Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol.11, Issue (2022)
https://www.jneonatalsurg.com

OPEN ACCESS

Assessment of the Clinical Outcome of Management of Prenatally Detected Severe Bilateral Ureteric-Pelvic Junction Obstruction

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Cite this paper as: Hussein Mamdoh, El-Gamal OM, (2022) Assessment of the Clinical Outcome of Management of Prenatally Detected Severe Bilateral Ureteric-Pelvic Junction Obstruction .Journal of Neonatal Surgery, 11, 45-50

ABSTRACT

Background: Hydronephrosis is the most frequently encountered genitourinary issue during prenatal ultrasounds. Antenatal and neonatal hydronephrosis are predominantly caused by ureteric-pelvic junction obstruction (UPJO). Our purpose was to evaluate the clinical prognosis of the severe bilateral UPJO management that was prenatally detected.

Methods: This retrospective study analyzed the records of patients diagnosed with bilateral hydronephrosis, grades 3–4, which subsequently led to the severe UPJO diagnosis on postnatal ultrasonography. All patients underwent voiding cystourethrography (VCUG) during the perinatal period. Ultrasonography was repeated within 4 weeks of birth.

Results: 11 patients out of the 34 patients referred with antenatal bilateral hydronephrosis (5.98%) with grade 3–4 hydronephrosis. Two patients (18.18%) had hydronephrosis with complications; they underwent bilateral percutaneous nephrostomies. A total of four patients (36.36%) were diagnosed with bilateral grade 4 hydronephrosis and underwent unilateral open pyeloplasty with contralateral stenting. The number of patients with unilateral grade 4 hydronephrosis and contralateral grade 3 hydronephrosis was five (45.45%). Four of the five patients demonstrated an improvement in their hydronephrosis on ultrasonography and a favourable drainage pattern on a renal scan, while one patient had deteriorated and underwent late pyeloplasty on a worsening renal unit with a significant decrease in relative renal function (RRF).

Conclusions: In neonates presenting with bilateral UPJO, consecutive bilateral pyeloplasty was an effective approach for such cases, which found hydronephrosis improvement on ultrasonography and a good drainage pattern on the 99mTc-MAG3 renal scan..

.**Keywords**: *Clinical; Outcome; Management; Prenatal; Severe; Bilateral; Ureteric-Pelvic Junction Obstruction*

1. INTRODUCTION

On prenatal ultrasounds, hydronephrosis is the most frequently identified genitourinary abnormality [1]. Prenatal and neonatal hydronephrosis are predominantly caused by UPJO. Approximately one in 1500 live births is the estimated prevalence, with a male-to-female ratio of approximately 3-4 to 1 [2].

The difficulties in managing infants with prenatally diagnosed UPJO arise from the absence of diagnostic instruments capable of detecting obstructions that may result in renal function deterioration or hinder normal renal development. Because of the widespread adoption of routine antenatal ultrasonography, the incidence of foetal hydronephrosis has significantly increased [3, 4].

The first course of treatment for the majority of patients who present with unilateral UPJO is conservative. The surgical intervention is reserved for individuals who exhibit a significant reduction in differential renal function (DRF) during subsequent visits [5].

Bilateral UPJO is a rare and complex condition frequently linked to considerable morbidity [6]. In contrast to unilateral UPJO, At present, there is no established protocol for the neonatal management of bilateral severe UPJO that is diagnosed antenatally [7]. If bilateral UPJO occurs, the recuperation of the contralateral, less afflicted kidney during serial follow-up evaluations may result from pyeloplasty performed on one side [8, 9]. A persistent dispute and disagreement among the authors regarding the management protocols for individuals with bilateral severe UPJO has been the consequence of this [10].

Our purpose was to evaluate the clinical prognosis of the severe bilateral UPJO management that was prenatally detected.

Patients and Methods

This retrospective study analyzed the records of patients diagnosed with bilateral hydronephrosis, grades 3–4, according to the Society of Fetal Urology (SFU) classification [11], which subsequently led to the severe UPJO diagnosis on postnatal ultrasonography, at the Urology Department in Tanta University Hospitals from March 2021 to September 2021.

Exclusion criteria were neonates presenting with unilateral grade 3-4 and contralateral grade 1-2 hydronephrosis, as well as those exhibiting other urinary tract anomalies.

All patient records were gathered, encompassing detailed history including age and gender, and laboratory investigations, including creatinine levels and blood urea nitrogen. To exclude presence of a posterior urethral valve (PUV) and identify associated vesicoureteric reflux (VUR) using this method, voiding cystourethrography (VCUG) was administered to all patients during the perinatal period. Within four weeks of birth, ultrasonography was conducted again to evaluate hydronephrosis, with a particular focus on SFU grade progression and renal anteroposterior diameter (APD) measurement. The radiologist documented the presence or absence of parenchymal thinning in order to designate a grade 4 SFU, taking into account the inconsistent reporting and analysis of parenchymal measurements.

The renal function and diuretic drainage properties were assessed using a well-calibrated diuretic renogram, which was performed using a 99m Technetium mercaptoacetyl triglycine (99m Tc-MAG3) renal scan and a standard intravenous furosemide protocol [12]. The postoperative and preoperative outcomes were compared using the single-kidney glomerular filtration rate (s-GFR), as the bilateral condition may have affected the DRF.

In an effort to stabilise patients who initially presented with bilateral grade 4 hydronephrosis and complications, such as respiratory distress caused by a large mass or sepsis, bilateral intervention was implemented. This intervention included percutaneous nephrostomy, which involved the insertion of a 6 F pigtail catheter under ultrasound guidance for a period of one week.

In pediatric patients who present with bilateral grade 4 hydronephrosis that is uncomplicated, unilateral pyeloplasty combined with contralateral retrograde stenting was executed between 4 and 8 weeks of age. The primary objective of the contralateral stenting was to mitigate the risk of functional impairment or rupture during the observation period. Following a four-week interval, the stent was extracted, and a contralateral re-evaluation was immediately conducted utilising renography. No improvement was observed in the contralateral unit; therefore, a contralateral pyeloplasty was done between 12 and 16 weeks.

The patient was positioned supine for bilateral pyeloplasty, and an anterior transverse extraperitoneal approach was employed. The surgeon alternated between the two sides as required. Antegrade DJ stenting was implemented in conjunction with a nephrostomy in all bilateral pyeloplasties. The stent was extracted after a period of four to 6 weeks, and the nephrostomy was removed prior to discharge. Stent removal and contralateral pyeloplasty were performed concurrently between eight and twelve weeks, and unilateral pyeloplasty was conducted within four weeks when contralateral cystoscopy or retrograde stenting was feasible.

Patients who presented with unilateral grade 4 and contralateral grade 3 UPJO underwent unilateral open pyeloplasty on the more severely affected side between the ages of 8 and 12 weeks. The catheter was removed after four weeks. The potential for further development or deterioration of the contralateral renal unit was evaluated in the subsequent assessment. Standard open dismembered pyeloplasty was performed on neonates and infants in the supine position using an anterior extraperitoneal approach. The same surgeon used 6-0 Vicryl to execute the pelvic reduction procedure. We encountered no difficulties in performing antegrade stenting during pyeloplasty. The postoperative diuresis was evaluated using a prompt input/output chart. The immediate postoperative period was characterised by attentive monitoring of serum electrolyte levels and fluid balance, and supplementation as required.

All cases underwent follow-up assessments utilising ultrasonography and renography at 3 months, and six months. Dismembered pyeloplasty was performed for cases experiencing a subsequent decline within the follow-up period. The case records were analysed to evaluate the resolution of APD or the improvement of s-GFR in the surgical facilities.

Sample size:

The World Health Organisation (WHO) and the Centres for Disease Control and Prevention (CDC) collaborated to create the EpI-Info 2002 software statistical application, was employed to calculate sample size. The sample size was determined by taking into account the following factors: The study's power and 95% level of significance were used to demonstrate the prevalence of bilateral grade 3–4 hydronephrosis, which accounted for 2% of all antenatal hydronephrosis in a previous study [10]; therefore 11 patients were included.

Statistical analysis:

The SPSS v28 tool, created by IBM (Armonk, NY, USA), was utilised for statistical analysis. Shapiro-Wilks and histograms were used to confirm that the data distribution was normal. Following analysis with an unpaired student t-test, the quantitative

parametric data was displayed as means and standard deviations (SD). The IQR and median were used to display quantitative non-parametric data. The Mann Whitney-test was employed for evaluation. The frequency and percentage (%) of qualitative variables were reported, and when applicable, for this data analysis, we resorted to Fisher's exact test or a chi-square test. To be deemed statistically significant, the two-tailed P value has to be less than 0.05.

Results

In the current study, 184 cases were referred with antenatal hydronephrosis, 34 (18.47%) patients had UPJO and 11 patients out of the 34 patients referred with antenatal bilateral hydronephrosis (5.98%) with grade 3–4 hydronephrosis. Of the 11 cases, there were 10 (90.91%) males and 1 (9.09%) female. Their mean age was 2.73± 0.47 months. Two patients (18.18%) of the eleven cases had hydronephrosis with complications; they underwent bilateral percutaneous nephrostomies which were placed urgently with no antegrade flow seen followed by bilateral open pyeloplasty. A normalization of creatinine and potassium was achieved within 24 hours. The contrast media passed readily down the ureters in repeated nephrostograms 24 hours after the systems were decompressed, confirming the narrowed PUJs on both sides. The diagnosis of bilateral grade 4 hydronephrosis was made in four patients (36.36%), who underwent unilateral open pyeloplasty with contralateral stenting. The patients were re-evaluated following stent removal. Regarding the improvement, 2 patients (50%) improved, while 2 (50%) worsened and needed contralateral pyeloplasty. The mean preoperative parenchymal thickness was 3.55± 1.37 mm

Table 1: Demographic data of the studied patients

		Total (n=11)
Age (months)		2.73± 0.47
Gender	Male	10 (90.91%)
	Female	1 (9.09%)
Preoperative parenchymal thickness (mm)		3.55± 1.37

Data presented as mean ± SD, median (IQR) or frequency (%).

The remaining five patients (45.45%) had unilateral grade 4 hydronephrosis and contralateral grade 3 hydronephrosis; The side with the most severe hydronephrosis underwent surgery, while the side with grade 3 hydronephrosis was observed without stenting. In terms of improvement, four patients exhibited an improvement in their hydronephrosis on ultrasonography and a favourable discharge pattern on the renal scan. However, one patient experienced a deterioration and underwent a late pyeloplasty. In the current study; 6 patients (who were stented or electively observed) had been improved spontaneously. At 3 months, the s-GFR was significantly higher in the patients who recovered spontaneously compared to those who underwent surgery (44.17± 6.4 vs., 17.2± 3.03 ml/mt, P<0.001). Meanwhile the APD was significantly decrease in the cases who recovered spontaneously than those who underwent surgery (22.67± 1.37 vs. 30± 2.16 mm, P<0.001). While parenchymal thickness was significantly increase in patients who recovered spontaneously compared to those who underwent surgery (6.6± 1.31 vs. 4.7± 0.48 mm, P=0.025). **Table 2**

Table 2: Outcome of the studied patients at 3 months

	Recovered spontaneously (n=6)	Underwent surgery (n=5)	P value
s-GFR (ml/mt)	44.17± 6.4	17.2± 3.03	<0.001*
APD (mm)	22.67± 1.37	30± 2.16	<0.001*
Parenchymal thickness (mm)	6.6± 1.31	4.7± 0.48	0.025*

Data presented as mean ± SD, s-GFR: single-kidney glomerular filtration rate, APD: anteroposterior diameter *: statistically significant as p value <0.05

At 6 months, s-GFR was significantly increase in the cases who recovered spontaneously compared to those who underwent surgery (51.83± 6.11 vs., 23.4± 3.44 ml/mt, P<0.001). Meanwhile the APD was significantly decrease in the cases who recovered spontaneously than those who underwent surgery (18.83± 0.98 vs. 25.25± 2.5 mm, P<0.001). While the parenchymal thickness was significantly increase in patients who recovered spontaneously compared to those who underwent surgery (9.07± 1.17 vs. 6.9± 1.58 mm, P=0.028). **Table 3**

Table 3: Outcome of the studied patients at 6 months

	Recovered spontaneously (n=6)	Underwent surgery (n=5)	P value
s-GFR (ml/mt)	51.83± 6.11	23.4± 3.44	<0.001*
APD (mm)	18.83± 0.98	25.25± 2.5	<0.001*
Parenchymal thickness (mm)	9.07± 1.17	6.9± 1.58	0.028*

Data presented as mean ± SD, s-GFR: single-kidney glomerular filtration rate, APD: anteroposterior diameter *: statistically significant as p value <0.05

2. DISCUSSION

In children and young adults, UPJ obstruction is a common condition; however, it can occur at any age and is often accompanied by complications that arise from a delayed diagnosis. Various degrees of renal function impairment, hydronephrosis, stone formation, and pyelonephritis are among the various complications. A significant morbidity rate is associated with bilateral obstruction of UPJs, which is an uncommon occurrence [13].

Approximately 35% of patients in a series with bilateral severe hydronephrosis, SFU grades 3 and 4, demonstrated progressive renal deterioration that required surgical intervention [14].

The neonates with unilateral UPJO management has long been a subject of controversy, and this issue has persistently occupied the attention of numerous paediatric urologists. Some researchers argue that early surgical intervention may not invariably be justified [15].

Ransley et al., [16] determined that majority of cases with non-refluxing hydronephrosis can be managed conservatively, exhibiting symptoms of improvement or complete resolution. Cartwright et al., [17] suggested that a prudent management approach is to implement an initial conservative strategy that includes sequential renal scan assessments and delayed pyeloplasty as indicated in cases of kidney with evident UPJO and preserved function.

We found that two patients (18.18%) of the eleven cases had hydronephrosis with complications; They underwent bilateral percutaneous nephrostomies that were performed urgently in the absence of antegrade flow, followed by bilateral open pyeloplasty. A normalisation of creatinine and potassium was achieved within 24 hours. Repeated nephrostograms were performed 24 hours after the systems were decompressed to confirm the narrowed PUJs on both sides. This verified that the contrast media was readily transported through the ureters. Four patients (36.36%) were diagnosed with bilateral grade 4 hydronephrosis and underwent unilateral open pyeloplasty with contralateral stenting. The patients were re-evaluated following stent removal. Regarding the improvement, 2 patients (50%) improved, while 2 (50%) worsened and needed a contralateral pyeloplasty. In the remaining five patients (45.45%), who had unilateral grade 4 hydronephrosis and contralateral grade 3 hydronephrosis; 1 (20%) patient underwent open pyeloplasty and 4 (80%) patients were simply observed without stenting. In terms of improvement, four cases were found to have improved hydronephrosis on ultrasonography and a good drainage pattern on 99mTc-MAG3 renal scan after consecutive bilateral pyeloplasty. One patient, however, had deteriorated and underwent late pyeloplasty on a worse renal unit with a significantly lower RRF. In the current study; 6 patients had been improved spontaneously.

Consistent with our findings, King et al. [18] showed that early correction for UPJO is recommended promptly after diagnosis, and that young neonates tend to exhibit more rapid improvement in RRF compared to older children. Tapia and Gonzalez [19] It was showed which pyeloplasty is effective in improving renal function in children under the age of one who have hydronephrosis with grades 3 or 4 due to UPJO. They also recommended early pyeloplasty for children who are demonstrating decreased kidney function.

Eckstein and Drake [20] exhibited the feasibility of performing concurrent bilateral open pyeloplasties, though Schwab and Casale [21] successfully carried out concurrent bilateral laparoscopic pyeloplasties with favourable results. Nonetheless, Staged pyeloplasties, which have been traditionally administered, have been recommended as a secure surgical approach.

In instances of bilateral hydronephrosis, certain centres recommend an immediate 'well-tempered' diuretic renogram [22]; however, given postnatal ultrasound findings observed on the 3th day of life, At this early stage, we are uncertain whether this infant would have been subjected to such an investigation.

Gordon [12] suggested its application during the early perinatal stage in rare situations such as bilateral UPJO. Babu [10] also employed renogram (s-GFR) as an indicator of recovery in patients done conservatively. They concluded that the probability of postoperative functional recovery was limited in units with an initial s-GFR of less than 10 ml/m.

Uncomplicated, severe bilateral Grade 4 UPJO may be treated with unilateral pyeloplasty and contralateral stenting. It may

hypothetically inhibit the deterioration of the untreated unit, facilitate recovery in certain cases without surgical intervention, and can be considered when there is concern about an imminent rupture. Nevertheless, it is essential to notify parents that UPJO is a restricted, adynamic segment and that a stent can be effectively inserted across it. As a result, the issue may not be resolved by stenting alone, and UPJO may recur after stent removal, requiring surgical intervention at a later level. Nasser et al., [23] favoured the use of external nephrostents for pyeloplasties, Contrary to a nephrostent, we advocate for an internal DJ stent due to its ease of management for parents in neonates and its ability to be maintained for an extended period.

We found that 6 patients improved spontaneously. At 3 months, the s-GFR was significantly higher in the patients who recovered spontaneously compared to those who underwent surgery (44.17± 6.4 vs., 17.2± 3.03 ml/mt, P<0.001). Meanwhile the APD was significantly decrease in patients who recovered spontaneously compared to those who underwent surgery (22.67± 1.37 vs. 30± 2.16 mm, P<0.001). While the parenchymal thickness was significantly increase in patients who recovered spontaneously compared to those who underwent surgery (6.6± 1.31 vs. 4.7± 0.48 mm, P=0.025). At 6 months, the s-GFR was significantly higher in the patients who recovered spontaneously compared to those who underwent surgery (51.83± 6.11 vs., 23.4± 3.44 ml/mt, P<0.001). Meanwhile the APD was significantly decrease in cases who recovered spontaneously than those who underwent surgery (18.83± 0.98 vs. 25.25± 2.5 mm, P<0.001).

In accordance with our findings, Babu [10] observed initial APD and s-GFR outcomes of 3 operated groups and those that demonstrated spontaneous improvement. The median initial s-GFR, which was 40.5 (± 3.25) ml/min in the units that recovered spontaneously, was significantly increased, while the median initial APD was significantly decreased, at 24.0 (± 4.5) mm.

Furthermore, Kim et al., [15] It was demonstrated that the hydronephrosis in non-operated renal units of neonates had severe bilateral UPJO improved or resolved, had SFU grade 3 hydronephrosis and, some patients develop SFU grade 4 hydronephrosis as a result of unilateral pyeloplasty of the afflicted renal unit.

Our investigation was retrospective and nonrandomized, which may have produced bias. Additionally, sample size was relatively small, and follow-up period was brief.

3. CONCLUSIONS:

In neonates presenting with bilateral UPJO, consecutive bilateral pyeloplasty was an effective approach for such cases, which found the hydronephrosis improvement on ultrasonography and a good drainage pattern on ^{99m}Tc-MAG3 renal scan. A high rate of improvement were obtained with high s-GFR which served as a reliable predicator for the assessment of the bilateral UPJO.

Therefore, larger randomized cohorts with larger sample size and extended follow-up duration are recommended.

Financial support and sponsorship: Nil

Conflict of Interest: Nil.

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