

## ORIGINAL PAPER

# Comparative study between ureter first approach and conventional open Anderson-Hynes pyeloplasty in paediatric patients: A prospective randomised study

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**Summary** *Background: Uretero-pelvic junction obstruction is the most common form of congenital anomaly of the kidney and urinary tract with an incidence of about 1/1.000-1.500 of births and the aetiology and pathogenesis of this anomaly are still unclear until now.*

*Methods: This is a prospective randomized comparative study conducted from March 2022 to December 2022. Thirty children with uretero-pelvic junction obstruction were included and randomly divided into two groups according to a 1:1 ratio (computer-generated randomization, single blind). Fifteen cases (12 males and 3 female) were subjected to ureter first approach pyeloplasty, and another fifteen (9 males and 6 female) were subjected to conventional Anderson Hynes pyeloplasty.*

*Results: The mean age of all patients was  $6.7 \pm 5.4$  years in ureter first approach group and  $5.1 \pm 4.3$  years in conventional Anderson-Hynes pyeloplasty group. There were no significant differences between the two groups regarding age, gender, presentation, side, preoperative renogram and post-operative renogram. Also, there were no significant differences between the two groups regarding operative time (in first group  $110.3 \pm 12.4$  and in the second group  $111.2 \pm 12.0$  with  $p < 0.836$ ), pre and post-operative complication rate. Two cases of urinary tract infections in the first group, one of them having fever, and four cases in the second group, two of them having fever ( $p < 0.651$ ); four cases of loin pain in the first group and one case in the second group ( $p < 0.330$ ); one case in the first group having prolonged leakage of urine for 7 days in post-operative period ( $p < 0.309$ ). However GFR and  $t \frac{1}{2}$  improved significantly after operation in both groups ( $p < 0.001$ ).*

*Conclusions: Ureter first approach is a simple and effective procedure in children with good short term outcomes and could be done safely especially for beginners and less expert surgeons. Finally, it can overcome the problem of long ureteric stricture that may be found intraoperatively because you can shift easily to a flap procedure and complete a tension free anastomosis.*

**KEY WORDS:** Hydronephrosis; Pyeloplasty; Ureter first.

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## INTRODUCTION

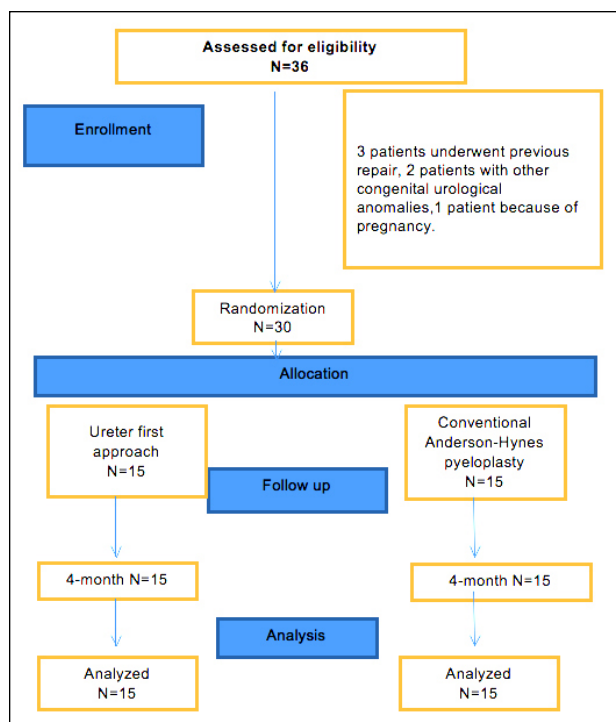
In uretero-pelvic junction (UPJ) obstruction, there is an impaired urine flow from renal pelvis to proximal ureter leading to dilatation of the pelvi-calyceal system with the risk of renal damage (1). Incidence of UPJ obstruction is

about 1/1.000-1.500 of births and it is the most common form of congenital anomalies of the kidney and urinary tract (2, 3). Until now the aetiology and pathogenesis of this anomaly are still unclear. They involved either genetic and/or environmental factors and the mechanism may involve abnormal innervation, impaired differentiation of smooth muscle and failure in development or recanalization of the uretero-pelvic junction (4-6). The most commonly diagnostic tool used to detect the function of the kidney and evaluate the extent and pattern of clearance of the urine from the urinary tract is diuretic-renography. The radionuclide of choice is *Technetium99m* ( $^{99m}\text{Tc}$ ) *mercapto-acetyl-triglycine* (MAG3). The study must be performed under standardised circumstances as good hydration and a transurethral catheter if needed. The study should be done after the fourth-sixth weeks of life (7, 8). The surgical intervention is indicated when there are poor drainage function after the administration of furosemide, impaired split renal function ( $< 40\%$ ), a decrease of split renal function of  $> 10\%$  in subsequent studies and grade III or IV dilatation as defined by the *Society for Foetal Urology* (9). The aim of this study is to compare ureter first approach and conventional Anderson Hynes pyeloplasty in terms of feasibility, duration of operation, efficacy, and complications.

## PATIENTS AND METHODS

This prospective randomized comparative study was conducted at Al-Azhar university hospitals during the period from March 2022 to December 2022. Thirty-six cases with uretero-pelvic junction obstruction were assessed for eligibility. Among them, six cases were excluded due to the presence of other congenital urological anomalies (ectopic pelvic kidney or horse-shoe kidney) ( $n = 2$ ), underwent previous repair ( $n = 3$ ), and pregnancy (18 years) ( $n = 1$ ). Thirty children were randomly divided into two groups according to a 1:1 ratio (computer-generated randomization, single blind). Fifteen cases were subjected to ureter first approach pyeloplasty, and the rest were subjected to conventional *Anderson Hynes* (A-H) pyeloplasty (Figure 1). An informed written consent was taken from parents of patients prior to the intervention. All patients were subjected to complete history taking,

**Figure 1.**  
Consort chart of all studied cases.



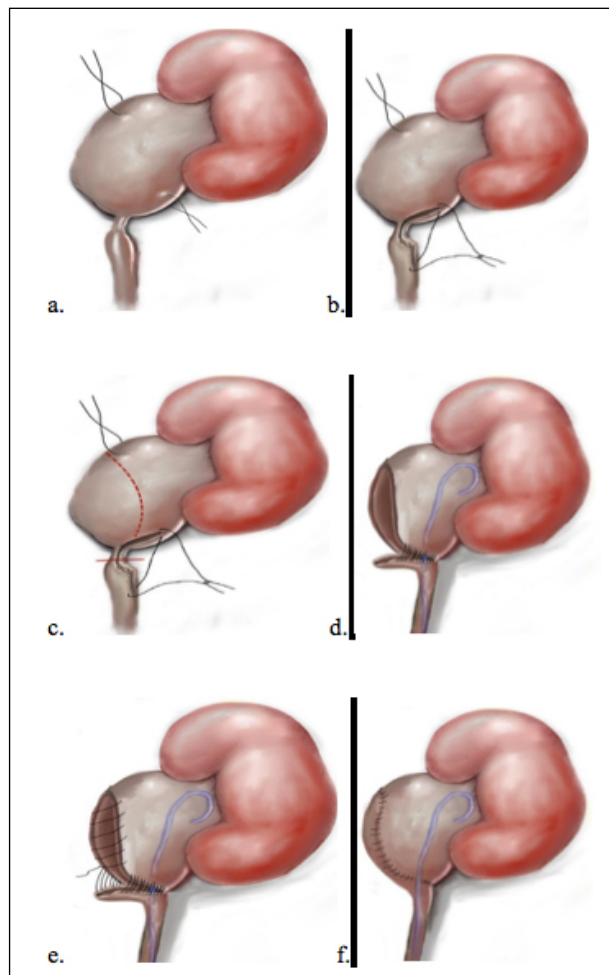
full physical examination and laboratory investigations including complete urine analysis, complete blood count, coagulation profile, urea and creatinine. In all patients, we routinely performed renal ultrasonography preoperatively. Evaluation of patients with renal isotope scan were done in all children to confirm the obstruction and as a baseline for follow-up. Four months after pyeloplasty another renal isotope scan was done for evaluation of renal drainage and function. The protocol of this study was approved by the research ethics committee of Faculty of medicine for Girls, Al-Azhar University (FMG-IRB) (approval Number: 1279). All procedures were in accordance with Helsinki Declaration. Sample size was calculated by Stata Corp. 2021 (Stata Statistical Software: Release 17. College Station, TX: Stata Corp LLC). Calculation was made considering an estimated incidence of uretero-pelvic junction (UPJ) obstruction of 1 in 1.000-1.500. Using confidence limits of 5%, confidence level of 95%, required minimal sample size is 16. To compensate for lost follow up cases and to increase the power of the study, sample size was increased to 30 cases divided into 15 cases for each group.

**Surgical technique**

After diagnosis, all patients underwent surgery without delay. The procedure was done in all children under general anaesthesia. Retrograde pyelography was done to determine the exact length of obstructed part, urethral catheter was fixed, and then patients were turned in lateral position. After incision of skin and muscle, the ureter was identified in the extraperitoneal space on the affected side, dissection was performed around the pelvis and proximal part of the ureter, then 2 stay sutures were placed in the upper and lower part of the pelvis.

Anastomosis was done by 6-0 polyglycolic acid sutures. In the first group, ureter first approach technique was used. We performed an incision in the most dependent part of the pelvis on its lateral aspect and along the ureteral axis, then ureteric spatulation was done till the normal ureter. The apex of ureteric spatulation is sutured to the lower-most point on the lower pelvis lip using 6-0 polyglycolic acid sutures. The redundant pelvis tissue is completely dismembered from its small remaining attachment to the pelvis. Suturing is continued along one wall of spatulation. Double J stent was placed in an antegrade fashion. Then opposite wall of UPJ is sutured, starting again from the apex of ureteric spatulation to meet its counterpart superiorly where it was continued to sew the two edges of pelvis (Figure 2). In the second group conventional

**Figure 2.**  
Steps of ureter first approach.  
A. 2 stay sutures were placed in the upper and lower part of the pelvis. B. an incision in the most dependent part of the pelvis on its lateral aspect and along the ureteral axis with spatulation of ureter to the normal lumen with suturing of the apex of ureteric spatulation to the lower-most point on the lower pelvis lip. C. cutting of the strictured segment of the proximal ureter and redundant part of pelvis. D. suturing is continued along one wall of spatulation. E. double J stent is placed in an antegrade fashion and the opposite wall of UPJ is sutured. F. final appearance after complete closure of pelvis.

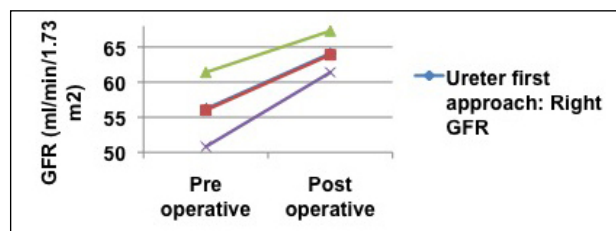


Anderson-Hynes technique was used (10). An L-shaped incision with developing of a flap from the redundant part of the renal pelvis was done. Then a stay suture was placed in the anterior wall of the ureter, ureter was spatulated laterally to the healthy part and then anastomosis was done between the ureter and pelvis using 6-0 polyglycolic acid sutures. Before completion of the anastomosis, a stent was introduced through the ureter. After completion of the anastomosis, a drain was placed through another stab incision. Patients were scheduled for follow-up after 1 week, then renal ultrasonography was done after 1 month. The ureteral stent was removed after 1 month and 4 months postoperatively an isotope scan was performed. Success was defined subjectively by symptomatic relief and objectively by renal scan results that were evaluated as improved differential renal function > 5%, good drainage and T-half < 20 minutes.

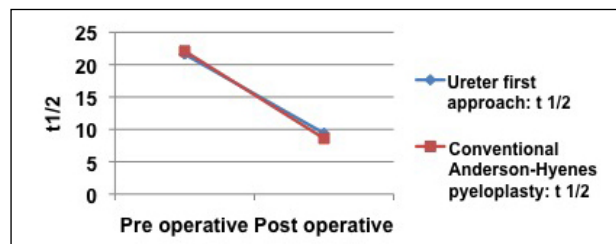
**Statistical analysis**

The collected data were revised, coded, tabulated and introduced in a PC using *Statistical package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.)*. Student T test was used to assess the statistical significance of the difference between the two study group means. Mann Whitney Test (U test) was used to assess the statistical significance of the difference of non-parametric variables between two study groups. Chi-Square test was used to examine the relationship between two qualitative variables. All reported p values were two-tailed and p < 0.05 was considered as significant.

**Figure 3.** Pre and post-operative GFR by both approaches.



**Figure 4.** Pre and post-operative t1/2 by both approaches.



**Table 1.** Comparison of baseline parameters among studied groups.

		Ureter first approach		Conventional Anderson-Hynes pyeloplasty		P value	
		N = 15		N = 15			
Age	mean ± SD	6.7	± 5.4	5.1	± 4.3	0.368	
	range	0.40	16	0.25	13		
Gender	male	N, %	12	80.0%	9	60.0%	0.427
	female	N, %	3	20.0%	6	40.0%	
Presentation	antenatal HN	N, %	3	20.0%	2	13.3%	0.624
	asymptomatic	N, %	7	46.7%	7	46.7%	
	symptomatic	N, %	8	53.3%	8	53.3%	0.705
	symptoms UTI	N, %	5	33.3%	6	40.0%	
	loin pain	N, %	3	20.0%	2	13.3%	
Side	left	N, %	9	60.0%	9	60.0%	1
	right	N, %	6	40.0%	6	40.0%	
Pre op renogram	Rt GFR	mean ± SD	56.2	19.8	61.4	15.6	0.431
		range	25	82	34	81	
	Lt GFR	mean ± SD	56.0	17.8	50.8	20.1	0.460
		range	32	81	25	81	
	t1/2	mean ± SD	21.6	2.7	22.1	3.9	0.669
		range	18	26	18	30	

**RESULTS**

There were no significant differences between both groups regarding age, gender, presentation, side and pre-operative renogram as shown in Table 1. Also, no significant differences were found between both groups regarding post op renogram as shown in Table 2 and Figures 3, 4. We found that both GFR and t 1/2 improved significantly after operation among both groups and no significant differences regarding changes in GFR and t 1/2 between the two approaches as shown in Table 3. The mean operative time for ureter first approach group was 110.3 ± 12.4 minutes, while the mean operative time for conventional Anderson-Hynes pyeloplasty group was 111.2 ± 12.0 with no significant statistical difference between the two groups (p = 0.836). There were no significant differences between both groups regarding blood loss, post-operative hospital stay and post-operative complications. We had two cases of UTI in the first group (one of them had fever) and four cases in the second group (two of them had fever). They were managed by proper antibiotic and antipyretic treatment until the infection resolved after 10 days. Also, there were four cases of loin pain in the first group and one case in the second group that were managed conservatively. One case in the first

**Table 2.** Comparison of post-operative renograms between the two groups.

		Ureter first approach		Conventional Anderson-Hynes pyeloplasty		P value	
		N = 15		N = 15			
Post op renogram	Rt GFR	mean ± SD	64.1	12.4	67.3	9.4	0.434
		range	34	82	47	81	
	Lt GFR	mean ± SD	63.9	11.2	61.4	11.9	0.553
		range	45	81	43	81	
	t1/2	mean ± SD	9.40	2.354	8.60	1.454	0.272
		range	6	14	6	11	

**Table 3.**  
Comparison of pre and post-operative renogram.

		Ureter first approach					Conventional Anderson-Hynes pyeloplasty					
		Pre		Post		P1	Pre		Post		P2	P3
		N = 15		N = 15			N = 15		N = 15			
Rt GFR	mean ± SD	56.2	19.8	64.1	12.4	<0.001	61.4	15.6	67.3	9.4	<0.001	0.851
	range	25	82	34	82		34	81	47	81		
Lt GFR	mean ± SD	56.0	17.8	63.9	11.2	<0.001	50.8	20.1	61.4	11.9	<0.001	0.368
	range	32	81	45	81		25	81	43	81		
t 1/2	mean ± SD	21.6	2.7	9.40	2.354	<0.001	22.1	3.9	8.60	1.454	<0.001	0.196
	range	18	26	6	14		18	30	6	11		

P1: comparison between pre and post level after ureter first approach.  
P2: comparison between pre and post level after Conventional Anderson-Hynes pyeloplasty.  
P3: comparison of pre and post-operative changes between ureter first approach and Conventional Anderson-Hynes pyeloplasty.

**Table 4.**  
Comparison of outcome among studied groups.

		Ureter first approach		Conventional Anderson-Hynes pyeloplasty		P value
		N = 15		N = 15		
Blood loss	mean ± SD	9.3	1.8	9.5	1.6	0.832
	range	6	12	6	12	
Hospital stay	mean ± SD	1.4	0.5	1.6	0.6	0.347
	range	1	2	1	3	
Post op complications	fever	N, %	1 6.7%	2 13.3%	0.543	
	UTI	N, %	2 13.3%	4 26.7%	0.651	
	prolonged leakage	N, %	1 6.7%	0 0.0%	0.309	
	loin pain	N, %	4 26.7%	1 6.7%	0.330	

group had prolonged leakage of urine for 7 days' post-operative and was managed conservatively after doing plain urinary tract X ray and abdomen-pelvic ultrasound showing no urinoma and the ureteric stent in place. Leakage stopped after 7 days spontaneously and there was no need for second intervention (Table 4).

**DISCUSSION**

UPJ obstruction is the most common cause of foetal kidney significant dilatation. Despite this, the clinical presentation may be delayed until adulthood (11). Many techniques for management of UPJ obstruction were mentioned throughout years and each of them had its advantages and disadvantages. They include open pyeloplasty (either dismembered or flap techniques), endo-pyelotomy and laparoscopic pyeloplasty (12). In our study we find that there was no statistically significant difference between the two groups of patients as regard the studied parameters. We believe this to be the first study to compare both techniques for repair of primary UPJ obstruction. In the conventional A-H pyeloplasty one of the problems that may happen during the operation, especially to the beginners, is the twisting of the ureter during anastomosis that may not be discovered during the procedure and can result in post-operative complications as increase time of leakage of urine in the drain and lead to recurrence of stricture. Another problem is that after excision of the redundant pelvis, the segment of stricture of ureter may be long resulting in difficult direct anastomosis to pelvis and requiring use of the redundant pelvic tissue for flap procedure. Those main

problems could be overcome easily in ureter first approach pyeloplasty as in this technique the pelvis remained attached in its upper end until nearly the end of operation. So, it is avoided the rotation of ureter that may happen during the anastomosis and if the segment of stricture is long you can shift easily to the flap procedure technique. During our search, we found only one study describing ureter first approach technique. Nayyar et al. (13) in their study that included fifty-one patients that had repair using ureter first approach technique found that there were no failures after follow up of cases

that required reintervention. They concluded that ureter approach could prevent unnecessary tissue loss if a wrong incision was done and could allow good tension-free anastomosis in all cases especially the uncommon ones like low insertion of the ureter and long segment of UPJO. They thought that such approach can also standardize the steps of pyeloplasty surgery and could reduce the surgical mistakes that may happen to newer surgeons or residents (13). There were multiple modifications of conventional A-H pyeloplasty aiming at reducing complications and make the procedure easier to perform (14-16). Recently, the advancements in urologic laparoscopy make feasible complex procedures, as pyeloplasty, that could be performed laparoscopically with the advantage of short hospital stay, less pain postoperatively and reduced morbidity but with longer operative time. Furthermore, comparative studies between open and laparoscopic dismembered pyeloplasty found that incidence of complications and functional outcome were nearly the same for both groups in adults (17-19). Our study has some limitations including being a single center study and the short term follow up of cases. In the future we plan to perform a multicenter study with long-term follow up to obtain more information and provide more impressive results.

**CONCLUSIONS**

As a conclusion we thought that ureter first approach is a simple and effective procedure in children with good short term outcomes and could be done safely especially for beginners and less expert surgeons. Also, it can overcome the problem of long ureteric stricture that may be found intraoperatively because you can shift easy to a flap procedure and complete the repair without the need of more kidney and ureter mobilization to make tension free anastomosis.

**Ethical Approval and Consent for Participation**

All procedures performed in this study complied with institutional and/or national research council ethical standards as well as the 1964 Declaration of Helsinki and its subsequent amendments or similar ethical standards. Protocols and written informed consent for all participants were approved by the Research Ethics Committee of the Faculty of medicine for Girls, Al-Azhar University (FMG-IRB) (approval Number: 1279).

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**Conflict of interest:** The authors declare no potential conflict of interest.