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Original Article

Role of USG and diuretic renogram in evaluation of outcome in children after Anderson-Hynes dismembered pyeloplasty for unilateral PUJ obstruction

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Abstract

Introduction: Pelvi-ureteric junction (PUJ) obstruction is one of the most common causes of Hydronephrosis in paediatric population. Anderson Hynes dismembered pyeloplasty is the standard surgical treatment of PUJ obstruction. Ultrasonogram (USG) and isotope renogram are widely used to assess the success of pyeloplasty. Changes in the anteroposterior diameter (APD) of renal pelvis, renal cortical thickness (CT) in USG and split renal function (SRF) in DTPA renogram can determine the postoperative outcome following pyeloplasty.

Aim of the study: The aim of this study was to see the changes in APD, CT and split renal function after pyeloplasty.

Materials and Methods: A quasi experimental study was done among children with unilateral PUJ obstruction who underwent open Anderson-Hynes dismembered pyeloplasty from January 2020 to December 2021 at Bangladesh Shishu Hospital and Institute. All patients were evaluated with ultrasonography at 6 months and DTPA after 1 year of operation. Changes AP diameter of renal pelvis, renal parenchymal thickness and SRF were recorded to assess the prognosis. Increase of SRF, more than 5% on the obstructed side compared with preoperative result was regarded as significant improvement. A change in SRF of within 5% of the preoperative level was defined as stable renal function and a decrease of SRF >5% of the preoperative level was considered as deteriorating renal function.

Results: In the present study, we enrolled 30 patients. Mean age of the patients was 25.80 months.The mean APD was 44.03 mm preoperatively and 31.03 mm after 6 months of pyeloplasty. The mean CT was 3.24 mm preoperatively and 6 months after operation it was 4.77 mm. The comparison of mean changes of APD and CT revealed significant. Postoperative renal SRF increased 6.04% (± 7.39%) than preoperative SRF value which was statistically significant.

Conclusion: Changes of renal APD (Anteroposterior diameter) and CT (cortical thickness) and Split renal function occur after pyeloplasty. So USG and DTPA can be used to assess the outcome of pyeloplasty in children with unilateral PUJ obstruction.

Key Words: PUJ obstruction, Pyeloplasty, APD, CT, Split renal function.

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Introduction

Pelvi-ureteric junction (PUJ) obstruction is one of the most common causes of Hydronephrosis in paediatric population with an incidence of 1 in 1000-2000 live birth[1]. It causes obstruction to the flow of urine from the kidney to the proximal ureter resulting deterioration of renal function. Anderson-Hynes dismembered pyeloplasty is the standard surgical treatment of PUJ obstruction. Ultrasonogram (USG) and dynamic isotope renogram are widely used to assess the success of pyeloplasty. Changes in the anteroposterior

diameter (APD) of renal pelvis, renal cortical thickness (CT) and pelvis/cortex ratio in USG can determine the postoperative outcome following pyeloplasty[2]. Isotope renogram looks for the improvement of split renal function (SRF) and GFR after operation[1]. The aim of this study was to see the changes in APD and CT in USG and split renal function (SRF) in DTPA renogram after pyeloplasty and that may help to predict the recovery of renal function after pyeloplasty in unilateral PUJ obstructed patients.

Materials and Methods

A quasi experimental study was done among the cases with unilateral PUJ obstruction who underwent open Anderson-Hynes dismembered pyeloplasty from January 2020 to December 2021 at Bangladesh Shishu Hospital and Institute. Initial work up included ultrasonogram, and DTPA renogram, voiding cystourethrogram for diagnosis, assessment of the initial functional status and to find out associated abnormalities. Patients with associated vesicoureteric junction obstruction or vesicoureteric reflux, PUJ obstruction in horse shoe kidney or single kidney were excluded from the study. A standard protocol was followed to measure APD and CT in ultrasonography before and after surgery.

The indications for pyeloplasty included a combination of symptoms, progressive enlargement of hydronephrosis and deteriorations of split renal function in DTPA renal scan. A open dismembered pyeloplasty without reduction of pelvis with double J (DJ) stent was performed in every patient. DJ stent was removed 6-8 wks after pyeloplasty.

All patients were evaluated with ultrasonography at 6 months after operation. Changes in APD of renal pelvis, renal cortical thickness were recorded to assess the prognosis.

A diuretic renogram was done in all patients preoperatively and 1 year after operation. Increase in split renal function (SRF), more than 5% on the obstructed side compared with preoperative result was regarded as significant improvement. A change in SRF of within 5% of the preoperative level was defined as stable renal function and a decrease of SRF >5% of the preoperative level was considered as deteriorating renal function.

The pyeloplasty was defined as successful when ultrasound showed decreased in APD of renal pelvis, increased renal cortical thickness and improvement in split renal function (SRF) on renal scintigraphy using Tc-99m DTPA scan after pyeloplasty.

Data were collected on variables of interests and were analyzed using chi-square tests and paired t test.

Results

In the present study, we enrolled 30 patients who underwent pyeloplasty from January 2020 to December 2021. Mean (±SD) age of the patients was 25.80 (± 22.27) months & minimum and maximum age of the patients were 3 months & 89 months respectively. Among the patients 24 (80%) were boys and 6 (20%) were girls. The left side was involved in 77% patients and 23% had right sided Hydronephrosis.

Table-I showed the distribution of the patients according to age .

Table-I
Age category of the patients (n =30)

Age category of the respondents	Frequency	Percent
Below 1 year	10	33.3
1 year to 5 years	18	60.0
More than 5 years	2	6.7
Total	30	100.0

The mean APD was 44.03 mm (SD = ± 14.88 mm) preoperatively and 31.03 mm (±8.32 mm) after 6 months of pyeloplasty (Table-II).The comparison of mean changes of APD revealed that on average, postoperative APD of renal pelvis was12.80 mm decreased than preoperative APD value among the unilateral PUJ obstructed children.The difference was statistically highly significant. The mean CT was 3.24 mm (± 1.10 mm) preoperatively and it was 4.77 mm (±1.43 mm) 6 months after operation. Postoperative renal CT was1.53 mm increased than preoperative CT value among the unilateral PUJ obstructed children.

Table III showed the comparison of mean changes of renal CT. The increase in CT was significant at 6 months postoperatively.

Table-II
Comparison of mean changes of anterior posterior diameter (APD) of renal pelvis after surgery (n = 30)

APD of renal pelvis of the respondents before & after surgery	N	Mean	Std. Deviation	t	p
Preoperative anterior posterior diameter (mm)	30	44.03	14.88	7.39	<.001
Postoperative anterior posterior diameter (mm)	30	31.23	8.32		

Table-III
Comparison of mean changes of real cortical thickness after surgery (n = 30)

Renal cortical thickness of the respondents before & after surgery	N	Mean	Std. Deviation	t	p
Preoperative renal cortical thickness (mm)	30	3.24	1.10	-7.46	<.001
Postoperative renal cortical thickness (mm)	30	4.77	1.43		

Postoperative DTPA (1year after operation) revealed that postoperative renal SRF increased 6.04% (± 7.39%) than preoperative SRF value which was statistically significant (Table IV).

Table-IV
Comparison of mean changes of split renal function (SRF) after surgery among the respondents (n = 30).

SRF of the patients before & after surgery	N	Mean	Std. Deviation	t	p
Preoperative split renal function (SRF %)	30	33.38	11.65	4.48	<.001
Postoperative split renal function (SRF %)	30	39.42	8.14		

Table no IV showed the mean SRF before and after surgery among the patients (n = 30). A paired samples t-test was used to compare the mean preoperative SRF and mean postoperative SRF. It revealed that on average, postoperative renal SRF was 6.04% (±7.39%) increased than preoperative SRF value. The difference was statistically highly significant.

In our study, about 1/3rd of the patients had more than 40% preoperative SRF in affected kidney and 4 had below 20% SRF. Again, 16 patients had preoperative SRF in between 21-40%.

Table-V showed the relation of postoperative SRF with baseline SRF among the patients.

Table-V
Changes of postoperative split renal function (SRF) from preoperative SRF function among the patients after surgical intervention (n = 30)

Preoperative SRF category	Post operative SRF category		Total	χ^2 (df)	P valye
	21-40% SRF (n = 19)	> 40% SRF (n = 11)			
SRF up to 20% (n =4)	4 (100.0%)	0 (0.0%)	4 (100.0%)	12.61	<.05
SRF, 21-40% (n= 16)	13 (81.3%)	3 (18.8%)	16 (100.0%)		
SRF >40% (n = 10)	2 (20.0%)	8 (80.0%)	10 (100.0%)		
Total	19 (63.3%)	11 (36.7%)	30 (100.0%)		

Table-VI

Distribution of the patients according to postoperative renal function status on the basis of postoperative SRF changes from baseline SRF level (n= 30).

Postoperative renal function status according SRF (split renal function)	Frequency	Percent
changes from base line SRF		
Stable renal function (changes of SRF within 5%)	10	33.3
Significant improvement of renal function	17	56.7
(After operation SRF increase > 5% of preoperative level)		
Deterioration of renal function (> 5% decrease SRF from preoperative level)	3	10.0
Total	30	100.0

Discussion

A successful pyeloplasty relieves obstruction and improves renal drainage but not all kidneys show functional improvement after surgery. USG and DTPA renogram are commonly used to follow up the children who undergo pyeloplasty.

In our study, the comparison of preoperative and postoperative APD revealed that on average, postoperative APD of renal pelvis 12.80 mm decreased than preoperative APD value. The mean change of APD was highly significant.The findings is similar with other study[2,3].

Babu et al.[2] compared preoperative and postoperative APD, CT and Pelvis cortex ratio among 24 children with unilateral PUJ obstruction. The mean preoperative APD was 40.70 mm and the mean postoperative APD was 30.04 mm and 12.75 mm at 3 months and at 1 year respectively in their study. The mean CT was 4.41 preoperatively and 6.29 mm at 3 months and 9.45 mm at 1 year. The author concluded that reduction in the size of APD and the increase in CT were not significant at 3 months but was significant at 1 year. The percentage improvement of renal pelvis APD as a predictor of successful pyeloplasty[4]. Some researchers noted that the majority of cases took more than 6 months to improve on USG[5].

We found that significant increase of mean postoperative renal CT than preoperative CT among the children after 6 months of pyeloplasty. This finding is consistent with the study conducted by Kim et al[6]. He mentioned that parenchymal size and thickness increased with serial follow up. Kis et al[7] noted that renal parenchymal thickness was normal or had increased in 92% of cases at 1 year after surgery. Some authors proposed that ultrasound alone could be used for initial assessment following pyeloplasty, with nuclear scans being reserved for the sub group without improvement[8].

In the present study, the comparison of mean changes of split renal function (SRF) in DTPA before and 1 year after surgery among the patients was highly significant. The similar findings were observed by other study[1]. They did a prospective study among 30 children and compared the renal parenchymal thickness and renal isotope scan preoperatively and postoperatively. They found mean preoperative and postoperative SRF at 6 month were 37.58±3.9 and 44.003±4.4 respectively and the change was highly significant. Chandrasekharam and his colleagues described that there was a significant improvement in SRF occurred until 1 year after pyeloplasty[9].

In our study 56.7% kidney showed functional improvement, 33% had stable renal function and only 10% had functional deterioration of renal function on follow-up DTPA renogram after pyeloplasty. Ortapamuk et al[10] mentioned in their study that pyeloplasty improved the function in 40% patients and provide stable renal function in 87.5% patient. But they did their study among the adult patients. One study with 267 patients showed 76% of them had stable or improved renal function[4].

In our study, among the 3 cases with >5% deterioration of renal function, 1 case had preoperative renal function >50% although this patient, according to our category, fall into deteriorating renal function group after surgery in comparison to their preoperative SRF. But postoperative SRF had returned to >40% at 1 year after pyeloplasty. The similar finding was observed by other study[11]. In their study they mentioned that one of their patient had a preoperative supra-normal renal

function (SNRF) with renal function 77% and the postoperative DRF of that patient had nearly returned to normal in comparison to contralateral side. Chandrashekharam et al[10] also mentioned in their study that initial SRF over 40% was associated with little or no improvement. Our another 2 cases of deteriorated group had stable renal pelvis size in follow up USG and patients were asymptomatic. So they were kept under observation.

The standard diagnostic work up and follow up of PUJ obstruction is a combination of ultrasonogram and dynamic renal scan. These investigations are complementary to each other but cannot replace one another.

Limitations of our study were the short follow up time and small sample size. Another limitation was, the accuracy and consistency of the DTPA results might not be uniform as they were done from different center. Researcher had no control over it.

Conclusion

Renal APD (Anteroposterior diameter) and CT (cortical thickness) and split renal function after pyeloplasty can be used as a good indicator to find out the the outcome of pyeloplasty in children with unilateral PUJ obstruction.

Conflict of interest: None

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