

# Evaluation of Early and Late Clinical, Radiological and Scintigraphic Datas After Laparoscopic Pyeloplasty in Ureteropelvic Junction Obstruction

Üreteropelvik Darlıkta Klinik, Radyolojik ve Sintigrafik Verilerin Laparoskopik Piyeloplasti Sonrası Erken ve Geç Dönem Seyrinin Değerlendirilmesi

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## Abstract

Ureteropelvic junction obstruction (UPJO) causes inadequate transport of urine from the renal pelvis to the ureter. Laparoscopic pyeloplasty (LP) is increasingly preferred in patients with UPJO. We aimed to compare the clinical, radiological and scintigraphic findings before the treatment and the early and late progress of the patients underwent LP for UPJO. Sixty-eight cases underwent LP for UPJO (January 2010-May 2016) were included. Demographic characteristics, clinical findings, intraoperative characteristics, data on preoperative and postoperative clinical, radiological and scintigraphic follow-ups of the cases were evaluated retrospectively. LP was performed in 68 patients (51 males, 17 females) for UPJO. Twenty-four patients with antenatal hydronephrosis, 46 patients with abdominal pain, hematuria and urinary tract infection (UTI) findings were diagnosed with UPJO. Patients were preoperatively followed up by USG and DTPA-MAG3 imaging. During surgery, aberrant vessel in 13 (19.1%) patients, malrotation in 4 (5.8%) and polyp in one (1.4%) patient were detected. Thirteen patients (19.1%) underwent surgery with the transmesocolic approach, 55 patients (80.8%) underwent retrocolic surgery, 33 patients underwent laparoscopy-assisted extracorporeal pyeloplasty. In postoperative period, patients were followed up at 1st, 3rd, 6th months and in the first year with USG and at 6th months with DTPA-MAG3 imaging. Postoperative USG follow up showed a decrease in hydronephrosis ( $p < 0.001$ ), an increase in parenchymal thickness ( $p < 0.001$ ), and a decrease in caliceal dilatation ( $p < 0.001$ ). In scintigraphic data, renal function was increased but it is not statistically significant ( $p > 0.05$ ) and activated half-time was decreased ( $p < 0.05$ ) in postoperative period. LP is a surgical treatment method with successful results when performed with appropriate indications in experienced clinics.

**Keywords:** Laparoscopic pyeloplasty; Hydronephrosis; Ureteropelvic junction obstruction; Pediatric; Differential renal function

## Özet

Üreteropelvik bileşke darlığı (ÜPBĐ), idrarın renal pelvisden üretere yetersiz transportuna neden olur. Laparoskopik piyeloplasti (LP), üreteropelvik bileşke darlığı (ÜPBĐ) olan hastalarda teknolojik gelişmelerle birlikte artan bir sıklıkta cerrahi yöntem olarak tercih edilmektedir. Bu çalışmada ÜPBĐ nedeniyle LP yapılan olguların tedavi öncesi klinik, radyolojik ve sintigrafik bulgularının, tedavi sonrası erken ve geç dönemdeki seyrinin karşılaştırarak sonuçların değerlendirilmesi amaçlanmıştır. Bu çalışmaya, Ocak 2010-Mayıs 2016 tarihleri arasında Eskişehir Osmangazi Üniversitesi Tıp Fakültesi Çocuk Cerrahisi Anabilim Dalı'nda ÜPBĐ nedeniyle LP uygulanan 68 olgu dahil edildi. Retrospektif olarak yapılan bu çalışmada olguların demografik özellikleri, klinik bulguları, intraoperatif özellikleri ve preoperatif ve postoperatif klinik, radyolojik ve sintigrafik incelemelerinin takipleriyle ilgili veriler değerlendirildi. ÜPBĐ nedeniyle 68 hastaya (51 erkek, 17 kız) LP yapıldı. Çalışmaya dahil edilen hastaların, 24'ü antenatal hidronefroz, 46'sı karın ağrısı, hematüri ve idrar yolu enfeksiyonu (İYE) bulguları sonrasında yapılan tetkikler sonucunda ÜPBĐ tanısı aldı. Hastalar ameliyat öncesi USG ve DTPA-MAG3 görüntülemeleriyle takip edildi. Cerrahi esnasında hastaların 13'ünde (%19.1) aberran damar basısı, 4'ünde (%5.8) malrotasyon ve birinde (%1.4) polip saptandı. Hastaların 13'ünde (%19.1) transmezokolik LP, 55'inde (%80.8) retrokolik LP uygulandı; 33 hastada laparoskopik yardımcı ekstrakorporeal piyeloplasti yapıldı. Hastalar postoperatif dönemde 1,3,6. ay ve 1. yılda USG ve 6. Ayda DTPA-MAG3 görüntülemeleriyle takip edildi. Postoperatif USG takiplerinde hidronefrozun gerilediği ( $p < 0.001$ ), parankim kalınlığının arttığı ( $p < 0.001$ ), kalisiyel dilatasyonun azaldığı ( $p < 0.001$ ) gözlemlendi. Sintigrafide, postoperatif dönemde böbrek fonksiyonlarının istatistiksel olarak anlamlı olmamakla birlikte ( $p > 0.05$ ) arttığı ve aktivite yarılanma sürelerinin azaldığı ( $p > 0.05$ ) gözlemlendi. LP deneyimli kliniklerde uygun endikasyonlar ile yapıldığında başarılı sonuçları olan bir cerrahi tedavi yöntemidir.

**Anahtar Kelimeler:** Laparoskopik piyeloplasti; Hidronefroz; Üreteropelvik bileşke darlığı; Pediatric; Diferansiyel böbrek fonksiyonu

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## 1. Introduction

The term ureteropelvic junction obstruction (UPJO) is a congenital or acquired disease characterized by limited urinary passage from the renal pelvis to the ureter due to intrinsic or extrinsic causes. Internal causes such as adynamic or atretic segments are more common, but external causes such as fibrous bands or crossed aberrant vessels are also seen. UPJO is one of the most common causes of prenatally diagnosed hydronephrosis (1). Although UPJO is the most common cause of upper urinary tract obstruction in children, it can cause renal parenchymal damage and permanent renal dysfunction if not treated. Therefore, in surgical indications such as significant pain or decreased renal function, surgical correction of ureteropelvic junction (UPJ) is crucial to prevent further kidney damage (2). Although UPJO has a different incidence in pediatric and adult ages, its overall incidence is 1 in 1,250. The male/female ratio is 2:1. It is more likely to be seen on the left side compared to the right side (66%). It is bilateral in 10-36% of cases (3).

UPJO is asymptomatic in infancy while it may be symptomatic in adolescence or adulthood. USG should be performed after the first 2 days of temporary dehydration or oliguria in the postnatal period (3-5). Newborns who are not diagnosed with UPJO in the prenatal period have nonspecific symptoms such as restlessness and weakness in sucking, while flank pain, vomiting, palpable mass in the hypochondrium, hematuria, kidney stones or hypertension are the most common symptoms in older age groups (6).

USG and DTPA-MAG3 imaging and also the patient's clinical symptoms are of great importance when taking the decision to continue follow-up or shift to surgery in the patients with UPJO who are in follow up, and in the follow-ups performed after surgery (7).

Open pyeloplasty (OP) with the dismembered technique described by Anderson and Hynes is the traditional gold standard for the surgical treatment of UPJO (8,9). However, with the development of laparoscopic, robotic and endoscopic techniques, open pyeloplasty has left its place to new treatment options. Many

studies compared the efficacy of the laparoscopic approach with traditional open pyeloplasty and reported similar surgical success rates (10-12). In addition, it was reported that LP offered additional advantages such as low morbidity, short hospital stay, and short recovery time, but had difficulties such as long operative times and intracorporeal suturing (13-16).

In this study, we aimed to evaluate the results by comparing the clinical, radiological and scintigraphic findings before the treatment and the early and late progress of the patients who underwent LP for UPJO.

## 2. Materials and Methods

This study was carried out with the approval of the ethics committee of Eskişehir Osmangazi University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee with the decision date 15.08.2016 and number 80558721/G-235. The data of 68 cases who underwent laparoscopic pyeloplasty (LP) for UPJ between January 2010 and May 2016 in Eskişehir Osmangazi University Faculty of Medicine, Department of Pediatric Surgery were evaluated retrospectively.

Patients aged between 0-204 months who underwent LP due to UPJO with abdominal pain during the follow-up, urinary tract infection accompanied by fever that exceeds 38 °C at least 3 times a year during the follow-up, patients with any of the signs and symptoms such as hematuria, patients whose differentiated renal function was at least 10% below the initial value and/or whose half-time was observed above 20 minutes in dynamic renal scintigraphy were included in the study.

Age, gender, symptoms and clinical findings of the patients, kidney sizes measured in preoperative and postoperative USG images, pelvis AP diameters, renal parenchymal thickness (PT), parenchymal echogenicity, calyx and ureter dilatation, MAG-3 or DTPA differential function values, activity half-time, operated side, preferred method of operation and postoperative complications were evaluated retrospectively.

### *Surgical Technique*

In patients who underwent LP, it was decided during the operation whether the approach to the kidney would be retrocolic or transmesocolic, and the operation would be completed laparoscopically or extracorporeally.

The patients were placed in the lithotomy position under general anesthesia before the LP session or in the same session. The surgical field was cleaned with 10% povidine-iodine, and after sterile draping, cystoscopy was performed by using a cystoscope with appropriate size for the patient's age. The urethra, bladder and ureteral mouths of the patient were evaluated. A ureteral stent was placed on the side with hydronephrosis. By performing RPG, ureter-pelvis anatomy, ureteropelvic narrow segment and flow pattern were visualized.

The patient was placed in a 45° lateral position with the LP side up. A 5 mm umbilical cannula was inserted using the Hasson method from the umbilicus, and 5 mm 30° telescopes were used. The abdomen was entered from the lower quadrant of the abdomen on the same side, from the xiphoid process and the middle of the umbilicus, with 3 or 5 mm working ports, depending on the age of 2 patients. Right colon, ipsilateral Toldt line cut through the peritoneum and overturned medial to the kidney lodge; on the left, the colon was cut to the medial side of the kidney lodge by cutting the peritoneum along the ipsilateral Toldt line, or the kidney lodge was reached by separating the mesocolon from the kidney projection. Gerato's fascia was opened and the renal pelvis was found and suspended in the ipsilateral upper quadrant of the abdomen with a transabdominal suspension suture. The narrow segment of the UPJ was excised. The ureter was cut open from the antimesenteric face until the non-fibrotic ureteral mucosa could be seen. The posterior wall of the renal pelvis was anastomosed with one by one suture technique using 5/0-20 6/0 polydioxanone. Age-appropriate 3- 4.8 F J-J catheter through a 16 G vascular plastic cannula inserted into the peritoneum through

the abdominal wall or through the port was advanced from the ureter to the bladder over the guide wire, and the guide wire was removed. The cranial end of the J-J catheter was inserted into the renal pelvis and dismembered pyeloplasty was completed. After the anastomosis was completed, the remaining pelvic opening was closed with a single or continuous suture technique. The drain was not used. Gerato's fascia and retroperitoneum were closed.

### *Monitoring*

Foley catheter was placed 1-3 days after the urethral catheter operation, and in patients who had a drain, the drain was removed 2-3 days later and the J-J catheter was removed 4-6 weeks later with cystoscopy. Patients were evaluated with USG 1-3-6 months and 1 year after and with MAG-3 or DTPA scintigraphy 6 months after J-J catheter removal. Surgical success was defined as absence or improvement of symptoms and resolution of hydronephrosis in USG and/or drainage on diuretic renal screening.

### *Study Outcomes*

Demographic data, complaints, preoperative imaging, duration of surgery, presence of abnormal vascular access, postoperative complications, decrease in hemoglobin, duration of drain and hospital stay, and success rates of the patients were evaluated.

### *Statistical Evaluation*

Statistical analysis of data was made by using SPSS 21 (SPSS Inc., Chicago, IL, USA) package program. The normal distribution of the data was evaluated with the Shapiro Wilk test. Descriptive statistics were presented as numbers (n) and percentages (%) for categorical variables, and as mean and standard deviation for numerical variables. In double and multiple comparisons, Chi-square test for categorical variables, Independent t-test, and One Way Anova test for quantitative variables were used. During the comparison of the before and after measurements, the dependent sample t test was used if the distribution of the differences was normal,

and the Wilcoxon test was used if it was not normally distributed. The results were considered as statistically significant with a value of  $p < 0.05$  at the 95% confidence interval.

### 3. Results

The mean age of the female patients was  $57.47 \pm 59.8$  (2-174) months, while the mean age of the male patients was  $46.37 \pm 52.32$  (1-197) months, with a male predominance of 51 (75%) of 68 patients who underwent LP for UPJO (Table 1). The right side was operated in 19 of the LP cases while 49 of them were operated on the left side. Twenty-four (35.2%) of the patients were infants diagnosed with antenatal hydronephrosis. Thirty of the patients (44.1%) applied with at least one of the complaints and findings of flank pain, urinary tract infection and hematuria. 14 of the patients (20.7%) were diagnosed with hydronephrosis while being examined for other reasons and were diagnosed with UPJO as a result of the examinations. LP was performed in 13 of the patients with a transmesocolic approach and in 55 of the patients with a retrocolic approach. In 33 of these patients, surgery was continued with laparoscopy-assisted mini-incision extracorporeal pyeloplasty. RPG was performed in 35 of 68 operated patients in the same or different session before surgery. No pathological findings were detected in the distal ureter, and the patient's diagnosis of UPJO was confirmed. J-J stent was placed in 54 of the patients. In 6 of 14 cases where stent was not placed, the J-J catheter did not pass from the UVB to the bladder; stentless LP was performed in 8 of them. Fifty (73.5%) of the patients had UPJO, 13 (19.1%) had aberrant vascular compression, 4 (5.9%) had malrotated kidneys and 1 (1.5%) had polyp.

The increase in kidney size was found to be statistically significant ( $p < 0.05$ ) when

compared in terms of kidney size, AP diameter, PT, increased echogenicity, calyx dilatation and ureter dilatation in the first admission and preoperative USG. The increase in echogenicity between admission and preoperative USG was statistically significant ( $p < 0.05$ ). The mean kidney size was  $82.24 \pm 26.95$  mm in the USG at the time of admission, while the mean kidney size was  $91.98 \pm 20.14$  mm in the preoperative USG. Preoperative and postoperative 1st month, 6th month and 1st year USG follow-ups showed a statistically significant decrease in AP diameter ( $p < 0.05$ ). In addition, the increase in PT was found to be statistically significant in the 1st year ( $p < 0.05$ ). There was no statistical difference in calyx dilatation and ureter dilatation ( $p > 0.05$ ). In the postoperative USG follow-ups, it was found that the change in kidney size, decrease in AP diameter, and increase in PT were significant in terms of response to treatment ( $p < 0.001$ ). The decrease in AP diameter and increase in PT were found to be statistically significant in the USGs performed in the 1st month and 1st year postoperatively ( $p < 0.05$ ) (Table 2).

It was found that the drainage was successful and the surgery was significant in terms of response to treatment ( $p < 0.05$ ) when the decrease in  $t_{1/2}$  was compared in the preoperative and postoperative scintigraphic data (Table 3). Postoperative UTI did not develop in 18 (78.3%) of 23 patients who presented with a preoperative fever of more than  $38^\circ\text{C}$  and a UTI at least 3 times a year. It has been observed that surgery reduces the frequency or occurrence of UTI.

During the follow-up, it was observed that 4 of 8 patients who required revision had aberrant vascular compression during the operation. However, postoperative recurrence was not statistically significant in patients with aberrant vascular compression ( $p > 0.05$ ).

**Table 1.** Demographic and clinical characteristics of the patients

<b>Age (month) (Mean ± Std)</b>	Female	$57.47 \pm 59.8$ (2-174)
	Male	$46.37 \pm 52.32$ (1-197)
<b>Gender, n (%)</b>	<b>Female</b>	17 (25)
	Male	51 (75)
<b>Side, n (%)</b>	Right	19 (27.9)

Clinical symptoms, n (%)	Left	49 (72.1)
	UTI with fever	23 (33.8)
	Stomach ache	26 (38.2)
	Hematuria	3 (4.4)
Surgical Method, n (%)	Random	14 (20.6)
	Antenatal	24 (35.3)
	Transmesocolic	13 (19.1)
Surgical Findings, n (%)	Retrocolic	55 (80.9)
	Aberrant vascular compression	13 (19.1)
	UPJO	50 (73.5)
	Malrotation	4 (5.9)
	Polyp	1 (1.5)

**Table 2.** Kidney size, AP diameter and PT in preoperative and postoperative USG follow-ups.

(Mean ± Std)	Preoperative USG	Postoperative 1. month USG	Postoperative 3. month USG	Postoperative 6. month USG	Postoperative 1. Year USG
Kidney size (mm)	94.20 ± 21.35	90.46 ± 21.48	89.85 ± 21.32	91.61 ± 20.89	91.74 ± 18.87
AP diameter (mm)	27.32 ± 12.43	19.01 ± 8.93	18.46 ± 9.13	14.78 ± 9.58	13.89 ± 7.2
PT (mm)	5.06 ± 3.32	4.43 ± 1.99	5.04 ± 2.09	5.86 ± 2.18	5.48 ± 2.05

\*AP: Anteroposterior, PT: Parenchyma thickness

**Table 3.** Preoperative and postoperative comparison of MAG3-DTPA kidney function and MAG3-DTPA  $t_{1/2}$

		Mean ± Std	p
MAG3-DTPA	Right Kidney Preoperative	44.09 ± 8.55	0.480
	Right Kidney Postoperative	45.46 ± 7.73	
	Left Kidney Preoperative	46.74 ± 6.39	0.803
	Left Kidney Postoperative	47.11 ± 8.96	
MAG3-DTPA $t_{1/2}$	Preoperative	28.22 ± 17.30	0.045
	Postoperative	22.35 ± 14.13	

#### 4. Discussion

UPJO is the most common cause of obstructive uropathies in children (44-65%) (17). Hydronephrosis is more common in men and is usually unilateral (18). In our study, 51 of 68 patients were male and UPJ was unilateral in all patients who underwent pyeloplasty. UPJO is usually observed unilaterally and is most frequently observed on the left (19). In the cases in our study, unilateral UPJO was observed mostly on the left.

Infants with severe hydronephrosis with UPJO should receive antibiotic prophylaxis (20). In the study by Song et al., the incidence of UTI was found to be high in cases with severe obstructive hydronephrosis and presenting before the first 6 months of life (20). Recurrent UTI was detected in 23 (33.8%) of the cases in our study and

prophylaxis was started. UTI did not recur in 18 (78.3%) of 23 patients after surgery. We found that surgery reduced the frequency or occurrence of urinary tract infections in patients presenting with recurrent UTI.

In UPJO, most patients present with symptoms of hematuria, back pain, or recurrent UTIs (21,22). It can also be detected incidentally as a result of widespread use of imaging methods (23). In the study of Demirdağ et al., pain was observed in 50% of patients, and UTI was observed in 18.1%, while 5.2% of the patients had hematuria and 26.7% were asymptomatic (22). The incidence of kidney stones has been reported to be approximately 16-30% (24-27). In the study of Greenfield et al., congenital urological anomalies were found in 13% of the patients who presented with hematuria.

UPJO was detected in 17.7% of patients in this group (28). O'Donnell detected UPJO in only one of 32 patients presenting with recurrent abdominal pain (29). In Apley's review of pediatric patients with abdominal pain, UPJ was found in 1% of these patients (30). In this study, the first presentation finding of the cases was abdominal pain in 38.2% and hematuria in 4.4%.

One of the factors causing UPJO is aberrant vascular compression on the UPJ and is observed in approximately 30% of the cases (31). Ureteral polyps are a very rare mechanical cause (32). Although the true incidence of isolated renal malrotation is not clearly known, it has been reported to occur at a rate of approximately 1/400-1000 in different studies (33). In our study, aberrant vascular compression was found in 19.1%, malrotated kidney in 5.9% and urethral polyps in 1.5% of the cases. As clearly seen, although our sample size is small, the clinical features of our cases are consistent with the studies in the literature.

Although there are many surgical treatment options for UPJO, the choice depends on the surgeon's experience and preference. Although each method has advantages and disadvantages, the surgeon's preference has shifted to endoscopic methods in line with technological developments. Many factors such as cost, equipment, experience and patient's condition are the factors that determine the method to be preferred. While the transmesocolic approach is more commonly used due to providing a larger work area to be sutured and familiar and identifiable anatomical landmarks, the retrocolic approach may be preferred in patients who have had previous abdominal surgery or are morbidly obese (34). LP was performed in 19.1% of the 68 patients included in our study, with a transmesocolic approach and in 80.9% with a retrocolic approach.

There are series of pyeloplasty without the use of a J-J catheter after LP (35,36). J-J stent was placed in 79.4% of the cases in our study. In 8.8% of the 20.6% cases in which the stent was not placed, the J-J catheter did not pass

from the ureterovesical junction to the bladder; stentless LP was performed in 11.8% of them.

Complication rates range from 12.9% to 15.8% in LP series involving large numbers of patients, while this rate rises to 22.5% in studies with few cases (37,38). Complications reported after pyeloplasty are recurrence of stenosis, urinoma, fistula development, devascularization, and permanent obstruction (39). Permanent obstruction or anastomotic strictures have been reported to range from 2% to 6% (40). In this study, revision was performed because obstruction recurred in 8 cases. In 7 of the patients, the J-J stent was removed early during catheter removal. No J-J stent was placed in these patients during their follow-up. Renal function loss of more than 10% was observed in the scintigraphic data of two of the patients. As a result, no major complication was observed.

Patients undergoing surgery for UPJO should be followed up intermittently with USG and MAG3 or DTPA in the post-treatment period. Preoperative hydronephrosis and other accompanying findings are expected to improve in the postoperative period. If no problem is observed in the early postoperative period, it is appropriate to perform the first control with urinary USG at the 1st month. The absence of increase in hydronephrosis and the alleviation of symptoms, if any, may be considered as clinically sufficient (41). In our study, only the decrease in AP diameter was found statistically significant in the USG performed at the postoperative 1st month ( $p < 0.05$ ). No statistically significant change was observed in kidney size, PT and calyceal dilatation.

It is recommended to follow-up patients with USG at 3 and 6 months after surgery, and with diuretic renogram at 6 months because improvement in renal discharge is expected after 6 months, while an increase in PT, decrease in the pressure in the kidney and an improvement in calyceal dilatation, is expected in the late period. Significant improvement is observed after at least 1 year (41). Similarly, in our study, when the findings in the USGs performed at the

postoperative 3th and 6th months and the first year were evaluated in terms of prognosis, we found that the positive changes in kidney size, AP diameter, PT, calyceal dilatation were statistically significant ( $p<0.001$ ).

This is a retrospective study with a small sample size. These are limitations restricts to make an adequate generalization. However, since this study includes our experience, it will contribute to some centers to start performing LPs.

## 5. Conclusion

As a result of this study, when the preoperative and postoperative early and late

values were compared within the entire follow-up period; In USG follow-ups, hydronephrosis regressed, parenchyma thickness increased, calyceal dilatation decreased; In scintigraphy, it was determined that the renal functions, although being not statistically significant, increased, and the activity half-times decreased after surgery. According to the patient's clinical findings, we suggest that it is appropriate to perform USG at 1,3,6th months and 1st year and DTPA-MAG3 imaging at 6th month in the postoperative follow-up and to decide whether the patient needs intervention in the early period or the course of long-term follow-up according to the findings here.

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- Ethics**  
**Ethics Committee Approval:** The study was approved by Eskişehir Osmangazi University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Decision no: 05, Date: 10.08.2016).  
**Informed Consent:** The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.  
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