Original Article

Bilateral ureteropelvic junction obstruction: Factors guiding management

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ABSTRACT

Background: The management of prenatally detected hydronephrosis due to bilateral ureteropelvic junction obstruction (UPJO) remains controversial. No definite recommendations exist regarding management, and many authors recommend unilateral or bilateral pyeloplasty. **Objective:** This study was conducted to evaluate the clinical outcome of patients with bilateral UPJO treated at a tertiary care hospital. **Materials and Methods:** This descriptive study was performed in the Department of Pediatric Surgery, Lucknow. All patients with prenatally diagnosed bilateral hydronephrosis and postnatal diagnosis of bilateral UPJO, who underwent initial unilateral pyeloplasty, were prospectively evaluated and were included in the study. The outcome of contralateral hydronephrosis was assessed as resolution or surgery. **Results:** A total of 16 patients underwent initial unilateral pyeloplasty and met the inclusion criteria (mean age: 2.6 months). Of all 16 patients, 12 (75%) had resolution and 4 (25%) patients required additional contralateral pyeloplasty during the follow-up. The mean follow-up period was 18 months (range 9–36 months) and the mean anteroposterior pelvic diameter and pelvis-to-cortex (P/C) were significantly different among the groups ($p<0.01$). **Conclusion:** Our findings suggest that in children with bilateral UPJO type of hydronephrosis, improvement or resolution of the contralateral renal unit can occur following initial unilateral pyeloplasty for the worse renal unit. In patients in whom both the renal units have similar split renal function and grades of hydronephrosis, pelvic AP diameter, cortical thickness, and P/C ratio can be used to determine the likelihood of contralateral delayed pyeloplasty.

Key words: *Bilateral, Hydronephrosis, Pelvic diameter, Pelvis-to-cortex ratio, Pyeloplasty, Ureteropelvic junction obstruction*

One of the most common causes of antenatally diagnosed hydronephrosis is ureteropelvic junction obstruction (UPJO) [1]. Most of the literature in the past two decades deals with unilateral hydronephrosis with a normal contralateral kidney. Many authors manage such cases by non-operative observation, reserving surgery for deteriorating function, or symptoms [2-5]. Compared with unilateral UPJO, however, few published reports deal with the management protocol for patients with prenatally diagnosed bilateral hydronephrosis that leads to the postnatal diagnosis of bilateral UPJO [6-9].

Few important questions need to be answered in planning the surgical treatment of bilateral UPJO. Should we operate urgently or follow a non-operative approach? If we operate, should we operate on both renal units simultaneously or separately? If separately, which renal unit should be corrected first? If both renal units have similar split renal function (SRF) and grades of hydronephrosis, which is the pathological side? Do we need to operate on the contralateral side after unilateral pyeloplasty in cases of bilateral UPJO? To answer these questions, we evaluated the clinical outcome of patients with bilateral UPJO treated at our institution.

MATERIALS AND METHODS

This descriptive study was performed in accordance with the principles of the declaration of Helsinki. All patients with prenatally diagnosed bilateral hydronephrosis with postnatal diagnosis of bilateral UPJO, who underwent initial unilateral pyeloplasty at the department of pediatric surgery of a tertiary care hospital, Lucknow, were prospectively evaluated and were included in the study. After getting approval from the ethical committee and written consent from the concerned parents, patients were recruited from January 2015 to December 2017. All the children were evaluated with renal ultrasonography (USG) and diuretic renography to confirm the diagnosis of bilateral UPJO. All the children underwent voiding cystourethrography to detect any associated anomalies. Patients with unilateral disease, renal dysplasia, a single kidney, hydroureter, and lower urinary tract abnormalities were excluded from the study.

USG was performed by a standardized technique and the USG machine, probe, and settings were kept identical during initial and follow-up scans to reduce error. Hydration was ensured in all the children by clinical assessment to prevent dehydration causing an impact on the pelvis size. During examination, the

child was kept quite so that crying and straining would not bias the measurements. The maximum anteroposterior pelvic diameter (APPD) was measured in coronal section and maximum polar cortical thickness (CT) was measured in longitudinal section accurately. Pelvis-to-cortex (P/C) ratio was calculated by dividing maximum APPD with maximum CT.

We used technetium-99m-L, L ethylene dicysteine (Tc-99 L, L-EC) for the diuretic renogram. Standard institutional protocol was used in which free oral hydration was allowed before the study and 1 mg/kg furosemide was given along with injection of the radiopharmaceutical. The uptake of tracer, visual impression on the images and amount of background activity, was assessed to determine the adequacy of individual kidney function, SRF, and drainage.

As per our protocol, initial unilateral pyeloplasty was performed on the kidney with worse function or higher grade of hydronephrosis and the contralateral kidney was observed. A standard Anderson-Hynes pyeloplasty was performed through a flank incision with a double J stent. The double J stent was removed cystoscopically after 6 weeks.

Serial clinical evaluation, USG, and diuretic renogram were performed at 3 monthly intervals after the initial surgery. The mean follow-up period was 18 months (range 9–36 months). Data on the APPD, maximum polar CT, and P/C ratio were compared. The outcome of contralateral hydronephrosis was determined by US and diuretic renography and assessed as resolution or surgery. Worsening hydronephrosis on USG with or without decreasing function on the 99 mTc-LLEC renal scan was the reason for the contralateral pyeloplasty. Statistical analysis was done using Student's t-test and Fisher's exact test, and the difference in outcome was considered statistically significant with $p<0.05$.

RESULTS

The demographic and clinical characteristics of the patients, who were enrolled in this study, are shown in Table 1. A total of 16 patients met the inclusion criteria; the mean age of the patients at the time of the initial surgery was 2.6 months (range 1–12 months). A total of 10 children underwent the initial pyeloplasty on the left kidney, and the right kidney was involved in six patients. Worsening hydronephrosis with or without decreased function on the 99 mTc-LLEC renal scan was the reason for the contralateral operation in four patients. The pathology and operative findings confirmed urinary tract obstruction in all patients. The mean follow-up period was 18 months (range 9–36 months). Of all 16 patients, 12 (75%) had resolution and 4 (25%) patients required additional contralateral pyeloplasty during the follow-up (Fig. 1).

Table 2 shows the USG parameters for children with different outcomes of contralateral hydronephrosis after the initial pyeloplasty. The outcome was assessed as resolution or surgery; the mean APPD was 12.8 mm (resolution) and 28.7 mm (surgery); $p<0.01$. However, the mean maximum CT was not significantly different among the groups. To determine whether US parameters were associated with an increased risk of contralateral pyeloplasty, the P/C ratio was compared among the different outcomes of contralateral hydronephrosis. The mean (±SD) P/C ratio was 4.7±2.6 in those in whom the contralateral hydronephrosis resolved and 14.4±3.5 in those who required contralateral pyeloplasty. The difference between the groups was statistically significant ($p<0.01$ Student's *t*-test). SRF was not significantly different between the groups.

Table 1: Patient characteristics

Variables	Number, n
Patients with bilateral PUJO who underwent initial ipsilateral pyeloplasty	16
Median age at initial pyeloplasty (months)	2.6 (Range 1–12 months)
Sex	
Male	9
Female	7
Laterality of initial pyeloplasty	
Right	6
Left	10
Patients requiring contralateral pyeloplasty	4 (25%)
Patients with resolution of contralateral hydronephrosis	12 (75%)
Median time interval between ipsilateral and contralateral pyeloplasty (months)	1.8 (Range 1–5 months)

Table 2: Ultrasound parameters of contralateral kidney in patients with bilateral PUJO who have undergone ipsilateral pyeloplasty

Parameter	Resolution	Surgery	p value
Number of patients, n	12	4	-
APPD, mm	12.8±4.2	28.7±6.9	<0.01
Maximum polar cortical thickness, mm	3.12±1.4	2.4±0.8	>0.05
P/C ratio	4.1±2.6	14.4±3.5	<0.01
SRF	54±6	48±8	>0.05

APPD: Anteroposterior Pelvic Diameter, SRF: Split renal function, P/C: Pelvis-to-cortex

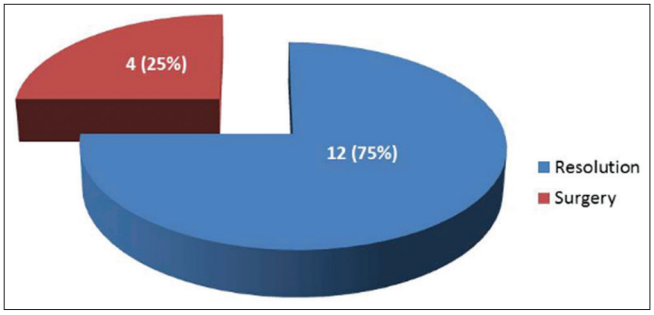

Figure 1: Outcome of contralateral hydronephrosis after initial pyeloplasty

DISCUSSION

During the past decade, the controversy surrounding postnatal management of unilateral prenatally diagnosed hydronephrosis

has shifted significantly toward an initial non-operative approach [2-5]. Compared with unilateral UPJO, however, few published management protocols exist for patients with prenatally diagnosed bilateral hydronephrosis that leads to the postnatal diagnosis of bilateral UPJO. There are many reports to suggest non-operative management with close follow-up for patients with primary bilateral ureteropelvic junction type hydronephrosis. Bajpai and Chandrasekharam reported that of 31 patients with moderate or severe hydronephrosis, only 4 (12.5%) required pyeloplasty during a mean follow-up of 36 months. The authors concluded that initial non-operative observation appears to be safe in all cases of moderate-to-severe bilateral neonatal hydronephrosis, and spontaneous improvement can be expected in most kidneys by 2 years [8].

Onen *et al*. reported that only 35% of total renal units with prenatally diagnosed primary Grade 3 to 4 bilateral hydronephrosis required unilateral or metachronous bilateral pyeloplasty, and the remaining 65% of renal units that were followed non-operatively showed resolution or improvement of the hydronephrosis for a mean 54-month follow-up [9]. Eckstein and Drake reported the feasibility of concurrent bilateral open pyeloplasties [10], and Schwab and Casale performed successful concurrent bilateral laparoscopic pyeloplasties with favorable results [11]. However, traditionally, staged pyeloplasties have been recommended as a safe surgical modality. Therefore, we performed initial unilateral pyeloplasty in all cases.

Only a few reports have addressed the need of contralateral delayed pyeloplasty after the initial pyeloplasty. Kim *et al*. [12] performed additional delayed pyeloplasty after unilateral pyeloplasty in 61.5% of patients. In another study, additional contralateral pyeloplasty was required in six of 23 patients (26.1%) who had undergone an initial unilateral pyeloplasty [13]. Jiang *et al*. reported that 13.4% of patients required additional contralateral pyeloplasty after initial unilateral pyeloplasty [14]. The authors concluded that patients with contralateral calyceal dilatation >10 mm and the calyceal dilatation/parenchymal thickness ratio >5 are at higher risk of surgery. The follow-up data of patients, in our study, demonstrated that 75% of the contralateral hydronephrosis spontaneously resolved, and four of 16 patients (25%) required surgery.

Kim *et al*. [12] suspected that the severity of hydronephrosis in the contralateral kidney was associated with the future need of a delayed operation. However, Lee *et al*. [13] mentioned that there was no relationship between the grade of ipsilateral or contralateral hydronephrosis and the need for additional operations. We have herein, evaluated the association of the APPD, CT, and P/C ratio with the need for surgical intervention for contralateral hydronephrosis. Measurement of the APPD is commonly performed to determine the severity of hydronephrosis [12-14]. However, no universally agreed on reference range for the APPD has been established.

Moreover, the association between the contralateral APPD and the risk of surgical intervention after the initial pyeloplasty has not been well documented. In the present study, patients who underwent contralateral surgery had a significantly higher APPD as compared to those who had resolution of contralateral hydronephrosis. Although children with parenchymal thinning have a higher risk of impaired renal function, the value of CT alone was not significantly associated with the outcomes of contralateral hydronephrosis in our study. The P/C ratio is reportedly a sensitive marker for follow-up and may help to predict the outcome of pyeloplasty [15]. This is due to the increased intrapelvic pressure which distends the pelvis and compresses the parenchyma. We found that the presence of higher P/C ratio is significantly associated with the risk of contralateral operation.

Preservation of the optimal renal function of both units is the main goal of follow-up of a patient with bilateral UPJO. The assessment of individual and global renal function in the presence of bilateral hydronephrosis is difficult. Since both kidneys are affected by similar pathology, SRF measurement cannot be used as a single parameter to guide management.

CONCLUSION

Our findings suggest that in children with bilateral UPJO type of hydronephrosis, improvement, or resolution of the contralateral renal unit can occur following initial unilateral pyeloplasty for the worse renal unit. The patients in whom both the renal units have similar SRF and grades of hydronephrosis; pelvic AP diameter, CT, and P/C ratio, can be used to determine the likelihood of contralateral delayed pyeloplasty.

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