in ultrasound and diuretic renogram.

Post-operative changes	Improvement		Preservation		Deterioration	
	N	Percentage (%)	N	Percentage (%)	N	Percentage
Parenchymal thickness	53	88.7	-	-	7	11.7
Degree of hydronephrosis	55	91.7	-	-	5	8.3
Split renal function	42	70	13	21.7	5	8.3
Renal drainage	40	66.7	15	25	5	8.3

Table 3: Outcome of pyeloplasty in terms of SRF.

Characteristics		Deterioration in SRF	
		Yes	No
Age groups (years)	<1	2	38
	>1	3	17
Affected side	Left	2	31
	Right	3	24
Presentation	Antenatal diagnosis	3	28
	Abdominal mass	2	9
SFU grade	Grade 3	1	37
	Grade 4	4	18
Parenchymal thickness	<5	2	5
	>5	3	50
Pre-operative SRF	<30%	1	5
	>30%	4	40

DISCUSSION

UPJO is commonly encountered in pediatric urology. Obstruction is more commonly found in boys than in girls, especially in the newborn period, when the ratio exceeds 2:1. Left-sided lesions predominate, particularly in the neonate, up to approximately 67%, and bilateral cases are observed in 10-40% of cases; however, fewer than 5% of patients require bilateral repair.

Unilateral pyeloplasty not only improves hydronephrosis but also significantly increases creatinine clearance (as calculated by the Schwartz formula) and somatic growth.[5] The implication is that unilateral obstruction has negative effects on renal function and on somatic growth. Spontaneous resolution of hydronephrosis is not as benign as proposed by Koff and Campbell, that is 15-33% of patients with asymptomatic neonatal hydronephrosis show progressive ipsilateral renal deterioration, and about one half of them never regain the lost function by pyeloplasty.[6] With more early-detected cases, the management of pediatric UPJO remains more important. Choosing an optimal therapeutic regimen is difficult due to the high variability in function, degree of obstruction, extent of damage, and potential for regeneration in growing kidneys.

Thirty-one (51.7%) out of the sixty patients included in this study were antenatally detected which is similar to the findings of other studies in literature.[7] According to our study left sided UPJO was present in 33 (55%) of cases and right sided UPJO was present in 27 (45%) patients. Studies show a 66% left sided UPJO.[8] Males are more commonly affected than females with a ratio of 5:1 according to our study whereas literature showed a ratio of 2:1. Several reports have advocated early relief of UPJO to allow function to recover or to prevent further loss of kidney function.[9,10]

Some studies have suggested that affected kidneys with good SRF at the time of diagnosis are less likely to manifest deterioration of renal function after surgery.[11] In contrast, other series concluded that renal function did not improve after pyeloplasty, regardless of the initial level of renal function.[12] Salem et al also observed that only kidneys with impaired preoperative function were

associated with greater degrees of improvement after surgery.[13]

In the study by Zaccara et al an increase or decrease in renal function was found to be randomly distributed among patients operated upon at different ages, and the unpredictability of postoperative renal function was also emphasized.[14,15] Diuretic renography has been widely used to differentiate true obstructed hydronephrosis. However, some authors have questioned the interpretation of the obstructive patterns of diuretic renography and drainage half-times for the diagnosis of hydronephrosis.[8,9] The definition of obstruction based on a 20 min washout after the diuretic challenge is useful in symptomatic older children and adults, but assuming that the same criteria can be used in an asymptomatic group of young children has generated debate.[8,9,14] One issue is the variable drainage halftime on follow-up diuretic renography, and second is the concern over interpretation of results of diuretic renography showing impaired drainage. Many institutions have reported inadequate responses to the diuretic challenge without incorporating the important factors of an empty bladder and gravity drainage in acquiring and analyzing the data.[15-17]

It was assumed that progressive renal deterioration had begun only when there was a decrease in renal function and/or progressive dilatation of the renal pelvis. In our study, according to the findings on renography, postoperative SRF improved in 42 patients (70%), remained stable in 13 (21.7%), and deteriorated in 5 cases (8.3%). Post-operative renal drainage improved in 40 patients (66.7%), remained stable in 15 (25%) and deteriorated in 5 (8.3%). The degree of hydronephrosis deteriorated in 5 (8.3%) cases but improved or was preserved in 55 (91.7%) cases. The renal parenchyma deteriorated in 7 (11.7%) cases. When studying the effects of the patients' age, the affected side, clinical presentation, ultrasound findings and pre-operative SRF on the functional outcome of dismembered pyeloplasty, no statistical significant correlation (p value>0.05) was found between these factors and the success of pyeloplasty. In conclusion, AH pyeloplasty which is a gold standard surgical treatment for ureteropelvic junction obstruction needs to be followed up with radionuclide scan to know the post-operative function of the kidney, the only way to assess the functional status of the kidney. The need for redo pyeloplasty is based on symptoms and the deteriorating renal function.

The limitations of the present study included the different age ranges of the patients and that the surgeries were performed by multiple surgeons.

CONCLUSION

Dismembered pyeloplasty is a safe and effective treatment of UPJO in the pediatric population, not only providing relief of obstruction but also improvement of renal function. It remains the treatment of choice for this patient group in our department. The patients' age, the affected side, clinical presentation, ultrasound findings and preoperative SRF have no statistically significant correlation with the functional outcome of dismembered pyeloplasty. Majority of the patients had an improved split renal function, renal drainage, and cortical thickness; and decreased degree of hydronephrosis.

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