ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.5336/urology.2022-92676

The Success of Pyeloplasty in Adult Patients with Ureteropelvic Junction Obstruction: A Retrospective Clinical Study

Erişkin Üreteropelvik Bileşke Darlığı Hastalarında Piyeloplastinin Başarısı: Retrospektif Klinik Çalışma

Abdullah İLKTAÇ[a], Cevper ERSÖZ[a], Bayram DOĞAN[a], Habib AKBULUT[a], Yusuf Özlem İLBEY[a]

[a]Department of Urology, Bezmiâlem Vakıf University Faculty of Medicine, İstanbul, Türkiye

ABSTRACT Objective: Ureteropelvic junction obstruction (UPJO) is a disease often diagnosed in childhood, but it can rarely be detected in adults. Dismembered pyeloplasty is the gold standard treatment method. In this study, we evaluated the success of pyeloplasty in adult patients with UPJO. **Material and Methods:** We retrospectively reviewed the data of the adult patients who underwent pyeloplasty between January 2012 and July 2021. Preoperative and postoperative differential renal function (DRF), the time required for the clearance of half of the radioisotope from the renal pelvis (T1/2), presence of symptoms, degree of hydronephrosis, anteroposterior (AP) diameter of the renal pelvis, and parenchymal thickness were compared. **Results:** A total of 30 patients with a mean age of 32.43±7.18 were included in the study. No statistically significant difference was detected between preoperative and postoperative mean DRF (37.6±12.08 and 38±11.35, respectively) (p=0.775). In 19 (63.33%) patients DRF remained unchanged. In 7 (23.33%) patients DRF was improved, and in 4 (13.34%) patients DRF deteriorated. The mean AP diameter and grade of hydronephrosis were significantly improved after pyeloplasty. The ratio of patients with a T1/2>20 minutes significantly decreased from 83.33% to 26.67% (p=0.001). Before the operation 26 (86.67%) patients were symptomatic. After the operation only 8 (26.67%) patients were symptomatic. This change was statistically significant (p=0.001). **Conclusion:** There were significant improvements in T1/2, AP diameter of the renal pelvis, and the degree of hydronephrosis. Renal function was preserved after the surgery. Also, pyeloplasty was effective in pain relief and should be recommended to adults with UPJO.

Keywords: Ureteral obstruction; adult; hydronephrosis; kidney

ÖZET Amaç: Üreteropelvik bileşke obstrüksiyonu (UPJO) sıklıkla çocukluk çağında tanı konulan bir hastalıktır ancak nadiren erişkin dönemde de saptanabilir. Dismembered pyeloplasti altın standart tedavi yöntemidir. Bu çalışmada, UPJO'lu erişkin hastalarda dismembered pyeloplasti operasyonunun başarısını değerlendirdik. **Gereç ve Yöntemler:** Ocak 2012 ile Temmuz 2021 tarihleri arasında dismembered pyeloplasti yapılan erişkin hastaların verileri geriye dönük olarak incelendi. Preoperatif ve postoperatif diferansiyel renal fonksiyon (DRF), radyoizotopun yarısının renal pelvisten temizlenmesi için gereken süre (T1/2), semptom varlığı, hidronefroz derecesi, renal pelvis anteroposterior (AP) çapı ve parankim kalınlığı karşılaştırıldı. **Bulgular:** Çalışmaya yaş ortalaması 32,43±7,18 olan toplam 30 hasta dâhil edildi. Ameliyat öncesi ve ameliyat sonrası ortalama DRF değerleri (sırasıyla 37,6±12,08 ve 38±11,35) arasında istatistiksel olarak anlamlı fark saptanmadı (p=0,775). DRF, 19 (%63,33) hastada değişmeden kaldı, 7 (%23,33) hastada düzeldi ve 4 (%13,34) hastada kötüleşti. Ortalama AP çapı ve hidronefroz derecesi piyeloplasti sonrası önemli ölçüde düzeldi. T1/2>20 dk olan hastaların oranı %83,33'ten %26,67'ye düştü (p=0,001). Ameliyat öncesi 26 (%86,67) hasta semptomatik iken, ameliyat sonrası sadece 8 (%26,67) hastada semptom mevcuttu. Bu değişiklik istatistiksel olarak anlamlıydı (p=0,001). **Sonuç:** Ameliyattan sonra T1/2'de, renal pelvis AP çapında ve hidronefroz derecesinde anlamlı iyileşmeler olduğu ve böbrek fonksiyonlarının korunduğu ortaya konuldu. Ayrıca pyeloplastinin ağrının giderilmesinde etkili bir yöntem olduğu ve UPJO'lu erişkinlere önerilmesi gerektiği sonuçlarına ulaşıldı.

Anahtar Kelimeler: Üreteral obstrüksiyon; erişkin; hidronefroz; böbrek

Correspondence: Abdullah İLKTAÇ
Department of Urology, Bezmiâlem Vakıf University Faculty of Medicine, İstanbul, Türkiye
E-mail: ailktac@beazmialem.edu.tr

Peer review under responsibility of Journal of Reconstructive Urology.

Received: 01 Aug 2022 ***Received in revised form:*** 11 Oct 2022 ***Accepted:*** 11 Oct 2022 ***Available online:*** 14 Oct 2022

Ureteropelvic junction obstruction (UPJO) is defined as the anatomical or functional obstruction of ureteropelvic junction that impairs the passage of urine from the renal pelvis into the proximal ureter.[1] It is a congenital condition either caused by intrinsic factors such as intraureteral stenosis, and dynamic ureteral dysfunction, or extrinsic factors like crossing vessels.[2,3] Although it is mostly detected in early childhood, a considerable number of patients are diagnosed in adulthood. If left untreated it may cause renal impairment and complications like stone formation and urinary infection.[4,5] Indications for surgery are the presence of a differential renal function (DRF) under 40%, worsening of hydronephrosis, persistent pain, presence of kidney stones, and prolonged drainage time on diuretic renogram.[6] Surgical repair with dismembered pyeloplasty is the gold standard treatment method with high success rates.[7-9]

In adults, symptoms of UPJ obstruction can be mild and it may be detected incidentally during a radiological imaging modality such as ultrasonography or tomography.[10] The most common symptoms are abdominal, flank, or back pain, recurrent urinary tract infections, and hematuria.[11,12] UPJO is mainly diagnosed with radiological imaging methods. Ultrasonography is a non-invasive tool and it is very successful in evaluating the degree of hydronephrosis. Unlike children, computerized tomography (CT) urography is frequently used to evaluate obstruction in adults. It has high sensitivity and specificity for kidney pathologies; also it provides detailed anatomical information and reveals possible other causes of obstruction like urolithiasis and urinary system tumors.[13,14] Diuretic renography with technetium-99m mercaptoacetyltriglycine (MAG3) is preferred to assess and confirm the obstruction and to evaluate the renal function.[15] Most of the studies investigating UPJO were carried out in the pediatric population. In the literature, it was shown that a significant improvement in DRF and regression of symptoms were observed after the operation in children.[16,17] In adults, however, some authors reported that the improvement in kidney function would be limited after pyeloplasty since the development of the kidneys has been completed.[18,19]

Currently, there are a limited number of studies in the literature investigating the effects of pyeloplasty in the adult population. In this study, we evaluated the success of pyeloplasty in adult patients with UPJO.

MATERIAL AND METHODS

We retrospectively reviewed the records of all adult patients (age ≥18 years old) who underwent pyeloplasty with the diagnosis of UPJO between January 2012 and July 2021. Patients with a normal contralateral kidney and unilateral UPJO were included in this study. Patients with a history of previous surgery for UPJO, bilateral UPJO, solitary, ectopic, or anatomically abnormal kidneys, DRF<10%, incomplete data, and patients who had no preoperative and postoperative MAG3 scans were excluded. All patients underwent preoperative urinary ultrasonography for the evaluation of hydronephrosis and anteroposterior (AP) diameter of the renal pelvis. The grade of hydronephrosis was assessed according to the criteria determined by the society of fetal urology.[20] Additional radiological imaging modalities [e.g.: intravenous pyelography (IVP), non-contrast CT, CT urography, magnetic resonance (MR) urography] preferred to confirm the diagnosis were evaluated. Patients' age, presence of symptoms, presence of preoperative Double J (DJ) stent or nephrostomy, and type of the surgery were noted.

Indications for surgery were persistent pain, decreased DRF (<40%), obstructive pattern in MAG3, and/or the presence of secondary renal stones. All patients underwent open or laparoscopic dismembered Anderson-Hynes pyeloplasty. The type of surgery was determined by the joint decision of the patient and the surgeon. All surgeons had the necessary experience in the operation technique and completed their learning curve. The operations were performed by 4 surgeons. A learning curve for open pyeloplasty in adults has not yet been described in the literature but 2 senior surgeons have been performing open pyeloplasty for more than 20 years. Laparoscopic procedures were carried out by the other 2 surgeons who performed more than 20 laparoscopic pyeloplasty operations after completing their residency programs. Operations performed by residents were

not included in the study. None of the patients underwent renal pelvis reconstruction. DJ stents were placed in all patients and removed 4-6 weeks after the surgery. According to our clinical protocol postoperative MAG3 was performed 6 months after the surgery. Changes in the degree of hydronephrosis and AP diameter were evaluated by ultrasonography 6 months after the surgery and then annually. Preoperative and postoperative degree of hydronephrosis, AP diameter of the renal pelvis, parenchymal thickness, DRF, and the time required for the clearance of half of the radioisotope from the renal pelvis (T1/2) detected in the MAG3 scan were compared. A decrease or increase in DRF <5% was considered as unchanged, any increase in DRF by 5% or more was considered as improved and any decrease in DRF by 5% or more was considered as deteriorated function. Obstruction was defined as a T1/2 value greater than 20 minutes. A T1/2 value less than 10 minutes was accepted as nonobstructive and a T1/2 value between 10 and 20 minutes was accepted as an equivocal result. Functional success was defined as the absence of a significant deterioration in DRF and clinical success was defined as no need for a secondary intervention like DJ stenting, redo pyeloplasty or nephrectomy.

ETHICAL APPROVAL

This study was approved by the Bezmiâlem Vakıf University Ethic Committee (date: April 19, 2022, number: 2022/121). The study was conducted in accordance with the principles of the Declaration of Helsinki.

STATISTICAL ANALYSIS

Data storage and statistical analyses were performed using the SPSS 24.0 statistical program (SPSS Inc., Chicago, IL, USA). Paired sample test was used in the comparison of the preoperative and postoperative measurements of the parameters with normal distribution, and the Wilcoxon signed rank test was used in the comparison of parameters that did not show normal distribution. Drainage was divided into 3 groups: obstructive, non-obstructive, and equivocal. Whether there was a difference between the proportions of these groups before and after surgery was evaluated with the Cochran Q test. The McNemar test was used for the evaluation of the measurements of 2 groups of qualitative data. A p value less than 0.05 was considered significant.

RESULTS

A total of 30 patients (14 men and 16 women) were included in the study. The mean age of the patients was 32.43±7.18 years and the mean duration of follow-up was 37.73±27.01 months. Detailed characteristics are shown in Table 1. The majority of the patients were symptomatic and the only symptom reported by the patients was flank pain. No other symptoms were reported. CT urography was the most commonly preferred (36.67%) radiological imaging modality after the ultrasound. The least preferred ones were found as IVP and MR urography (10% and 3.3%, respectively). One patient had a DJ stent and another patient had a nephrostomy placed before the surgery. Both patients were referred from other centers to our clinic. Crossing vessels to the lower pole of the kidney were detected in 10 (33.33%) patients.

TABLE 1: Demographic data of the patients.

Number of patients (n)		**30**
Age (years), $\bar{X}$±SD (minimum-maximum)		32.43±7.18 (20-46)
Sex (%)	Male (%)	14 (46.67)
	Female (%)	16 (53.33)
Side	Left	19 (63.33)
	Right	11 (36.67)
Operation technique	Open (%)	14 (46.67)
	Lap (%)	16 (53.33)
Presence of symptom	Symptomatic (%)	26 (86.67)
	Asymptomatic (%)	4 (13.33)
Preoperative radiological evaluation (%)	IVP	3 (10)
	Noncontrast CT	8 (26.67)
	Noncontrast CT+IVP	7 (23.33)
	CT urography	11 (36.67)
	MRI urography	1 (3.33)
No of patients with coexisting kidney stones (%)		2 (6.67)
No of patients with preoperative stent/nephrostomy (%)		2 (6.67)
Duration of follow-up (months), $\bar{X}$±SD (minimum-maximum)		37.73±27.01 (6-108)

SD: Standard deviation; IVP: Intravenous pyelography; CT: Computed tomography; MRI: Magnetic resonance imaging.

No statistically significant difference was detected between preoperative and postoperative mean DRF (37.6±12.08 and 38±11.35, p=0.775). In 19 (63.33%) patients DRF remained unchanged, in 7 (23.33%) patients DRF improved, and in 4 (13.34%) patients DRF deteriorated. The mean AP diameter significantly decreased from 38.57±12.44 mm to 21.7±10.68, and the mean grade of hydronephrosis significantly decreased from 2.83±0.79 to 1.57±1.07 (p=0.001). Similarly, a significant improvement in parenchymal thickness was detected after the operation (Table 2). Only 8 (26.67%) patients stated that their flank pain persisted after surgery. MAG3 was reported as obstructive in 25 (83.33%) patients preoperatively. The number of patients with obstructive MAG3 study decreased to 8 (26.67%) postoperatively; 14 (46.66%) patients had non-obstructive drainage and 8 (26.67%) patients had equivocal drainage 6 months after the operation. These changes were statistically significant (p=0.001). Before pyeloplasty the number of patients with a T1/2<20 minutes was 5 (16.67%) whereas postoperatively 22 (73.33%) patients had a T1/2<20 minutes. This difference was statistically significant (p=0.001).

Of the 25 patients with preoperative obstructive MAG3 (T1/2>20 minutes): 12 had non-obstructive MAG3 (T1/2<10), 8 had obstructive MAG3 (T1/2>20) and 5 had equivocal MAG3 (T1/2 between 10 and 20 minutes) postoperatively. Of the 4 patients with preoperative equivocal MAG3 (T1/2 between 10 and 20 minutes): 3 had equivocal and 1 patient had non-obstructive MAG3 (T1/2<10) postoperatively. One patient had already non-obstructive MAG3 scan preoperatively, this patient was operated on because of the presence of flank pain and increasing grade of hydronephrosis. MAG3 scan remained non-obstructive postoperatively. Flank pain resolved after the operation and hydronephrosis was stabilized.

When we evaluated the patients with an unchanged postoperative DRF, we obtained similar results. There were significant improvements in postoperative T1/2, grade of hydronephrosis, AP diameter of the renal pelvis, parenchymal thickness, and the number of symptomatic patients (Table 3).

Two of the patients with deteriorated postoperative DFR had obstructive (T1/2>20) control MAG3 scans. In one of these patients, retrograde pyelography was performed and no anatomical obstruction was detected. DJ was placed. DJ stent was removed 3 months later as the patient could not tolerate it and DRF remained stable during the rest of the follow-up. The other patient was operated on 6 months later as AP diameter and grade of hydronephrosis were increased also. The primary operation of this patient was laparoscopic pyeloplasty and re-operation was performed with the open technique. The other 2 patients with deteriorated DFR had non-obstructive excretion on the MAG3 scan (T1/2<20). Additionally,

TABLE 2: Comparison of preoperative and postoperative characteristics of the patients (n=30).

	Preoperative	Postoperative	p value
DRF (%), $\bar{X}$±SD (minimum-maximum)	37.6±12.08 (13-57)	38.01±11.35 (16-56)	0.775[a]
Grade of hydronephrosis, $\bar{X}$±SD (minimum-maximum)	2.83±0.79 (1-4)	1.57±1.07 (0-4)	**0.001**[a]
AP diameter (mm), $\bar{X}$±SD (minimum-maximum)	38.57±12.44 (22-75)	21.7±10.68 (6-24)	**0.001**[a]
Parenchymal thickness (mm), $\bar{X}$±SD (minimum-maximum)	13.8±4.85 (5-23)	17.3±5.29 (6-26)	**0.001**[a]
No of symptomatic patients (%)	26 (86.67)	8 (26.67)	**0.001**[b]
Drainage			**0.001**[c]
Obstructive (%)	25 (83.33)	8 (26.67)	
Non-obstructive (%)	1 (3.33)	14 (46.66)	
Equivocal (%)	4 (13.34)	8 (26.67)	
T1/2 (minutes)			**0.001**[b]
<20 (%)	5 (16.67)	22 (73.33)	
>20 (%)	25 (83.33)	8 (26.67)	

[a]Paired sample test; [b]McNemar test; [c]Cochran Q test; SD: Standard deviation; DRF: Differential renal function; AP: Anteroposterior; T1/2: The time required for the clearance of half of the radioisotope from the renal pelvis.

TABLE 3: Comparison of the preoperative and postoperative characteristics of the patients with no change in postoperative DRF (n=19).

	Preoperative	Postoperative	p value
Drainage			**0.001**[a]
Obstructive (%)	15 (78.95)	5 (26.32)	
Non-obstructive (%)	1 (5.26)	7 (36.84)	
Equivocal (%)	3 (15.79)	7 (36.84)	
Grade of hydronephrosis, $\bar{X}$±SD (minimum-maximum)	2.89	1.63	**0.001**[b]
AP diameter (mm), $\bar{X}$±SD (minimum-maximum)	39.63	19.68	**0.001**[b]
Parenchymal thickness (mm), $\bar{X}$±SD (minimum-maximum)	12.15	15.84	**0.001**[b]
No of symptomatic patients (%)	17	5	**0.001**[c]
T1/2 (minutes)			**0.001**[c]
<20 (%)	4	14	
>20 (%)	15	5	

[a]Cochran Q test; [b]Wilcoxon signed rank test; [c]McNemar test; DRF: Differential renal function; SD: Standard deviation; AP: Anteroposterior; T1/2: The time required for the clearance of half of the radioisotope from the renal pelvis.

they had no worsening in the degree of hydronephrosis and AP diameter of the renal pelvis. These 2 patients were followed up routinely. We had a functional success rate of 88.33% and a clinical success rate of 93.33%.

DISCUSSION

The main purpose of the pyeloplasty operation is to maintain the normal drainage of the kidney by relieving the obstruction. Thus, it is aimed to preserve or improve kidney function and relieve symptoms. In this study, we evaluated the results of dismembered pyeloplasty in adults with UPJO. We did not detect a significant difference between the mean DFR values before and after surgery. Renal function was preserved in most of the patients. Although an increase in DRF of more than 5% was detected in a small number of patients, significant improvements were observed in the postoperative AP diameter, grade of hydronephrosis, and the number of symptomatic patients. The postoperative MAG3 evaluation revealed a significant decrease in the number of patients with obstructive drainage (T1/2>20). All these results show that the pyeloplasty operation is a successful procedure in adults as it is in children.

Although there are different definitions for clinical and functional success, dismembered pyeloplasty has a success rate of over 90% in adults, regardless of the technique used (open, laparoscopic, or robotic).[21] Nishi et al. defined success as improvement in symptoms, radiographic evidence of a patent ureteropelvic junction, and stable or improved renal function.[22] Bhat et al. defined success as stabilization or improvement in renal function on renal scan and a decrease in washout time or resolution of symptoms.[23] Elbaset et al. defined functional success as the absence of obstructive pattern on MAG3 scan with no decline in renal function and clinical success as no need for secondary intervention.[24] Nascimento et al. defined success as patient-reported symptom improvement and DRF improvement or stabilization.[25] Nayyar et al. defined functional and clinical success as no further decline in renal function and no need for secondary intervention as we did.[18] We preferred the definition of absence of significant deterioration in DRF because we believe that preservation of renal function after pyeloplasty is as important as the improvement of renal function. Also, the "need for a secondary intervention" is a more objective definition for clinical success.

The functional success rate of this study according to the definition we used is slightly lower compared to the literature. Elbaset et al. evaluated the role of pyeloplasty in 119 adults with a mean age of 62.3±16.4.[26] The patients were divided into 2 groups based on their age: patients ≥65 years of age and patients between 45 and 65 years of age. No significant

difference between preoperative and postoperative mean DRF was found in both groups. Eighty-two patients completed the follow-up and they reported that 62 patients had no change in DRF, 7 patients had deterioration and 13 patients had improvement in DRF. Ortapamuk et al. found no significant change in DRF but they detected a significant decrease in T1/2 after pyeloplasty.[19] Wu et al. evaluated the change in DRF after treatment in patients with chronic renal obstruction.[27] Although most of the patients had UPJO (78%), patients with obstructing ureteral stones and ureteral stenosis were included in the study also. They detected no significant change in DRF after surgery in the pyeloplasty subgroup. Low et al. reported similar results in their study with 228 patients who had unilateral ureteral obstruction.[28] The results of these studies are similar to the results we obtained. In our study, preoperative and postoperative mean DRF values were 37.6±12.08 and 38.01±11.35, respectively. There was no significant difference. In 19 (63.33%) patients DRF remained unchanged and in 7 (23.33%) patients DRF was improved. The number of studies reporting a significant change in DRF after surgery in adults is very limited. Harraz et al. reported a statistically significant increase in DRF from 34% to 37.2% after pyeloplasty in 85 adults with UPJO.[29] Nishi et al. reported a significant DRF improvement from 16.5% to 23.8% in UPJO patients with a preoperative renal function <20%.[22] These results together with the data from the literature show that the probability of a significant improvement in DRF value after pyeloplasty is low in adults. A stabilization rather than an improvement in DRF is observed. Before the operation, the patient should be informed that there may not be a significant increase in DRF after the procedure, but the deterioration in kidney function can be stopped.

In the MAG3 scan, besides DRF, another important parameter to be considered is T1/2. A T1/2 greater than 20 minutes is regarded as obstruction. Isoyama et al. evaluated the change in hydronephrosis after pyeloplasty and 12 of the patients in their study had unmeasurable preoperative T1/2.[30] One year after the surgery 9 (75%) of these patients had a T1/2<20 minutes. In another study, 211 adult UPJO patients with a preoperative DRF<30% were evaluated.[24] Patients were further subdivided into 2 groups as group A: DRF<20% and group B: DRF>20% and DRF<30%. Preoperative T1/2 was >20 minutes in all patients and a significant decrease in T1/2 after pyeloplasty was detected in both groups. In our study, the number of patients with a T1/2<20 minutes increased significantly after pyeloplasty. When patients with no significant change in DRF were evaluated separately, we detected significant improvements in drainage, grade of hydronephrosis, AP diameter, parenchymal thickness, the number of symptomatic patients, and T1/2 after the surgery. Twenty-five patients had an obstructive MAG3 scan before the surgery in this study. Of these 25 patients, 8 patients still had an obstructive scan postoperatively. If functional success is accepted as a MAG3 scan with no obstruction, our success rate (68%) is lower compared to the values reported in the literature.

Improvements in the grade of hydronephrosis and parenchymal thickness are strong indicators of a successful pyeloplasty. In children, it was shown that renal parenchymal thickness increases after pyeloplasty.[31] We detected a significant decrease in hydronephrosis and a significant increase in parenchymal thickness after pyeloplasty in adults. In the study of Isoyama et al., it was reported that in 73% of the cases one grade of improvement, and in 27% of the cases 2 grades of improvement in hydronephrosis were detected 6 months after the surgery.[30] They concluded that improvement in hydronephrosis started early after surgery and continued for more than 12 months. Merder et al. compared the results of open pyeloplasty and laparoscopic pyeloplasty in adults and reported a decrease in hydronephrosis 6 months after the surgery in 58% and 52.9% of the patients, respectively.[32]

Studies have shown that a significant number of adults with UPJO are symptomatic.[18,33] Although the main symptom is pain, recurrent urinary tract infections can also be observed in this patient group. Nascimento et al. compared the efficacy of laparoscopic pyeloplasty in patients with DRF≤15% and patients with DRF>15%.[25] All patients with DRF≤15% had flank pain preoperatively. After pyeloplasty, 73.3% of the patients had no pain and in 26.7% of the patients, the severity of the pain was re-

duced. In patients with DRF >15%, 95.2% of the patients had pain preoperatively. Only 1 patient had persistent pain after pyeloplasty; in other patients, pain either disappeared or improved. Isoyama et al. reported a complete resolution in pain 3 months after the surgery.[30] Ozayar et al. evaluated patients with equivocal MAG3 (T1/2<20) and ipsilateral flank pain.[33] Pain was the primary factor in making the decision of surgery and they found that 95.7% of patients were free of pain postoperatively. Although the resolution rate of flank pain was high in our study, it was lower compared to the results in the literature. Flank pain persisted after pyeloplasty in 8 of 26 symptomatic patients. In some studies, clinical success was defined as resolution symptoms after surgery.[25] According to this definition, our clinical success rate (69.23%) was lower compared to the rates reported in literature. This may be due to several reasons. First of all, pain is a subjective experience and we didn't use a pain rating scale before and after surgery to compare the change in severity. Also, the flank pain may be caused by another problem.

Despite the improvements in the degree of hydronephrosis, T1/2, and symptoms, the lack of improvement in DRF is a situation that has been observed in other studies also. Unlike other studies, we found a significant increase in parenchymal thickness, but this change was not sufficient to maintain a significant increase in DRF. Since the development of the kidney is completed in adults, the removal of the obstruction may not lead to an improvement in renal function. Only deterioration in DRF can be stopped, preventing further damage to the kidney. Bhat et al. performed intraoperative renal biopsy during pyeloplasty and found that in the presence of severe obstructive changes like glomerulosclerosis and interstitial fibrosis, an increase in postoperative DRF was less likely.[23] Also, The DRF result is determined by MAG3 and some authors stated that MAG3 may underestimate the DRF value in the presence of severe hydronephrosis.[34]

Ultrasound, voiding cystourethrography and renal scintigraphy are basic imaging modalities used in the evaluation of hydronephrosis in children.[15] Contrast-enhanced CT is rarely used. However, in adult patients, contrast-enhanced CT, especially CT urography, is more commonly used as it provides information about other pathologies that cause hydronephrosis like stones or urothelial tumors.[13,14] In this study, CT urography is the most commonly preferred advanced imaging modality followed by non-contrast CT. Nowadays, IVP is rarely used, it is mostly replaced by CT. In our study, most of the patients who had IVP were those who underwent pyeloplasty between the years of 2012 and 2013.

This study has several limitations. First of all, it is a retrospective study with a limited number of patients. Operations were performed by different surgeons. Also, the relatively short duration of follow-up may have affected the results. We only evaluated the MAG3 scans performed in the 6th postoperative month. Data about the MAG3 scans performed after 6 months were missing in most of the patients so they were not included in the study.

CONCLUSION

The results obtained in this study reveal that there is a stabilization rather than a significant increase in DRF after pyeloplasty, similar to the literature. However, there are significant improvements, especially in T1/2, AP diameter of the renal pelvis, and the degree of hydronephrosis after surgery. Also, we detected a significant increase in parenchymal thickness. This study together with the limited number of studies in literature suggest that pyeloplasty is effective in providing symptomatic relief and should be recommended to adults with UPJO. Larger, prospective studies with long-term follow-up periods are needed on this subject.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Abdullah İlktaç, Cevper Ersöz;* ***Design:*** *Abdullah İlktaç, Cevper Ersöz, Bayram Doğan, Habib Akbulut;* ***Control/Supervision:*** *Habib Akbulut, Yusuf Özlem İlbey;* ***Data Collection and/or Processing:*** *Abdullah İlktaç, Cevper Ersöz, Bayram Doğan, Habib Akbulut;* ***Analysis and/or Interpretation:*** *Abdullah İlktaç, Cevper Ersöz, Bayram Doğan, Habib Akbulut;* ***Literature Review:*** *Abdullah İlktaç, Cevper Ersöz, Bayram Doğan, Yusuf Özlem İlbey;* ***Writing the Article:*** *Abdullah İlktaç, Cevper Ersöz, Bayram Doğan;* ***Critical Review:*** *Habib Akbulut, Yusuf Özlem İlbey;* ***References and Fundings:*** *Abdullah İlktaç, Yusuf Özlem İlbey;* ***Materials:*** *Abdullah İlktaç, Yusuf Özlem İlbey.*

REFERENCES

1. Hashim H, Woodhouse CRJ. Ureteropelvic junction obstruction. Eur Urol Suppl. 2012;11(2):25-32. [Crossref]
2. Ellerkamp V, Kurth RR, Schmid E, Zundel S, Warmann SW, Fuchs J. Differences between intrinsic and extrinsic ureteropelvic junction obstruction related to crossing vessels: histology and functional analyses. World J Urol. 2016;34(4):577-83. [Crossref] [PubMed]
3. Zhang X, Li HZ, Wang SG, Ma X, Zheng T, Fu B, et al. Retroperitoneal laparoscopic dismembered pyeloplasty: experience with 50 cases. Urology. 2005;66(3):514-7. [Crossref] [PubMed]
4. Mesrobian HG, Mirza SP. Hydronephrosis: a view from the inside. Pediatr Clin North Am. 2012;59(4):839-51. [Crossref] [PubMed]
5. Grasso M, Caruso RP, Phillips CK. UPJ obstruction in the adult population: Are crossing vessels significant? Rev Urol. 2001;3(1):42-51. [PubMed] [PMC]
6. Chertin B, Pollack A, Koulikov D, Rabinowitz R, Hain D, Hadas-Halpren I, et al. Conservative treatment of ureteropelvic junction obstruction in children with antenatal diagnosis of hydronephrosis: lessons learned after 16 years of follow-up. Eur Urol. 2006;49(4):734-8. [Crossref] [PubMed]
7. O'Reilly PH, Brooman PJ, Mak S, Jones M, Pickup C, Atkinson C, et al. The long-term results of Anderson-Hynes pyeloplasty. BJU Int. 2001;87(4):287-9. [Crossref] [PubMed]
8. Arap MA, Torricelli FC, Mitre AI, Chambo JL, Duarte RJ, Srougi M. Lessons from 90 consecutive laparoscopic dismembered pyeloplasties in a residency program. Scand J Urol. 2013;47(4):323-7. [Crossref] [PubMed]
9. Autorino R, Eden C, El-Ghoneimi A, Guazzoni G, Buffi N, Peters CA, et al. Robot-assisted and laparoscopic repair of ureteropelvic junction obstruction: a systematic review and meta-analysis. Eur Urol. 2014;65(2):430-52. [Crossref] [PubMed]
10. Borin JF. Ureteropelvic junction obstruction in adults. Rev Urol. 2017;19(4):261-4. [PubMed] [PMC]
11. Riehle RA Jr, Vaughan ED Jr. Renin participation in hypertension associated with unilateral hydronephrosis. J Urol. 1981;126(2):243-6. [Crossref] [PubMed]
12. Jacobs JA, Berger BW, Goldman SM, Robbins MA, Young JD Jr. Ureteropelvic obstruction in adults with previously normal pyelograms: a report of 5 cases. J Urol. 1979;121(2):242-4. [Crossref] [PubMed]
13. Lam JS, Breda A, Schulam PG. Ureteropelvic junction obstruction. J Urol. 2007;177(5):1652-8. [Crossref] [PubMed]
14. El-Nahas AR, Abou-El-Ghar M, Shoma AM, Eraky I, El-Kenawy MR, El-Kappany H. Role of multiphasic helical computed tomography in planning surgical treatment for pelvi-ureteric junction obstruction. BJU Int. 2004;94(4):582-7. [Crossref] [PubMed]
15. Radmayr C, Bogaert G, Castagnetti M, Dogan HS, Kennedy UK, O'kelly F, et al. EAU Guidelines on Paediatric Urology. EAU Guidelines, Edition Presented at the Annual EAU Congress Amsterdam. 2022. [Link]
16. Huang Y, Wu Y, Shan W, Zeng L, Huang L. An updated meta-analysis of laparoscopic versus open pyeloplasty for ureteropelvic junction obstruction in children. Int J Clin Exp Med. 2015;8(4):4922-31. [PubMed] [PMC]
17. Menon P, Rao KL, Bhattacharya A, Mittal BR. Outcome analysis of pediatric pyeloplasty in units with less than 20% differential renal function. J Pediatr Urol. 2016;12(3):171.e1-7. [Crossref] [PubMed]
18. Nayyar R, Yadav S, Singh P, Kumar R, Seth A, Dogra PN. Outcomes of pyeloplasty in very poorly functioning kidneys: examining the myths. Urology. 2016;92:132-5. [Crossref] [PubMed]
19. Ortapamuk H, Naldoken S, Tekdogan UY, Aslan Y, Atan A. Differential renal function in the prediction of recovery in adult obstructed kidneys after pyeloplasty. Ann Nucl Med. 2003;17(8):663-8. [Crossref] [PubMed]
20. Fernbach SK, Maizels M, Conway JJ. Ultrasound grading of hydronephrosis: introduction to the system used by the Society for Fetal Urology. Pediatr Radiol. 1993;23(6):478-80. [Crossref] [PubMed]
21. Strother MC, Mucksavage P. Minimally invasive techniques for the management of adult UPJ obstruction. Curr Urol Rep. 2016;17(5):39. [Crossref] [PubMed]
22. Nishi M, Matsumoto K, Fujita T, Iwamura M. Improvement in renal function and symptoms of patients treated with laparoscopic pyeloplasty for ureteropelvic junction obstruction with less than 20% split renal function. J Endourol. 2016;30(11):1214-8. [Crossref] [PubMed]
23. Bhat GS, Maregowda S, Jayaram S, Siddappa S. Is renal biopsy a better predictor of the outcome of pyeloplasty in adult ureteropelvic junction obstruction? Urology. 2012;79(2):321-5. [Crossref] [PubMed]
24. Elbaset MA, Zahran MH, Sharaf MA, Elmeniar AM, Ezzat O, Elgamal M, et al. Long term functional success after pyeloplasty for pelvi-ureteral junction obstruction in unilateral poorly functioning kidney in exclusively adults population. Urology. 2019;131:234-9. [Crossref] [PubMed]
25. Nascimento B, Andrade HS, Miranda EP, Barbosa JABA, Moscardi PR, Arap MA, et al. Laparoscopic pyeloplasty as an alternative to nephrectomy in adults with poorly functioning kidneys due to ureteropelvic junction obstruction. Int Urol Nephrol. 2021;53(2):269-73. [Crossref] [PubMed]
26. Elbaset MA, Elmeniar AM, Sharaf MA, Ezzat O, Elgamal M, Edwan M, et al. Critical analysis of pyeloplasty role in adults with late diagnosis of ureteropelvic junction obstruction-a comparative study. Int Urol Nephrol. 2021;53(10):2051-6. [Crossref] [PubMed]
27. Wu AK, Tran TC, Sorensen MD, Durack JC, Stoller ML. Relative renal function does not improve after relieving chronic renal obstruction. BJU Int. 2012;109(10):1540-4. [Crossref] [PubMed]

28. Low ZY, Allen SE, Arumuham V, Davis LM, Allen C, Bomanji J, et al. Does relative renal function improve after intervention for chronic ureteric obstruction? Cent European J Urol. 2021;74(1):64-70. [Crossref] [PubMed] [PMC]

29. Harraz AM, Taha DE, Shalaby I, Hafez AT. Evaluation of factors predicting recoverability of renal function after pyeloplasty in adults. Urol Int. 2014;93(4):403-5. [Crossref] [PubMed]

30. Isoyama T, Iwamoto H, Inoue S, Morizane S, Hinata N, Yao A, et al. Hydronephrosis after retroperitoneal laparoscopic dismembered Anderson-Hynes pyeloplasty in adult patients with ureteropelvic junction obstruction: A longitudinal analysis. Cent European J Urol. 2014;67(1):101-5. [Crossref] [PubMed] [PMC]

31. Chalieopanyarwong V, Attawettayanon W. Renal cortical thickness after pyeloplasty in pediatric ureteropelvic junction obstruction. Res Rep Urol. 2021;13:699-704. [Crossref] [PubMed] [PMC]

32. Merder E, Arıman A, Sabuncu K, Altunrende F. Functional, morphological and operative outcome after pyeloplasty in adult patients: Laparoscopic versus open. Urologia. 2021;88(3):227-31. [Crossref] [PubMed]

33. Ozayar A, Friedlander JI, Shakir NA, Gahan JC, Cadeddu JA, Morgan MS. Equivocal ureteropelvic junction obstruction on diuretic renogram--should minimally invasive pyeloplasty be offered to symptomatic patients? J Urol. 2015;193(4):1278-82. [Crossref] [PubMed]

34. Li XD, Wu YP, Wei Y, Chen SH, Zheng QS, Cai H, et al. Predictors of Recoverability of Renal Function after Pyeloplasty in Adults with Ureteropelvic Junction Obstruction. Urol Int. 2018;100(2):209-15. [Crossref] [PubMed]