

Improvement of Renal Functional After Pediatric Pyeloplasty in Poorly Functioning Kidneys

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ABSTRACT

Background: Pediatric pyeloplasty in ureteropelvic junction obstruction (UPJO) is indicated in renal impaired drainage or renal function deterioration. The improvement of renal function after pediatric pyeloplasty is still controversial in poorly functioning kidneys. **Aim of the work :** The aim of the current study was to determine the efficacy and outcome of pyeloplasty in poorly functioning kidneys in the pediatric age group. **Patients and methods:** This observational retrospective analytical study carried out in the Urology Department, Faculty of Medicine, Zagazig University, after review of our data base system to identify the outcome of pyeloplasty in children with split renal function less than 10%, during the period from 2013 to 2019 **All patients were subjected at the time of pyeloplasty to Clinical assessment, Laboratory investigation,** Abdominopelvic ultra sound (serial) to assess (A – P diameter of renal pelvis, parenchymal thickness, Degree of hydronephrosis. **Results:** GFR SRF were highly significantly increased in post operative follow up renogram at 6 months and 12 months. Antero-postero diameter (APD), Parenchymal thickness was highly significantly reduced at 6 month postoperative follow up ultrasound. There were a highly significant improvement in degree of hydronephrosis from grades III, IV to I, II. **CONCLUSION:** Our data confirm emerging evidence that the outcome and prognosis of Anderson-Hynes pyeloplasty (AHP) in children with severely impaired renal function is good that show highly significant improvement of renal function postoperative.

Keywords: ureteropelvic junction obstruction, poorly functioning kidneys, pediatric pyeloplasty

INTRODUCTION

In children with unilateral ureteropelvic junction obstruction (UPJO), a reduction in the split renal function (SRF) of less than 40% is usually considered an indication for surgery. Improvement of SRF in poorly functioning kidneys after pediatric pyeloplasty is still under dispute. A study showed that PUJO cases with SRF < 35% had a high risk of substantial biopsy histological changes and a low likelihood of postoperative improvement in SRF ⁽¹⁾.

The pyeloplasty vs. nephrectomy indication is focused primarily on the results of repeated renal ultrasonography (US) and renal scintigraphy. Usually, nephrectomy was recommended when SRF < 10%. Long-term follow-up studies suggest that even with an initial

SRF of less than 10%, a considerable increase in SF can be seen when pyeloplasty is done so that nephrectomy is not warranted (2).

Past studies on poorly functioning kidneys had a variable SRF specification, and these studies often had a limited number of patients so that they did not achieve statistical significance (3). The traditional intervention for poorly functioning renal unit was nephrectomy but recently, there were studies which recommend pyeloplasty even with SRF<10% as these kidneys shows significant improvement. The definition of Poorly functioning kidneys show wide variability as we will discuss later on, we considered kidney is poorly functioning if SRF \leq 20% (4). Nephrectomy is usually recommended if SRF is less than 10%. However, recent studies with long-term follow-up indicate that even with an initial SRF of < 10%, a significant improvement of SRF may be seen when pyeloplasty is performed (5).

The aim of the current study was to determine the efficacy and outcome of pyeloplasty in poorly functioning kidneys in the pediatric age group.

PATIENTS AND METHODS

This observational retrospective analytical study carried out on 28 children \leq 16 years with split renal function of ipsilateral kidney \leq 10% in the Pediatric unit, Urology Department, Faculty of Medicine, Zagazig University, after review of our data base system to identify the outcome of pyeloplasty in children with split renal function less than 10%, during the period from 2013 to 2019.

Written informed consent was obtained from all children' parents or their relatives and the study were approved by the research ethical committee of Faculty of Medicine, Zagazig University (International review board IRB#:5922-I-12-2019). The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria: Children who were \leq 16 years at the time of pyeloplasty for 1ry pelviureteric junction obstruction (UPJO), split renal function of ipsilateral kidney \leq 10%. All patients underwent stented Anderson-Hynes dismembered pyeloplasty.

Exclusion criteria: Bilateral UPJO, redo pyeloplasty, children with ureteral anomalies associated with UPJO (VUR, ureteric stricture), secondary cause of UPJO.

Intraoperative: All patients in our study underwent stented Anderson–Hynes dismembered pyeloplasty (with reduction of dilated renal pelvis)

All patients were subjected at the time of pyeloplasty to the following

Clinical assessment: (History: Patient demographic characteristics such as age, gender, and past history), Complaint, either from parents or from patient itself. General examination including : abdominal mass and external genitalia.

Laboratory investigation: Routine preoperative investigation including: Complete Blood Count, Bleeding profile including prothrombin time, prothrombin concentration, and International Normalized Ratio, liver function tests, and serum creatinine level, Urine analysis – urine culture and if positive, patient was treated with the appropriate antibiotic before surgery.

Imaging studies: Abdominopelvic ultra sound (serial) to assess (A – P diameter of renal pelvis, parenchymal thickness, Degree of hydronephrosis according to the classification of the Society for Fetal Urology (SFU), ureter dilated or not, bladder status (post voiding residual urine). Magnetic resonance urography (MRU) when indicated to delineate the anatomy of the urinary

tract. Renal isotope scans using ^{99m}Diethylenetriaminepenta aceticacid (DTPA): looking for split renal function, T 1/2 and GFRvalue.

Primary endpoint

Improvement of GFR and SRF post pyeloplasty

Secondary endpoint

Relation between age and degree of improvement of renal function post pyeloplasty

Statistical Analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when parametric while non-parametric were presented as median with inter-quartile range (IQR). The comparison between groups regarding qualitative data was done by using **Chi-square test** and/or **Fisher exacttest**. The comparison between two independent groups with quantitative data and parametric distribution was done by using **Independent t-test** while with non parametric distribution was done by using **Mann-Whitney test**. the p-value was considered significant as the following: P-value > 0.05: Non significant (NS), P-value ≤ 0.05: Significant (S) and P-value < 0.001: Highly significant (HS).

RESULTS

Table (1): Demographic data of the studied group

N = 28	
Age (months)	
$\bar{X} \pm SD$	30 ± 26.6
Range	3- 84
Gender	
Male	16 (57.1%)
Female	12 (42.9%)
Side	
RT	12 (42.9%)
LT	16 (57.1%)

Mean age of patients was 30 ± 2.26 month, 16 were male and 12 were female. Left side in 16 patients and right side in 12 patients (table 1).

Table (2): Changes in Glomerular filtration rate (GFR)

	GFR (ml/min)	Paired t	P
Preoperative			
$\bar{X} \pm SD$	6.8 ± 2.06		
Range	3- 10.4		
6 month postoperative			
$\bar{X} \pm SD$	10.4 ± 2.33	16.5	< 0.001**
Range	6.5 – 16.6		
1 year postoperative			
$\bar{X} \pm SD$	16.9 ± 3.2	17.45	< 0.001**
Range	11.7 – 22.6		

GFR was highly significantly increased in post operative follow up renogram at 6 months and 12 months (10.4 ± 2.33 and 16.9 ± 3.2 ml/min) respectively (table 2)

Table (3): Changes in split renal function (SRF)

	SRF (%)	Paired t	P
Preoperative			
$\bar{X} \pm SD$	8.85 ± 2.63		
Range	4 – 17		
6 month postoperative			
$\bar{X} \pm SD$	12.1 ± 2.49	12.17	< 0.001**
Range	7.5 – 20		
1 year postoperative			
$\bar{X} \pm SD$	17.3 ± 3.5	13.75	< 0.001**
Range	12 – 22		

SRF was highly significantly increased in postoperative follow up renogram at 6 and 12 months (12.1 ± 2.49 and 17.3 ± 3.5) %, respectively (table 3)

Table (4): Changes in A-P diameter

	APD (mm) $\bar{X} \pm SD$ (Range)	Paired t	P
Preoperative	56.7 ± 11.3 (32 – 70)	16.7	< 0.001**
6 month postoperative	25.8 ± 3.5 (20 – 30)		

Antero-postero diameter (APD) was highly significantly reduced at 6 month postoperative follow up ultrasound (P < 0.001) (Table 4).

Table (5): Changes in parenchymal thickness

	Parenchymal Thickness (mm) $\bar{X} \pm SD$ (Range)	Paired t	P
Preoperative	3.9 ± 1.3 (2 – 6)	47.6	< 0.001**
6 month postoperative	9.6 ± 1.1 (7 – 11)		

Parenchymal thickness was highly significant increased in the postoperative follow up ultrasound at 6 months (P < 0.001) (Table 5).

Table (6): Classification of hydronephrosis before and after intervention

	Degree								P
	I		II		III		IV		
	N	%	N	%	N	%	N	%	
Preoperative	0	0.0	0	0.0	6	21.4	22	78.6	<0.001**
Postoperative	7	25.0	21	75.0	0	0.0	0	0.0	

There were a highly significant improvement in degree of hydronephrosis from grades III, IV to I, II. (Table 6).

DISCUSSION

Uretero-pelvic junction obstruction (UPJO) is the most common obstructive pathology in the upper urinary tract, with a reported incidence of 1:500 to 1:1250 live births. Pyeloplasty is indicated in the following Split renal function (< 40%), Deterioration of split renal function of > 10% in serial studies, impaired drainage after the injection of lasix, increased anteroposterior diameter on serial ultrasound and Grade III and IV dilatation according to the Society for Fetal Urology ⁽⁶⁾.

The intervention for poorly functioning kidneys has no clear protocol which can be used as a guideline. The traditional intervention is nephrectomy but recently, there were studies which recommend pyeloplasty even with SRF<10% as these kidneys shows significant improvement. Poorly functioning kidneys with UPJO [split renal function (SRF) < 10% on renal dynamic scan (RDS) present a therapeutic dilemma wherein one has to choose between pyeloplasty and nephrectomy. Performing pyeloplasty in a kidney with irreparable damage would unnecessarily add to the cost of treatment and increase the morbidity of the patient. On the other hand, doing nephrectomy in a potentially salvageable kidney would be disastrous. ⁽⁷⁾.

This is an observational retrospective analytical study carried out in the Urology Department, Faculty of Medicine, Zagazig University, after review of our data base system to identify the outcome of pyeloplasty in children with split renal function less than 10%, during the period from 2013 to 2019.

The current study showed that split renal function was improved from 8.85 ± 2.63 preoperative to 12.1 ± 2.49 after 6 months and 17.3 ± 3.5 at one year postoperative with a statistical significant difference between preoperative and postoperative differential functions ($P < 0.001$). which in agreement with the study of **Lone et al.** ⁽⁸⁾, they studied 24 patients with $SRF \leq 15\%$, divide them into two groups: group A (11%-15%) and group B ($\leq 10\%$). The overall preoperative mean SRF was $10.61 \pm 5.23\%$ increased in postoperative follow up to $18.08 \pm 7.3\%$, $18.17 \pm 8.63\%$ and $18.42 \pm 8.42\%$ at 3 months, 9 months and 18 months respectively. Preoperative mean SRF in group A was $14.4 \pm 1.01\%$ increased in postoperative follow up to $19.6 \pm 6.1\%$ (p value 0.29) and in group B was $5.3 \pm 3.7\%$ increased to $16.7 \pm 8.8\%$ (p-value 0.03),

so they concluded that in spite both group shows improvement, it was significant in group B and overall but not in group A. another study of **Ibrahim et al.**,⁽⁹⁾ reported that in patient with initial SRF 10-20%, SRF increased from $15.74 \pm 2.30\%$ to 23.07 ± 6.75 , (p-value 0.001) which is highly significant and in patient with initial SRF < 10%, SRF increased from 6.21 ± 2.26 to 15.04 ± 7.09 which is significant.

The current study showed that there was a significant increase in GFR from 6.8 ± 2.06 preoperative to 10.4 ± 2.33 at 6 months postoperative and 16.9 ± 3.2 at one year postoperative (P < 0.001).

Underbjerg al.⁽¹⁰⁾ reported that 71% (12 of 17) of patients showed improved GFR after pyeloplasty.

The current study showed that the APD was significantly reduced from 56.7 ± 11.3 preoperative to 25.8 ± 3.5 at 6 month postoperative (P < 0.001). Similarly **Abdelaziz et al.**,⁽¹¹⁾ who analyzed the data from 25 cases of ureteropelvic junction obstruction (UPJO) candidate for pyeloplasty with SRF less than 10% and they reported that the median APD of the renal pelvis was 3 cm (range: 2.2–5). There was significant improvement of median APD 0.8 cm (range: 0.5–1.9) (P value <0.05)

The current study showed that there was a significant improvement in degree of hydronephrosis from grades III, IV to I, II.

Tapia and Gonzalez⁽¹²⁾ reported that pyeloplasty in children younger than 1 year with grades 3 or 4 hydronephrosis secondary to UPJO is effective at improving renal function and they recommended early pyeloplasty for children with reduced function of the involved kidney.

The current study showed that there was a highly significant increase in parenchymal thickness from 3.9 ± 1.3 preoperative to 9.6 ± 1.1 after 6 month postoperative (p < 0.001). similar results were reported by **El-Desoukey et al.**,⁽¹³⁾ who revealed that the parenchymal thickness increased along with the serial follow-up with a statistically highly significant difference between pre and post-operative values at the 6th month post-operative.

By contrast, **Ransley et al**⁽¹⁴⁾ reported that deterioration of renal function occurred in only 23% of renal units with good function as ascertained by renography initially, and they proposed that conservative observation could be possible in infants who demonstrate relatively good renal function postnatally.

Conclusion: Our data confirm emerging evidence that the outcome and prognosis of Anderson-Hynes pyeloplasty (AHP) in children with severely impaired renal function is good that show highly significant improvement of renal function postoperative.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Conflicting Interest (If present, give more details): No Conflict of Interest

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Not applicable

Declarations

-Ethics approval and consent to participate

Written informed consent was obtained from all children's parents or their relatives and the study were approved by the research ethical committee of Faculty of Medicine, Zagazig University (International review board IRB#:5922-1-12-2019). The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

-Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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