



Experience in the Management of Poorly Functioning Obstructed Kidneys with Confirmed Pelvi-Ureteric Junction Obstruction

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Abstract

Background: The management of obstructed kidneys with poor relative function remains controversial. Guidance is minimal regarding the split function of <25% on renogram. We reviewed the local experience in such cases and explored how interventions affect the final outcome.

Patients and Methods: We identified patients with Pelvi-Ureteric Junction Obstruction (PUJO) and <25% split renal function in either kidney post diuretic renography (MAG-3) via the Radiology department database and reviewed their management and clinical outcome. The poor function has been defined as less than 25% based upon the available literature. Respective data was collated for demographics, diagnoses and intervention factor.

Results: Ninety-four patients were identified between 2007 and 2014. All of whom had been diagnosed with PUJO by renogram. The median age was 42 years (2-90). Males: 56%. Left kidney (65%). Ninety-four patients had unilateral pathology. Most presented with loin pain (80%). Of those patients who underwent pyeloplasty, they had a laparoscopic procedure. Follow-up (FU) data was available in all patients. Median FU is 24 months. The mean split function at presentation was 20%. 61 patients underwent pyeloplasty, 24 patients were managed endoscopically and the remaining 9 patients were managed conservatively. In total, 7 patients required nephrectomy during follow-up and 3 patients were awaiting elective nephrectomy due to ongoing symptoms of pain and infection. The majority of patients described significant improvements in pain and infection rates at follow up after surgical intervention.

Conclusion: In obstructed kidneys with poor function (<25%) on diuretic renography pyeloplasty can maintain function and improve symptoms. This can be of importance in specific patient populations such as those with diabetes or renal disease in whom renal preservation is essential. Conservative management or the long-term use of stents should be reserved for those who are not suitable for more invasive surgery as this group rarely have favourable outcomes in terms of functional benefit or symptom control.

Keywords: Pelvic ureteric junction; Poor function; Pyeloplasty; Nephrectomy

Introduction

There is currently no gold standard management for patients with unilateral Pelvi-Ureteric Junction Obstruction (PUJO) and <25% split function on dynamic renography which has been universally agreed upon. Minimally invasive pyeloplasty has proven to be an effective and durable method of intervention for PUJO with 5-year outcomes showing improvement in up to 90% of patients [1]. Although the efficacy of surgery has been confirmed, within the published studies the majority of the cohorts have pre-operative split function between 35 and 45 percent [2,3]. Questions have been raised clinically for many years regarding the outcomes of patients with poor function and whether they ultimately benefit from invasive surgery. The aim of this review was to identify whether patients would benefit from the surgical intervention in terms of functional recovery and symptomatic improvement, and to find which intervention would provide sustainable results and

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Table 1: Demographic and operative data of the initial intervention.

Variables	
Male	56%
Female	34%
Age (mean)	42
Age (range)	2-90
Affected side	
Right	35%
left	65%
Presentation	
Pain	80%
Incidental	10%
UTI/haematuria	10%
Performance status	
Mean	1
range	0-3
Initial mean split function (%)	20
Range (%)	7-25
Follow-up period	
Median	2 years
range	1-18

quality of life improvements.

Patients and Methods

The patients included in this analysis had been referred either internally or from regional centers based upon clinical diagnosis of pelvic ureteric obstruction. We identified patients from 2007 onwards with confirmed unilateral PUJO *via* cross-sectional imaging and functional dynamic renography (F-15 MAG-3). Patients with 25% or less split function and unilateral obstruction were included. A retrospective analysis has been undertaken using the patient's records via the hospital-based electronic record system. No prospective information has been obtained. Functional and procedural outcomes have been reviewed. A standard paired T-Test was used to derive p-values.

Results

In total 94 patients were identified with PUJO *via* diuretic renography (F-15 MAG-3). The mean age of this cohort was 42 years. Fifty-six percent of the study populations were males. Unilateral pathology was identified in the entire group and the left kidney was affected in 65%. The most common initial presentation was with pain. Incidental finding, recurrent UTI and hematuria accounted for the remaining patients (Table 1). The median follow-up was 24 months and patients underwent follow up renography at 6 months. All patients who had undergone pyeloplasty had a laparoscopic procedure performed with a standard approach [4]. A transperitoneal dismembered Anderson-Hynes technique was the procedure of choice and performed by an experienced consultant surgeon in a tertiary referral centre (Table 2). No intra-operative details were available due to hospital software updates rendering access unobtainable. A successful clinical outcome has been defined as a qualitative reduction in symptoms and maintenance/or improvement of function during follow-up. All patients had a follow up MAG-3 set to the same F-15 protocol as to when originally diagnosed.

Overall functional outcomes

The mean split function at presentation was 20% (range 7% to 25%). 61 patients underwent pyeloplasty and 24 patients were managed endoscopically (6 Fr double JJ stent or endopyelotomy). The choice for primary endoscopic intervention was primarily patient choice with confounding factors such as increased age and

comorbidity were also considered. Of those remaining, 9 patients were managed conservatively, again based upon patient choice with the primary reason being no symptoms and an incidental finding. In total, 7 patients required nephrectomy during follow up and 3 patients were awaiting elective nephrectomy due to ongoing symptoms of pain and infection.

Procedure-specific outcomes

Pyeloplasty group: Sixty-one patients underwent apyeloplasty as their primary procedure. The mean age within this cohort was 33 years with a median follow-up time of 2 years. The mean function within this group was 21% and 24%, pre and post-procedure, respectively (p-value 0.0018). During the follow-up period, no mean decline in biochemical renal function was observed. During the follow-up period nine percent of patients (n=6) described symptoms of chronic pain after initial improvement. However, their mean function was maintained. In total, a nine percent stricture rate (n=6) was observed in this population which required further intervention endoscopically. Again, the mean function was maintained in these patients. Three patients (5%) required subsequent elective nephrectomy (Table 3). Two patients had ongoing pain and recurrent symptomatic UTI's and despite follow up renography showing improvement in the mean split function of the affected kidneys elected to undergo removal of the symptomatic kidney as opposed to further medical/surgical management. One of the nephrectomy patients was a young female with an original function of 25% who presented during follow up with complicated UTI's and repeat renography showed a split function of 7%. There were no intra-operative complications documented to account for this and the MAG-3 was unobstructed. The likely reason for this is that there was a significant delay between the original renogram and her pyeloplasty (>16 months) due to pregnancy which may account for the loss of function during that time period. Another of the nephrectomy patients initially had been referred for a redo pyeloplasty after primary repair (from a different centre) had failed to improve symptoms. This patient maintained function at four years follow up after the redo, however, was unhappy with the recurrent nature of their UTI's and elected for removal of the affected kidney. In total within this group, 85% of patients can be considered to have had a successful outcome based upon the resolution of symptoms and no further intervention.

Non-pyeloplasty group: Thirty-three patients in total underwent an alternative management strategy. The mean age in this group was 56. This represents a 23-year age difference compared to the pyeloplasty cohort. The mean performance status of this cohort was one compared to the pyeloplasty group which was zero. The mean split function prior to and during follow up was the same at 19%; however, a significant number required further intervention. Twelve patients (36%) went on to have further procedures (this does not consider routine ureteric stent changes). 5 patients underwent pyeloplasty with symptomatic improvement and 2 elected for endopyelotomy. Seven patients (23%) went on to undergo elective nephrectomy (2 of these patients had further pain after endopyelotomy). The main indication for nephrectomy was persistent pain, recurrent urinary infections or loss of function (Table 4).

One group of interest is those managed conservatively (n=9). The mean initial function was 20% and at follow-up 19% (median time to second renogram 14 months). 66% (n=6) patients within this cohort presented incidentally and were asymptomatic versus a 10% incidental presentation from the total population (n=94). Within

Table 2: Initial Procedure specific details.

Procedure	Patient number	Mean age	Initial mean split function (%)	Follow-up split function (%)	Re-intervention rate (%)
Pyeloplasty	61	33	21	24	14
Endoscopic intervention	24	59	19	19	36
Conservative management	9	45	20	19	11

Table 3: Further surgical interventions during follow-up.

Group	Re-intervention rate (n)	Nephrectomy (n)	Pyeloplasty (n)	Endopyelotomy (n)
Pyeloplasty (n=61)	9	3	-	6
Non-pyeloplasty (n=33)	12	7	5	2 (prior to nephrectomy)

Table 4: Patients who underwent nephrectomy during follow-up.

Group	percentage	Mean age	Performance status mean	Split function (%) Pre Post	
Pyeloplasty	5 (n=3)	40	0	21	15
Non-pyeloplasty	23 (n=7)	51	1	19	13

those managed conservatively 1 patient (aged 90 at presentation) lost function but did not elect for further intervention and 1 patient underwent nephrectomy due to recurrent UTI and flank pain. The results from this group may indicate that in a patient with incidentally identified PUJO who are asymptomatic and co-morbid, the function may be maintained with conservative treatment and close follow-up. However, the numbers are not large enough to say with any statistical certainty.

Discussion

There is limited long term outcome data post-intervention in poorly functioning unilateral-obstructed kidneys available within the academic literature. Functional recovery has not been analyzed and published in high-level evidence bases in the adult population unlike in the pediatric population where excellent functional recovery can be seen in the correctly selected patients [4]. Logically, the published data shows that the poorer the preoperative function and the worsening patient morbidity the worse the functional improvement postoperatively [5]. It is also hypothesized that in chronically obstructed kidneys an automated form of progressive nephropathy may occur despite resolution of the initial obstructing insult resulting in no significant functional recovery [6]. The specific characteristics for this proposal have not been fully identified resulting in an inability to sensitively identify those who will functionally have the greatest outcomes from intervention [7]. Historically open pyeloplasty was associated with significant morbidity, and in poorly functioning chronically obstructed kidneys no significant quality of life improvements [8]. There are currently no highly sensitive methods of predicting which patient will benefit most in terms of functional recovery after de-obstruction. Increasing age, co-morbidity, recurrent pyelonephritis and increasing time of obstruction are negative prognostic factors [9]. The earlier a kidney is de-obstructed the likelier it is that functional recovery will be observed [10]. Parenchymal depth prior to intervention which can be sensitively assessed by grey-scale ultrasonography has been shown to correlate well with recovery [11]. Pyelo-lymphatic backflow has been theorized to play an important factor in reducing renal pelvis pressure during obstruction. Gillen water et al. [12] showed that irreversible necrosis of tubules is seen within 48 h when both the ureter and lymphatics are occluded compared to several months with complete ureteric obstruction alone. Maintenance of function will be seen in the majority of patients with PUJO as there will be a degree

of ureteric drainage combined with pyelo-lymphatic backflow. It is likely that in those patients with less than ten percent function with PUJO the ureter is either completely obstructed or the lymphatic backflow is very poor. Tc-DTPA in chronically obstructed kidneys has shown promise in 'predicted functional recovery' due to its sensitive measure of GFR in the setting of significant tubular damage when compared to MAG-3 and DMSA [13]. Urinary biomarkers such as lysosomal enzyme N-Acetyl-Glucosaminidase (NAG) and transforming growth factor Beta have not proven specific or sensitive enough to be considered a useful diagnostic test [14,15]. Ultimately a combination of clinical/patient factors, imaging and patient choice should guide decisions on who may benefit from de-obstructive surgery. In the past, a nephrectomy was considered a suitable first-line management strategy in symptomatic poorly functioning kidneys. The basis of this clinical strategy was founded from a seminal paper published in 1943 theorizing renal counterbalance and renal atrophy of disuse [16]. The pathological mechanism suggested that contralateral renal hypertrophy in the healthy non-obstructed kidney occurs within 6 to 8 weeks and ultimately leads to renal atrophy in the obstructed kidney. Animal and human models subsequently showed that this was not the case and functional improvement can be seen after de-obstruction [17,18]. With the continued innovation and development of minimally invasive surgery and the long-term cardiac risk factors associated with total nephrectomy seen in renal cancer patient's nephron preservation is now considered the gold standard in all patients if suitable [19]. Within the cohort presented here, it appears that function can be maintained in the majority of patient's cases when an appropriate intervention is selected on an individual basis. This outcome clinically has important ramifications particularly in those in whom functional preservation is imperative i.e. single kidneys and chronic kidney disease. Contrary to early theories it is now understood that if the non-obstructed kidney is poorly functioning then the recovery within the obstructed kidney after de-obstruction maybe even greater compared to having a fully functioning contralateral renal unit. This was shown by Schirmer and Hendricks whilst studying the metabolic aspects of unilateral obstruction [20]. Endoscopic management can maintain function; however, there is a clear distinction in outcomes between those managed with a pyeloplasty and in those managed with a less invasive measure. When selecting for a specific intervention within this cohort a clinician must consider the overall long-term impact on the quality of life as the main factor when counseling. Patients

must be aware of the potential for further procedures when electing for less invasive measures. Alternatively, conservative management in elderly asymptomatic patients may be a sensible decision. The overall clinical success within the pyeloplasty cohort (85%) correlates well with known literature, range 84% to 98% [21,222]. There are no randomized trials in poorly functioning kidneys to directly compare outcomes. The re-intervention rates are higher when compared to other retrospective series [23]. The underlying reason for this is unclear as intraoperative details are unavailable regarding the difficulty of the procedures. It is clear, however, that patient choice was a significant contributing factor to the higher than average nephrectomy rate given that the function was maintained in the majority. The results of this analysis show a clear difference in the patients experience at follow up after pyeloplasty compared to less invasive measures. The majority of patients at follow up described improved pain symptoms and reduction in infection rates following pyeloplasty. Seventeen patients managed with an alternative approach with time required further invasive procedures.

Limitations

The information presented from this analysis must be interpreted within the confines of its limitations. The median follow up time of 2 years is inadequate to justify solid recommendations. The retrospective nature and lack of operative details lead to uncertainty when interpreting the complication rates. Despite this, it is from this analysis that if clinically suitable for major intervention a laparoscopic pyeloplasty is the optimal procedure and preservation of function and symptomatic improvements will be seen in the majority despite the original split function of the affected kidney.

Conclusion

Pyeloplasty should be considered in all patients presenting with unilateral PUJO and poor function, defined here as less than 25% on dynamic renography. Long term outcomes show the maintenance of function and improvement of symptoms. Alternative interventions, on the whole, are associated with increased rates of re-intervention and kidney loss, and should only be considered in especially selected populations.

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