

Evaluation of Renal Function after Pyeloplasty for Poorly Functioning Kidney in Ureteropelvic Junction Obstruction in Infants and Children

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By

Mahmoud Esmail Mohammed Shabaan

(M.B.B.Ch)

Under Supervision Of

Prof. Abdel-Wahab Yousef El Okby

Professor of Pediatric Surgery

Faculty of Medicine- Al-Azhar University

Prof. Hussein Abdallah Galal

Professor of Urology

Faculty of Medicine- Al-Azhar University

Prof. Tarek Abd Elkareim Eldahshan

Assistant Professor of Clinical Pathology

Faculty of Medicine- Al-Azhar University

Prof .Amro Ahmed Mustafa

Assistant Professor of Diagnostic Radiology

Faculty of Medicine- Al-Azhar University

Dr. Hatem Waheed Al-Sherbeeni

Lecturer of Pediatric Surgery

Faculty of Medicine- Al-Azhar University

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Abstract

Purpose: The split function (SF) of hydronephrotic kidneys may dramatically decrease in the presence of severe and persistent obstruction, necessitating surgical correction. The indication for pyeloplasty versus nephrectomy is mainly based on the results of repeated renal ultrasonography (US) and diuretic nephrography (DNG) with SF. Nephrectomy is usually recommended if SF is less than 10%. However, recent studies with long-term follow-up indicate that even with an initial SF of < 10%, a significant improvement of SF may be seen when pyeloplasty is performed so that nephrectomy may not be justified.

Patients and Methods: This is a retrospective study including 30 patients, all of whom were diagnosed to have congenital UPJO pre- or postnatally diagnosed with poor renal function less

than 10% .All patients underwent pyeloplasty either open or laparoscopic at pediatric surgery unit and Urology department, Al-Azhar University hospitals, including both sexes during infancy and childhood age ranging from 3 months up to 10 years old. Surgical correction was indicated if US revealed marked hydronephrosis (anteroposterior diameter > 20 mm) and/or DNG demonstrated a loss of SF < 10 % and/or severe obstruction, respectively. Postoperative follow-up examinations included renal US after operation, 6 and 12 months, as well as DNG after operation, 6, 12 months.

Results: Thirty children (27 male, 3 female) underwent pyeloplasty either open or laparoscopic. At the time of operation, the mean age of the patients was 33 months (1–156 months). In 8 patients, percutaneous nephrostomy (PCN) was performed, followed by AHP. 24 patients with UPJO underwent open dismembered pyeloplasty with renal pelvic reduction and 20 patients were stented with JJ stent or ureteric stent and

the other 4 were non-stented, 3 patients underwent laparoscopic pyeloplasty with reduction of renal pelvis and all were stented and the other 3 patients underwent laparoscopic assisted pyeloplasty with reduction of renal pelvis and all were stented. Postoperatively, there was a decrease in mean A-P diameter of renal pelvis, increased parenchymal thickness and decreased degree of hydronephrosis noted on US scans at the 6th month and 1 year follow up after surgery, also postoperative parameters presented on renography were better with improvement of split renal function in 24 patients (80%) whatever the degree of improvement, with significant difference between pre- and postoperative parameters.

Conclusion: Long-term follow-up confirms that the prognosis for renal function is excellent in patients with UPJO with poorly functioning kidneys. The significant improvement of SF 12 months after pyeloplasty in most patients with a poor SF of less than 10% supports our approach of performing pyeloplasty in patients even with an initial SF of <

10%, so that nephrectomy may not be justified.

Introduction

Ureteropelvic junction (UPJ) obstruction is defined as impaired urine flow from the pelvis into the proximal ureter, causing dilatation of the collecting system. UPJ obstruction is the most common cause of congenital hydronephrosis (1).

UPJO is the most common form of obstruction in the upper urinary tract. It is reported to occur in 1:500 to 1:1250 live births [24, 25].

This obstruction can lead to an increase in backpressure on the kidney, hydronephrosis, and progressive damage to kidney function. It is therefore important to understand how to treat this condition (8)

Surgical repair is indicated by significantly impaired renal drainage or progressive deterioration of renal function. Other indications for active intervention are to relieve pain, or treat pathologies secondary to obstruction like calculi and infections [26, 27].

Dismembered Anderson-Hynes pyeloplasty is the gold standard therapeutic approach for the management of UPJ obstruction. The success rate of this procedure is estimated to be as high as 95% (2, 3).

Close follow-up after pyeloplasty is essential and may diagnose obstruction early so that further interventions can be undertaken to prevent irreversible loss of renal function(8).

Functional improvement after pyeloplasty in pediatric ureteropelvic junction obstruction (UPJO) is still debated, especially in poorly functioning kidneys (1, 2).

Most studies on poorly functioning kidneys, which incidentally have a variable definition, have very small numbers often not attaining statistical significance (6, 7).

Detection of improvement or regression in renal function in poor functioning kidneys after pyeloplasty would provide important data in the establishment of follow-up protocols. In our study, we aimed to compare preoperative and postoperative renal functions of UPJO cases with poor renal functioning (<30%) (8).

Indication for pyeloplasty versus nephrectomy is mainly based on the results of repeated renal ultrasonography (US) and MAG3-diuretic nephrography (DNG) with SF. Recent studies recommend nephrectomy if the SF is less than 10% [10, 22].

However, some authors report that even with an initial SF of less than 10%, a significant improvement of SF may be seen when pyeloplasty is performed, based on long-term follow-up of renal

function, and therefore nephrectomy is not recommended [9,17,18].

We performed a retrospective analysis to evaluate these recommendations and present the outcome data of our study group.

PATIENT AND METHODS:

This is a retrospective study including 30 patients, all of whom were diagnosed to have congenital UPJO with poor renal function less than 10% .All patients underwent pyeloplasty either open or laparoscopic at pediatric surgery unit and Urology department, Al-Azhar University hospitals, including both sexes during infancy and childhood age ranging from 3 months up to 10 years old.

Inclusion criteria were Patients during infancy and childhood age ranging from 3 months up to 10 years old who are presented by congenital Ureteropelvic Junction Obstruction (UPJO) with Split Renal Function by renal isotopic scanning of the affected kidney less than 10% who underwent pyeloplasty either open or laparoscopic. All of them have normal

renal function tests including Serum urea and serum creatinine.

Exclusion criteria were acquired Ureteropelvic Junction Obstruction (UPJO),UPJ obstruction with renal function above 10% and patients who have impaired renal function tests including serum urea and serum creatinine.

We retrospectively analyzed data of patients who underwent pyeloplasty for primary UPJO in kidneys with very poorly functioning kidneys (split renal function of less than 10 %). Perioperative complications and postoperative outcomes in terms of symptomatic improvement and functional stabilization or recovery were assessed.

All patients will be subjected to a recent assessment at the time of preparation of the study in the form of thorough history taking including:

Pre-operative history including: Prenatal or post natal discovery, complaint of the patient including onset ,course and duration, urological symptoms before operation, Past history of any abnormal

medical or surgical problems and previous urological system operations or operations done for other surgical problems. Family history including other similar anomalies in the family members as brothers, sisters and cousins and Consanguinity of parents.

Operative details including: either open or laparoscopic techniques, operative time, hospital stay, surgical approach and intra-operative complications

Post-operative follow-up data including assessment of drains and catheters, urine output post-operative, complications post-operative and their management and post-operative results as regard improvement or deterioration of symptoms.

Post-operative radiological Investigations obtained from patient's relatives and files of medical records including U/S, Renal scans, MRU, MCUG and other available investigations if present.

Thorough clinical assessment of the general condition : vital signs, assessment of the general condition, assessment for

abnormal colors as regard pallor, jaundice and cyanosis, Upper and lower limbs examination, Chest and heart examination and Local abdominopelvic examination on admission to the study including: inspection, palpation, percussion, auscultation.

Laboratory investigations including those done pre-operative and post-operative and on admission to the study including: Urine analysis, kidney function tests including Blood Urea, Serum creatinine and urine culture if present.

Post-operative Pelviabdominal U/S assessment that done pre and post-operative and 6 months after the operation and that after 1 year from the operation with comment on the condition of the kidney as regard parenchymal thickness ,degree of hydronephrosis, corticomedullary differentiation and the anterior posterior diameter of renal pelvis.

Renal isotopic scanning including the preoperative scan compared to the post-operative scan and 6 months after the operation and another one 1 year later to

evaluate outcomes after surgical intervention.

RESULTS

A total of 30 patients, infants and children with UPJO with poor renal function less than 10% were identified in the current study, 27 were males and 3 were females. 7 of them discovered prenatally during routine ultrasonography for the mother and they began to develop symptoms after birth and 1 of them present symptoms at age of 1 month and 23 discovered postnatally during routine investigations for associated symptoms with the mean age at presentation 4.7 y.

There were 12 cases have UPJO on the left side of, there were 7 cases have UPJO on right side and there were 3 cases who have bilateral presentation two of them have marked HN on the right side and one has severe left sided HN. Abdominal pain was the presenting symptom in 11 cases, fever due to UTI was discovered in 5 cases, and difficulty of micturition due to UTI was in 4 cases. 8

patients were accidentally discovered during routine ultrasound examination to detect cause of symptoms and one patient developed mass swelling and one patient asymptomatic.

10 cases were associated with renal, ureteric, or bladder stones which were secondary to UPJO and treated according to the size either conservatively or endoscopically removed.

V/MCUG was done in 20 cases, of them 19 patient don't have VUR and only one case has associated VUR, also IVU was in 13 case revealed delayed excretion and concentration in the affected side, moderate to marked back pressure changes, moderate to marked pelvicalyceal System dilatation and hold up of the contrast at the proximal end of the ureter at the site of UPJO.

All cases had laboratory investigations as urine analysis, serum urea and creatinine pre-operative and postoperative which revealed normal results. Only 8 patients developed increase in pus cells after operation by

about 5 months and treated conservatively. Urine culture was done in 6 patient post-operatively revealed growth of microorganisms and received treatment according to the result of sensitivity.

All patients underwent pre-operative ultrasound revealed moderate degree of hydronephrosis ,marked thinned out renal parenchyma ,increased anteroposterior pelvic diameter, decreased corticomedullary differentiation.

All of our study cases present by poor renal function pre-operatively by diuretic renography less than 10 %.

24 patients with UPJO underwent open dismembered pyeloplasty with renal pelvic reduction and 20 patients were stented with JJ stent or ureteric stent and the other 4 were non-stented, 3 patients underwent lap pyeloplasty with reduction of renal pelvis and all were stented and the other 3 of patients underwent laparoscopic assisted

pyeloplasty with reduction of renal pelvis and all were stented.

7 patients developed intraoperative complications which were 2 need blood transfusion due to mild amount of blood loss about 80 cc blood, 2 patients need admission in ICU for 1 day post-operative due to prolonged operation time and delayed recovery, 2 patient had prolonged time due to difficult dissection due to presence of fibrosis in the upper ureter, one patient developed laryngeal spasm after extubation but the patient improved and not in need to ICU.

26 patient underwent retrieval of DJ stent after pyeloplasty operation by about 1 month. The other 4 patients were not stented

The follow up ultrasound post-operatively, 6 months and 1 year after operation started to improve gradually after operation, degree of hydronephrosis started to improve,

corticomedullary differentiation started to improve, parenchymal thickness started to increase and anteroposterior pelvic diameter started to decrease.

There was marked improvement of symptoms in 8 patients, moderate improvement in symptoms in 9 patients, mild improvement in symptoms in 11 patients and no improvement in symptoms in 2 patients.

There was marked improvement in renal functions by renal isotopic scanning when followed 6 months and one year after operation in 15 patient (50%), moderate improvement in 2 patients (6.6%), mild improvement in 7 patients (23.3%), and no improvement in 4 patients (13.3%)and deteriorating functions in 2 patients(6.6%).

The patient is classified as marked improvement in renal function if in the range from 20% to 25% or more, moderate improvement of renal function in the range from 15% to 20 %, also classified as mild improvement if in the

range from 10% to 15%, finally classified as no improvement if not increase more than 10%, also the patient is classified as deteriorating if renal function after surgery is less than that present before operation.

DISCUSSION

The management of kidneys with a poor SF of less than 10% has been the subject of debate for more than a decade [9, 10, 15, 17-19, 22, 23].

Several authors advocate nephrectomy if the SF is less than 10% [10, 22], while others recommend PCN followed by pyeloplasty in case of recoverability of function [9, 17, 18]

The majority of hydronephrotic kidneys were detected prenatally and managed expectantly, but the patients then underwent delayed pyeloplasty because of persistent or progressive obstruction. There are several proponents of prolonged observation and delayed surgical intervention [15, 19, and 23].

Dhillon [15, Koff and Campbell [19] and Ulman et al. [23] demonstrated spontaneous resolution of UPJO in several patients. Thus, pyeloplasty should be performed only if renal SF deteriorates during observation. In contrast, some authors [20, 21] have suggested that early surgical intervention results in a maximum recovery of renal function and preservation of renal parenchyma.

Palmer et al. [21] recommend early surgical correction of UPJO in all neonates even if the initial renal SF is normal (> 40%).

Certainly, hydronephrosis diagnosed in utero can be treated non-operatively in most cases, and a high rate of spontaneous resolution has been reported [15]. However, close follow-up should be done to identify patients with progressive obstruction.

Ulman et al. [23] emphasize the critical interval within the first 2 years of life, when obstruction usually becomes evident, and therefore recommend a

maximum interval between follow-up examinations of no longer than 3 months during the first 2 years of life. Thus, increasing obstruction may be detected and corrected promptly before permanent renal damage occurs.

The consequence of not complying during the observation period (by patients or medical staff) has been noted in a study by Eskild-Jensen et al. [16], in which kidney function was irreversibly damaged in 3 of 8 cases during expectant management, and no improvement was demonstrated despite pyeloplasty.

In our study, the indication for surgery was mainly based on an APD > 20 mm, decreasing SF and an obstruction on DNG. In the group with a severely impaired SF of < 10% (group III), we observed a significant improvement of SF in all patients after early pyeloplasty.

Gupta and colleagues [17] concluded that no poorly functioning UPJO kidney should be removed without a trial of PCN, and therefore recommend still performing PCN for about 4 weeks to

evaluate recovery of kidney function. They also emphasize that poorly functioning kidneys with no recovery of function should be removed. They reported that 12 of 17 kidneys (70%) with UPJO showed a functional recovery from $< 10\%$ to $29.2\% \pm 2.6\%$ SD (mean \pm SD) after 4 weeks of drainage followed by pyeloplasty. After a follow-up of 2.3 ± 1.3 years (mean \pm SD) the SF improved to $31.4\% \pm 12.8\%$ (mean \pm SD). In the remaining 5 children, renal function showed no recovery and nephrectomy could not be avoided.

Ismail et al. [18] also advised performing PCN in poorly functioning kidneys to evaluate possible recovery of function in prenatally diagnosed severe hydronephrosis (APD > 35 mm). In their study, 4 of 6 children with a renal SF of $< 15\%$ showed recovery of function within 4 weeks of performing PCN and pyeloplasty.

In the remaining 2 children, nephrectomy was carried out due to a lack of improvement in kidney function.

In our study, 2 patients with prenatally diagnosed severe hydronephrosis underwent PCN until definitive surgery was performed.

Aziz et al. [9] also recommended nephrostomy to assess the recoverability of function in kidneys with UPJO and poor SF of less than 10%. In their study, all patients showed an improvement in kidney function from less than 10% (range 0–10%) to 20–25% at 4–6 weeks after nephrostomy and pyeloplasty was performed in all patients. They recommend nephrectomy in the absence of functional recovery during this period.

In contrast, Csaicsich et al. [14] were not able to observe a relevant improvement of renal function after pyeloplasty in 5 children with initial SF of less than 10%. Since we performed a retrospective study, there was no study protocol respecting the indication whether to perform a nephrostomy or not, and the indication was based on an individual decision. Additionally, not all patients underwent a routine MAG3 scan

and DMSA scan pre- and postoperatively. This represents a potential weakness of our retrospective study, as well as the limited number of patients included. With respect to group III, there are 2 main additional weaknesses in our patient group.

First, the group of infants is very small. Second, these 4 infants include both prenatally and postnatally diagnosed cases. The prenatal case had his initial functional evaluation within the first week of life and underwent a PCN for 2 weeks before the pyeloplasty. It is difficult in this case to know whether the improvement of function represents the relief of obstruction or maturation of the kidney function.

In the present study, there was no correlation between the recovery of SF after pyeloplasty and other preoperative variables, e.g., the age of patients at pyeloplasty or degree of hydronephrosis. The recovery of function of hydronephrotic kidneys diagnosed in utero was not better than in those diagnosed later, as also reported by

Capolicchio et al. and Cornford and Rickwood [11, 13].

In conclusion, we demonstrated a satisfactory functional improvement of renal SF after pyeloplasty in the majority of patients. Most subjects had an initial SF of > 40% (group I), and pyeloplasty prevented a further deterioration of kidney function. Kidney function was more likely to improve in children with reduced SF (groups II and III) in whom obstruction was relieved by pyeloplasty than in patients with normal SF of > 40% (group I). Thus, a SF of less than 10% was associated with the greatest degree of improvement, while an initial SF of > 40% was associated with only little or no improvement as described by Chandrasekharam et al. [12].

In our series no patient has undergone nephrectomy because of a poorly functioning kidney until now. It is difficult to compare the results of outcome studies, for example, with respect to improvement of renal function on DNG, due to the different procedures

for follow-up with individual recommendations for monitoring and the different ages of patients included. In addition, DNG performed in patients younger than 1 month of age will demonstrate a huge improvement in renal function when compared to older children because of the maturation of the renal blood flow and the different glomerular filtration rate in neonates [22].

CONCLUSION

Our purpose is to reduce the incidence of nephrectomy in cases of hydronephrosis due to UPJO with poor renal function in infants and children so we recommend to give these kidneys chance to improve by pyeloplasty operation either open or lap or lap assisted. Contrary to common practice we do not recommend nephrectomy for hydronephrotic kidneys which show less than 10 % of renal function on renogram. The renal functional status improves significantly after a preliminary nephrostomy then pyeloplasty, thus avoiding the need for a straightforward

nephrectomy in children along with all the possible long-term effects of a single kidney if nephrectomy had been done.

Pyeloplasty provides high rates of morphological and functional success even in very poorly functioning renal units. There is a possibility of marked functional improvement in 50% of patients, there is mild to moderate improvement in 30% of cases, there is no improvement in 13.3 % of cases and only deterioration in 6.6 % of cases. Nephrectomy may be avoidable in most cases of very poorly functioning kidney with UPJO.

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