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Comparative Study Between Anderson-Hynes Pyeloplasty Through Transperitoneal Laparoscopic Approach Versus Vertical Lumbotomy Approach in UPJO Repair

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Abstract: *Background*: Since 1949 dismembered pyeloplasty technique which was introduced by Anderson and Hynes has been the gold standard for the surgical correction of UPJO. And for decades Laparoscope has been the preferred approach. However, in Egypt - like many other developing countries- there is a limitation of laparoscopic interventions due to the limited number and distribution of laparoscopic sets. This limited availability forced many urologists in general hospitals to refer UPJO patients to tertiary centers and university hospitals, which added more burden on the already exhausted facilities. *Objective*: In this paper, we tried to explore options available to urologists who are working in areas where laparoscopic sets aren't available. We suggested the vertical lumbotomy approach to be explored in this study. *Method*: The study was conducted at El Demerdash Hospital in 2016. It included 20 patients with symptomatic UPJO. Patients were allocated to the 2 groups, 10 patients each using the closed envelop method. *Results*: Significantly shorter hospital stay in the vertical lumbotomy group. No statistically significant differences were noted between the studied group regarding postoperative pain, frequency of irritative LUS, hematuria, and pyuria. *Study limitations*: There were limitations of the study that might have affected its results such as the experience caliber of both teams, there were no unified preset criteria for post-operative management and there wasn't enough data about the learning curve of each approach. *Conclusion*: The laparoscopic approach for correction of UPJO is still the gold standard, however in some areas in developing countries which might be deprived of enough laparoscopic sets, the vertical lumbotomy approach can be utilized after proper training. This study results shouldn't be applied in hospitals where the laparoscopic approach is established for UPJO surgery.

Keywords: UPJO, Laparoscopic, Vertical Lumbotomy

1. Introduction

Ureteropelvic junction obstruction (UPJO) is defined as impeded urine outflow from the renal pelvis to the ureter, which may result in progressive damage to the kidney.

Etiology and epidemiology

There are multiple possible causes, which can be categorized to intrinsic versus extrinsic, or congenital versus acquired.

With a varying incidence of approximately 1 per 750–2,000, unilateral UPJO represents the most common obstructive uropathy.

Congenital UPJO affects approximately 1: 1,000–2,000 live births, with a male to female ratio of 2:1 and can be detected at any time, ranging from in utero (pre-natal ultrasonography) to old age. Two thirds of congenital cases affect the left kidney, with 10–46% occurring bilaterally.

The overall incidence of UPJO is 1 in 1,500; adults are more likely to present with UPJO secondary to acquired causes, such as kidney stones or previous surgery, with symptoms of acute renal colic and chronic back pain that can be exacerbated by increased fluid intake and diuretics. [1] Other nonspecific presenting features include haematuria, UTI, pyelonephritis and causal hypertension. Rarely, UPJO is detected incidentally on imaging. If left untreated, UPJO can cause an increase in back pressure on the kidney.

Hydronephrosis involves dilatation and distension of the renal pelvis and calyces, which leads to interstitial fibrosis, loss of nephrons and, ultimately, renal failure.

Diagnosis of UPJO

Imaging

Diuretic renography (DR)

Diuretic renography with technetium Tc 99m MAG3 is the main diagnostic tool for detecting the presence of obstruction. [2]

CT

Multi-detector row computed tomography (CT) with two and three dimensional post processing allow a comprehensive, single-study assessment of the uretero-vascular relationships in UPJO [3].

Multidetector CT angiography permits an adequate preoperative assessment of patients with UPJ obstruction as it is able to identify the presence and location of crossing vessels. Furthermore, it allows studying in detail the anatomy of the renal area and its vascular variants [4].

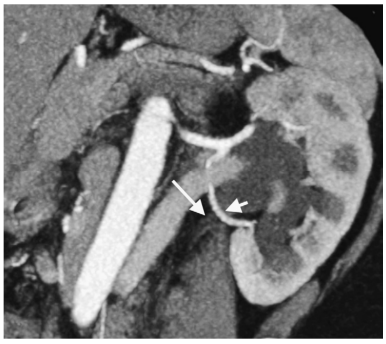

Figure 1. *Coronal maximum intensity projection (MIP) image of a 50-year old female patient demonstrating an anterior crossing vessel; a segmental renal artery (short white arrow); in contact with the UPJ (long white arrow) [4].*

MRI

MRI with contrast-enhanced MRA (MR angiography) is suitable to detect aberrant and obstructing renal arteries. An obstructive effect of the aberrant vessel is to be assumed if the vessel has a close relationship to the ureteropelvic junction and if it is linearly stretched [5].

Functional MRI (fMRI) was found to be a valuable source of information in the preoperative identification of the presence of a crossing vessel [6]. In addition, MR urography (MRU) allows detection of crossing vessels in pediatric UPJ obstruction. Although these vessels are the primary cause of obstruction in some children, they are incidental and non-contributory in others [7]. MRU can substitute for other imaging modalities and provide detailed information about the morphology and function of the affected kidney [8].

Dynamic Contrast-enhanced MRI provided better details of the anatomy when being compared to ultrasound and nuclear renogram. It doesn't include ionized radiation to children or infants but requires the subject to be sedated. It also equals the nuclear medicine to evaluate the split renal function and the mechanical obstruction. The contrast material is "Gadolinium" which is a complex of molecules between Gadolinium ion and a chelating agent to prevent toxicity of the Gadolinium which is injected intravenously and eliminated through the kidney and assessed by RTT (Renal Transit Time).

Treatment of UPJO

Overview

The indications for surgical intervention in patients with UPJO include symptoms associated with an obstructive system, impaired split renal function (the ratio of renal function between the ipsilateral and contra lateral kidneys) on diuretic renography, presence of renal calculi on CT and development of hypertension. Treatment aims to improve renal drainage, renal function and to resolve clinical symptoms. In the absence of these indications patients are closely monitored with CT and their management plan is dependent upon progression of clinical symptoms and/or impaired split renal function on diuretic renography.

Before evaluating the different procedural techniques used to treat UPJO, it is important to define a 'successful' procedure. Unfortunately, there is no universal consensus in the literature, which makes comparison of outcomes difficult [1].

Treatment Options

1. Minimally invasive
2. Open approach

Traditionally open pyeloplasty has been the standard of care. In addition, over the last three decades, minimally invasive treatment options for ureteropelvic junction obstruction have been developing and became more popular. Multiple series of laparoscopic pyeloplasty have demonstrated high success rates and low postoperative morbidity in pediatric and adult populations, for both the transperitoneal and retroperitoneal approaches [9].

Minimally invasive techniques

1. Antegrade Endopyelotomy
2. Retrograde Endopyelotomy
3. Robot-assisted laparoscopic pyeloplasty

1.1. Laparoscopic Approach

Laparoscopic pyeloplasty was first reported in the adult population by Kavoussi and Peters (1993) [10, 11] and Schuessler and colleagues (1993). [12]

Tan (1999) reported the first pediatric series of transperitoneal laparoscopic dismembered pyeloplasty in 18 children aged 3 months to 15 years [13]. Yeung et al., (2001) [14] described their initial experience with laparoscopic retroperitoneal dismembered pyeloplasty in 13 children, 1 of whom required open conversion. El Ghoneimi et al., (2003) [15] reported their experience of 50 retroperitoneal laparoscopic pyeloplasties in children aged 22 months to 15 years. Similarly, Reddy et al., [16] performed laparoscopic pyeloplasties in 16 children, 5 months to 11 years old.

1.2. Dorsal Lumbotomy

The posterior lumbotomy for pediatric pyeloplasty is useful in the form of smaller incision than traditional flank

incision, easy and quicker access to the location of the pathology, relatively short time of operation and recovery to normal activity. It could be practiced in urological surgeries if cases are selected with great attention. (Halder P, et al [17].

Dorsal lumbotomy dismembered pyeloplasty to correct UPJO is mainly performed with success in age under 5 years. A study was done using this technique with a 2 groups of children the first group weighing 1 - 8 kg and the other group 11-35 k. Mean operative time was shorter in the first group (98 minutes to 120 minutes), hospital stay with equal 2.5 days. Analgesia was 50% higher in the 2nd group. Success rate was equal after 26 months of follow up.

The study concluded that dismembered pyeloplasty is effective and safe in the young and older children. [18]

A study with 59 children with median age 5.7 years who underwent transverse dorsal lumbotomy. Median time was 78 minutes and median length of incision was 3-5 cm. All of children took liquid diet in the same day of surgery and returned to their normal activity within 48 hours. 88% were discharged in less than 30 hours. The study concluded that transverse dorsal lumbotomy provided an excellent exposure for UPJO pyeloplasty with appealing scar cosmetically and beneficial in bilateral cases as bilateral repair can be done without repositioning patient. [19]

2. Patients and Methods

The study was conducted at El Demerdash Hospital in the period extending from June 2016 through December 2016. It included 20 patients with symptomatic UPJO (recurrent pain, urolithiasis, deteriorating kidney function). We excluded patients with BMI >30, recurrent UPJO after one or more previous corrections and children less than 3 years due to unavailability of laparoscopic sets for this age group in the place of study.

Patients were allocated to the 2 groups using the closed envelop method, each group had 10 patients. Group I underwent vertical lumbotomy approach approach while group II was allocated for Laparoscopic approach. All cases were followed up in outpatient clinic and reassessed using radiological investigations including U/S, IVP, and Renal Scan.

3. Results

Table 1. *Comparison between the studied groups regarding the operative data.*

	GI n=10	GII n=10	P value
Operative time (min.)	77.3±16.7	175.0±56.4	0.0003*
Leakage amount (ml)	120.0±82.8	220.0±216.4	0.19
Leakage duration (days)	1.9±0.8	3.5±2.0	0.043*
Catheter duration (days)	2.0±1.1	3.0±1.8	0.16
Drain removal time (days)	4.1±1.5	5.3±1.2	0.07

This table shows significantly longer operative time and leakage duration in GII patients when compared with GI.

Table 2. *Comparison between the studied groups regarding the hospital stay and complications.*

	GI n=10	GII n=10	P value
Hospital stay (days)	2.7±1.1	6.1±2.3	0.001*
Postoperative pain (VAS)	5.2±1.3	4.7±1.6	0.47
Irritative LUS	1 (10.0%)	1 (10.0%)	1.0
Hematuria	1 (10.0%)	-	0.31
Pyuria	-	1 (10.0%)	0.31

VAS: Visual analog scale, LUS: Lower urinary symptoms.

This table shows significantly shorter hospital stay in GI patients when compared with GII patients. No statistically significant differences were noted between the studied group regarding postoperative pain, frequency of irritative LUS, hematuria and pyuria.

Table 3. *Comparison between the studied groups regarding the postoperative 3 months follow up findings.*

	GI n=10	GII n=10	P value
Missed follow up	-	1 (10.0%)	0.31
IVP (Non-secretory)	1 (10.0%)	2 (20.0%)	0.47
Pelvi-calyceal dilatation	2 (20.0%)	2 (20.0%)	1.0
Split renal functions (%)	32.5±8.2	28.9±15.4	0.53

This table shows no statistically significant differences between the studied groups regarding the postoperative follow up findings.

Study Limitations

1. In the operative room, it was noticed that the teams handling the laparoscopic approach group were much younger and of lesser urological experience years than the team handling the vertical lumbotomy approach, which might have been affected the outcome of the study.
2. There was no preset criteria to discharge the patients nor catheter removal, which might have affected the hospital stay and the catheter removal time.
3. There was no data collected about the learning curve for each approach (time required to master the laparoscopic approach and vertical lumbotomy approach).

4. Conclusion

The laparoscopic approach for correction of UPJO is still the gold standard, however in some areas in developing countries which might be deprived from enough number of laparoscopic sets, vertical lumbotomy approach can be utilized after proper training time for urologists there.

This study results shouldn't be applied in hospitals where the laparoscopic approach is established for UPJO surgery.

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