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Ultrasonographic Evaluation of Urinary Drainage Through New Pelvi-Ureteric Junction Following A-H Pyeloplasty In Children.

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Key words:
Hydronephrosis,Anderson-Hynes Pyeloplasty,Pelvi-ureteric junction obstruction, Pelvic volume, Corticalthickness, Pelvi-cortical ratio, Ultrasonography.

Abstract

Background*: Anderson-Hynes pyeloplasty (A-H pyeloplasty) is the established treatment for hydronephrosis. The early post-operative outcomes are variable due to use of different type of trans-anastomotic or trans-renal drainage either internal or external. It is important to evaluate the transa-nastomotic drainage of the pelvis after removal of the stent for the effectiveness of the procedure. The frequency and timing of follow up by imaging after A-H pyeloplasty is changeable, renal ultrasonography is commonly used. The aim of the was to document the volumetric changes of renal pelvis following A-H pyeloplastyand assess the urinary drainage through new pelvi-ureteric junction.* ***Methods****: This cohort study included 15 children who underwent A-H pyeloplasty due to pellvi-ureteric junction obstruction (PUJO) .Urinary drainage was evaluated as a term of renal pelvic volume by ultrasonography post-operatively before and after diuretic use. Antero-posterior pelvic diameter (APPD), cortical thickness (CT) and pelvi-cortical ratio (P/C ratio) was also recorded.* ***Results****: Mean APPD was 30.16mm in 1st visit, 24.16 mm in 2nd visit and 18.69 mm in 3rd visit. The improvement was notable but that was not statistically significant. Measured mean CT was 5.20 mm, 6.04 mm and 8.60 mm in 1st, 2nd, and 3rd visit respectively. Mean P/C ratio was 7.64 in 1st visit, 5.02 in 2nd visit and 2.97 in 3rd visit. At 3rd visit, CT value improved and P/C ratio decreased significantly. Mean pelvic volume at baseline was 28.28 mm and after diuretics 29.03 mm on first visit that was statistically significant. Like that 2nd and 3rd visit also significant.* ***Conclusion****: Improvement of postoperative pelvic volume, APPD , CT and P/C ratio can provide objective guidance to surgeons to decide who need early follow-up, and can help for early intervention after pyeloplasty.*

Introduction:

Pelvi-ureteric junction obstruction (PUJO) is most common cause of pediatric hydronephrosis encountered by pediatric surgeon with incidence of 1 in 5000 live births. It is more observed in boys than girls and ratio exceed 2:1. Though it may be unilateral or bilateral, left sided PUJO is predominant[1].

For PUJO, decision for intervention is usually based on different imaging techniques. Worsening hydronephrosis on ultrasonography or decreasing differential renal function on diuretic renogram

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are widely practiced in this regard[2]. Ultrasonography is the gold standard method of diagnosis of hydronephrosis both in prenatal and postnatal period. Antero-posterior pelvic diameter, cortical thickness, pelvic volume, pelvi-cortical ratio and hydronephrosis grade (described by the Society of Fetal Urology) are the most common sonographic parameters used to assess the severity of disease and to predict the need for surgery[3].

If surgery is indicated, pyeloplasty is an effective means for long-term correction of hydro-nephrosiswith significant obstruction. It improved both impaired drainage and renal function[4].

Several techniques have been designed for the pyeloplasty. Different flap techniques like Y-V-plasty, spiral flap, Scardino-Prince vertical flaps practiced for years. But in recent times, A-H pyeloplasty is widely practiced by pediatric surgeons due to its favorable outcome[5].

The basic operative technique for dismembered A-H pyeloplasty is universal, involving excision of the uretero-pelvic junction and redundant pelvis when necessary, and re-anastomosis of the healthy ureter to the renal pelvis in addition, stenting that ensures no early postoperative kinking at the anastomotic site[6].

But some children unfortunately experience recurrent obstruction following A-Hpyeloplasty, commonly due to anastomotic stenosis or kinking (3 to 7%)[7].Which may impair urinary drainage after removal of the stent and Further interventions required to avoid additional loss of renal function. So, the main challenge following pyeloplasty is through follow up of renal function and early detection of recurrence[2].

Resolution of hydronephrosis after surgery is relatively slow, but renal parenchymal growth is rapid due to release of obstruction that leads to proper drainage. Sonological reviewing the already stated parameters is to be done post-operatively. Also, improvement of drainage can be evaluated by the assessment of urinary volume within the pelvis[8]. The success of surgery is usually demonstrated radiographically by improvement in drainage or function on the postoperative diuretic renogram and by decreased pelvicalyceal dilatation on serial renal ultrasound. Renal ultrasound is also the best study to assess renal parenchymal thickness, echogenicity and renal growth postoperatively[9].

In this study, we evaluated the urinary drainage by measuring pelvic volume of the repaired kidney at pre and post status following the diuretic dose[10].A standard dose of furosemide (0.3 mg/kg) was given intravenously to mimic the dose given during diuretic renography[11].

The drainage through new PUJ usually demonstrated radiographically or by scintigraphy. Both the procedure is not available everywhere. This study was design to evaluate the effectiveness of new PUJ by a noninvasive, easily available technique as well as detection of recurrence.

Methods:

This cohortstudy was carried out in the department of Pediatric Surgery, Bangladesh Medical University (BMU), Dhaka at March 2021 to September 2022. All study subjects provided informed consent.A total of 15 pediatricpatients (6 months to 5 yearsold) who underwent A-H pyeloplasty due to unilateral pelvi-ureteric junction obstruction, were included[12]. Patients whose post-operative time exceeded 6 weeks, or patients facing any stent related complication like- encrustation of stent, stent migration or malposition, stent fracture, recurrent UTI and patient who refused to participate were excluded.The clinical history and physical examination were done for each patient and recorded in predesigned data collection sheet. After case selection, informed consent was obtained from. Follow up of all the study populations was done at defined time schedule (first visit- day after D-J stent removal at the 6th weeks of post-operative period, second and third– one month and four 4 months after the first visit respectively) and high resolution ultra-sonographic evaluation of the kidney was done. During follow-up, APPD, CT and pelvic volume were measured by high resolution ultra-sonography.After 10 minutes of intravenous diuretics administration, pelvic volume was further assessed.All data were compiled and sorted properly and analyzed. The numerical data was presented by percentage, ratio, mean ± SD. The parameters were compared with independent sample t-test and Paired t-test and P-value of <0.05 considered as significant. Statistical analyses were performed using SPSS software package version-22 (Strata Corporation, College station, Texas).

Results:

This cross-sectional study was carried out with the aim to assess urinary drainage in new pelvi-ureteric junction following A-H pyeloplasty in children. Antero-posterior pelvic diameter of pelvis at the level of hilum, cortical thickness, pelvi-cortical (P/C) ratio, and the renal pelvic volume before and after diuresis were assessed by high resolution ultrasonographic evaluation. Ultrasonography was done in the department of Radiology and Imaging, BMU, Shahbag, Dhaka.

APPD and P/C ratio of operated kidney of the respondents were decreased and CTvaluewas increasedin 2nd visitafterDJstent removal (TableI).

TableI: Changes in sonographic parameters in2nd visit of DJ stent removal in patients with PUJ obstruction (n=15).

Variables	1st visit	2nd visit	P
APPD(mm)	30.16 ±19.77	24.16 ± 14.47	value
Mean±SSD			0.56
CT (mm)	5.20 ± 1.92	6.04 ± 2.05	0.76
Mean±SSD			
P/Cratio	7.64 ± 7.18	5.02 ± 4.62	0.19

P Value was calculated by independent sample test

Results of sonographic parameters after 4 months of DJ stent removal have been shown in table II. In 3rd visit after DJ stent removal, a significant increase in CT value (5.20 ± 1.92 Vs 8.62 ± 3.22, P=0.04) along with significant reduction of P/C (7.64 ± 7.18 Vs 2.97 ± 2.83, P=0.02) ratio from 1st visit.

TableII: Changes in sonographic parameters in 3rd visit of DJ stent removal in patients with PUJ obstruction (n=15).

Variables	1stvisit	3rdvisit	Pvalue
APPD(mm)	30.16 ±19.77	18.69 ± 11.47	0.25
Mean±SSD			
CT (mm)	5.20 ± 1.92	8.62 ± 3.22	0.04*
Mean±SSD			
P/Cratio	7.64 ± 7.18	2.97 ± 2.83	0.02*

P Value was calculated by independent sample test.*significant

Table III showing sonographic parameters of pelvic volume before and after diuretics. At 1st visit baseline pelvic volume was 28.28 ± 37.80 and after 10 minutes 29.03 ± 38.50. On 2nd visit pelvic volume was 21.92 ± 32.30 and 22.60 ± 32.9. On third visit that was 17.95 ± 28.50 and 18.63 ± 29.10. In every visit pelvic volume shows, statistically significant relation with diuretic.

Table III: Comparison of pelvic volume from baseline to after 10 minutes ofdiureticuse(n=15).

Visit	Pelvicvolume Mean± SD	Difference	P value
1stvisit			
Baseline	28.28 ± 37.80	-0.74	0.006*
10minutes	29.03 ± 38.50		
2ndvisit			
Baseline	21.92 ± 32.30	-0.68	0.008*
10minutes	22.60 ± 32.9		
3rdvisit			
Baseline	17.95 ± 28.50	-0.68	0.008*
10minutes	18.63 ± 29.10		

P value was calculated by independent sample test,*significant

Discussion:

The standard procedure for hydronephrosis is an A-H dismembered pyeloplasty, which is combined with resection of the dilated renal pelvis[13]. Hydronephrosis caused by PUJ obstruction is treated surgically (open or laparoscopically) based on decreased renal function and worsening hydronephrosis on USG[2].

Traditionally, after A-H pyeloplasty, repeated USG together with radionuclide scans are the method of choice to confirm successful correction of obstruction[14]. However, nuclear scanning requires intravenous access and urethral catheterization, and entails radiation exposure with additional costs[15]. Some authur[16]found that patterns of hydronephrosis on serial USG were superior to invasive renography.

Simillar study[17] comparing the result of postoperative USG and diuretic renal scans, proposed that USG alone can be used for the initial assessment after A-H pyeloplasty, with nuclear

scans used for the subgroup showing no improvement.

In this study renal pelvic volume was measured at the resting stage or baseline value and 10 minutes after given standard diuretic dose. That was the first visit and measure day after removal of D-J stent following A-H pyeloplasty. And that was reapetd 1 month and 4 months after the first visit. On first visit mean pelvic volume at baseline 28.28 mm and after diuretics 29.03 mm that was statistically significant. Like that 2nd and 3rdvisit also significant. It was noted that well urinary drainage established though new PUJ. Our study almost similar to other study[11] attempt to measured intra-renal pelvic pressure at rest and in response to standard diuretic dose following pyeloplasty.

Miyamoto et al.[18] showed that initially poorly drainage kidney due to PUJO after pyeloplasty should be evaluated for good drainage and they achieved 57% of good drainage.

In this study , every visit APPD and CT was measured before diuresis. Mean APPD on 1stvisit 30.16 mm , 2ndvisit 24.16mm and 3rdvisit 18.69 mm. The improvement was notable but that was not statistically significant. Romao et al.[19] showed improvement in APPD pre and postoperatively, where postoperative APPD was less associated with success of pyeloplasty.

Measured mean CT was on 1stvisit 5.20 mm, 2ndvisit 6.04 mm and 3rdvisit 8.60 mm. That show improvement of CT on 2ndvisit and statistically significant on 3rdvisit .Babu et al.[20]show The increase in CT was not significant at 3 months, but was significant at 1 year ($P < 0.01$).

In this study P/C ratio was also recorded in every visit. That was on 1stvisit 7.64, 2ndvisit 5.02 and 3rdvisit2.97. P/C ratio also significant at 3rdvisit. Babuet al.[20] showed the reduction in P/C ratio was significant at 3 months ($P < 0.01$) as well as at 1 year ($P < 0.01$)

Renal pelvic volume can be early predictor for post-operative evaluation of urinary drainage and played a significant role in the monitoring of children who underwent A-H pyeloplasty. The noninvasive nature of ultrasonography makes it an appealing alternative diagnostic tool. This can be also use for child with hydronephrosis.

Conclusion:

Renal pelvic volume can be early predictor for post-operative evaluation of urinary drainage and played a significant role in the monitoring of children who underwent A-H pyeloplasty. The noninvasive nature of ultrasonography makes it an appealing alternative diagnostic tool. This can be also use for child with HDN.

Recommendations:

Multi- centered study and long-term follow-up should be done to further establish the finding.

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Ethical approval:

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by institutional review board (IRB) of Bangladesh Medical University (BSMMU/ 2021/1317). Written informed consent was obtained from the patients parents for research and publication of this study.

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