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Renal pelvis reduction during dismembered pyeloplasty: Is it necessary?

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Abstract *Objective:* To compare treatment results in patients who underwent pyeloplasty with and without pelvic reduction for ureteropelvic junction obstruction (UPJO).
Methods: This randomized prospective study involved 40 patients, all diagnosed with unilateral UPJO; 20 each were randomly selected to undergo open dismembered pyeloplasty with pelvic reduction (group A) or pelvis-sparing pyeloplasty (group B). Patients were evaluated with ultrasound and DPTA renography scans 6 months postoperatively. Mean follow-up was 9 months.
Results: The mean age in group B was 5.71 ± 6.36 years; in group A it was 4.81 ± 6.78 years. There was a decrease in mean anteroposterior renal pelvic diameter (from 49.9 to 26.35 ± 0.949 mm in A and 50.9 to 30.8 ± 1.556 mm in B) with improvement of split renal function (from 39 ± 22.47% to 42.4 ± 22.13% in A and 34.92 ± 16.79% to 38.8 ± 19.66% in B), glomerular filtration rate (from 37.25 ± 15.33 to 41.7 ± 19.34 ml/min in A and 31.3 ± 18.50 to 38.1 ± 23.23 ml/min in B) and draining curves on the 6-month scans, but without any significant difference between groups ($p > 0.05$). Two cases in group A and three in group B needed redo pyeloplasty, but without any significant difference in failure rate.
Conclusion: Excision of the pelvis is not necessary in dismembered pyeloplasty procedures. We had similar surgical outcomes for patients with or without pelvis reduction.

Introduction

Ureteropelvic junction obstruction (UPJO) is the most common congenital anomaly that is associated with hydronephrosis in infants [1]. The literature stresses the benign nature of hydronephrosis in early childhood. Newborns and infants are especially likely (up to 90%) to receive conservative therapy [2]. In some, early surgical intervention is indicated to prevent or reduce the risk of urinary tract infection (UTI) and irreversible renal damage [3]. The need for surgery is determined by the preoperative usage of ultrasound (US) scan and nuclear renography. These

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modalities are also the principal postoperative follow-up methods [4,5]. With a success rate of about 94%, the Anderson-Hynes dismembered pyeloplasty (AHDP) is the gold standard for the repair of UPJO [6]. Although the original technique describes surgical reduction in the size of the renal pelvis, it was in the late 1990s that this practice became popular. This was the era when many studies demonstrated histologic changes in the renal pelvis together with the problem at the ureteropelvic junction (UPJ) [7,8]. Thus, removal of abnormal pelvis and UPJ together was advocated. Other possible benefits of excision of the renal pelvis are to prevent urine stasis behind a newly created anastomosis and to avoid ureteral kinking [9].

With the increasing popularity of laparoscopic dismembered pyeloplasty, the need for reduction of the renal pelvis was re-evaluated, as most of the interventions using this technique were done without this reduction. Many surgeons believe that the redundant renal pelvis is protective, and removing it may deprive the ipsilateral kidney from its benefit at a time when it may need it most. Also, unnecessary surgery might lead to problems such as urine leakage or long hospitalization [9].

Limited data are available concerning the effects of pelvic reduction on surgical outcome. In this study, we compared the functional results after sparing resection of the dilated pelvis with those after pelvic reduction in open dismembered pyeloplasty.

Patients and methods

This was a prospective study including 40 patients (29 boys, 11 girls), all of whom were diagnosed with congenital UPJO with a pelvic anteroposterior (A-P) diameter in the transverse plane of at least 4 cm. AHDP was performed in all patients at our institution during 2009. Acquired or recurrent cases were excluded from the study. Preoperative urine analysis, serum creatinine and abdominal US scans were done for all patients. Voiding cystourethrography was used to exclude vesicoureteral reflux in all patients, while differential renal function was detected using diuresis renography with DTPA. DTPA scans were performed with the patient in supine position with a urethral catheter; all patients were hydrated intravenously. All patients were normal on voiding cystourethrography. None had ureteral dilatation. Only patients with unilateral single-system hydronephrosis were included in the study. Patients with ureteral dilatation, abnormal vesical appearance, bilateral UPJO, double-system hydronephrosis, and A-P pelvic diameter $<$40 mm were excluded from the study. All patients were under antibiotic prophylaxis. Patients were randomly divided into two groups according to whether resection of the dilated pelvis was done or only the UPJ was excised: 20 renal units (RU) were randomly selected to undergo open dismembered pyeloplasty with pelvic reduction (group A) and the remaining 20 RU to undergo open dismembered pyeloplasty without reduction (group B).

Reduction of the renal pelvis was done by excision of the renal pelvis up to 2 cm from the calyceal infundibula. In Group B, only the pelviureteric junction was excised. In each group, the surgery was done by a single person.

US was repeated on the postoperative 1st, 3rd and 6th months, and all patients underwent diuresis renography with DTPA scan at the 6th month after surgery. The US scans were read by a single radiologist who was blinded to the groups. This was done also with the renograms. The groups were compared postoperatively with regard to the presence of complications, diuretic renogram with differential renal function, and A-P diameter of the renal pelvis in the transverse plane.

Data were statistically described in terms of the range, mean $\pm$ standard deviation ($\pm$SD), median, frequency (number of cases) and percentages when appropriate. Comparison of quantitative variables between the study groups was done using the Mann–Whitney *U*-test for independent samples. For comparing categorical data, the Chi square ($\chi 2$) test was performed. An exact test was used instead when the expected frequency was less than 5. A probability value (p) less than 0.05 was considered statistically significant. All statistical calculations were done using the computer programs Microsoft Excel 2003 (Microsoft Corp., NY, USA) and SPSS (Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows. A power analysis was done on the glomerular filtration rate (GFR), half split function, as well as need for recurrent operations, which were primary outcomes of this study. Calculations were done using PS Power and Sample Size Calculations Software, version 2.1.30 for MS Windows (William D. Dupont and Walton D. Vanderbilt, USA).

Results

A total of 40 patients, aged 3 months to 15 years, underwent AHDP at our department between January 2009 and March 2010. The left and the right sides were affected in 22 (55%) and 18 renal units (45%), respectively. Twenty-five patients were asymptomatic and diagnosed on routine US evaluation; 15 patients presented with UTI, hematuria or flank pain. Renal stones were present in 4 renal units (1 unit (5%) in group A and 3 units (15%) in group B). Pyelolithotomy was done with pyeloplasty in all cases of renal stones with complete postoperative stone clearance. Crossing lower pole vessels were found in 2 cases. Patients' characteristics and preoperative data are given in Table 1.

Mean values of preoperative parameters including age at operation, A-P diameter of the renal pelvis on US scan, and differential renal function and GFR on DTPA renography are summarized in Table 1. No significant difference was found in terms of preoperative features when the two groups were compared.

Open dismembered pyeloplasty was done in the 40 renal units. Mean follow-up time was 9 months (6–12 months). Three cases from group B were obstructed and complicated by early postoperative fever and urinary leakage. Percutaneous nephrostomies were fixed followed by redo pyeloplasty. Two cases from group A presented during follow-up with infected urine, markedly dilated pelvis and decreasing function. Retrograde study showed obstructed pelviureteric junction in both cases which was treated by redo pyeloplasty. There was no statistically significant difference in failure rate between the two groups ($p = 1$).

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Table 1 Patients' characteristics and preoperative data.

	Group A (20 patients)	Group B (20 patients)
Age	4.81 ± 6.78 years	5.71 ± 6.36 years
A-P renal pelvic diameter	49.9 mm	50.9 mm
Preoperative GFR	37.25 ± 15.33 ml/min	31.3 ± 18.50 ml/min
Differential renal function	39 ± 22.47%	34.92 ± 16.79%

All numbers indicate mean values.

Postoperatively, there was a decrease in mean A-P diameter with mild improvement of split renal function and GFR in both groups, but without any significant difference between pre- and postoperative parameters except for A-P diameter which was significantly improved in both groups ($p < 0.05$). Although postoperative parameters presented on DTPA renography and pelvic A-P diameter noted on US scans at the 6th month after surgery were better in group A (Table 2), the difference between the groups was statistically insignificant (p value > 0.05). There was a significant improvement in renal drainage in both groups. Preoperatively, the curve for renal drainage on the renogram was rising in all renal units of both groups. Postoperatively, the curve became flat in 9 RU (50%) in group A and there was a normal descending curve in the other 9 RU (50%). In group B the curve became flat in 12 RU (70.5%) and descending in the other 5 RU (29.5%). There was no statistically significant difference in drainage between the two groups ($p = 0.36$).

From the above results, there is no statistically significant difference between the two techniques of pyeloplasty (with and without renal pelvic reduction) with regard to A-P diameter, split function and postoperative drainage.

The result of the power analysis was that the present study was 14.1% powerful in detecting the reported difference (4.45 ml/min; see Tables 1and 2) as an effect size for GFR, 7.4% in detecting a difference of 3.4% in half split function, and 7.6% in detecting the difference of 5% in the failure rate.

Discussion

Dismembered pyeloplasty is a widely used technique for the repair of UPJO. Usually, resection of the dilated pelvis is recommended to avoid postoperative accumulation of urine or reobstruction due to ureteral kinking. However, the relevance of extensive pelvic resection has not been investigated systematically [10]. Doing without extensive resection avoids the need for extensive retroperitoneal preparation and reduces the number of sutures, resulting in shorter operating times, especially in laparoscopic, but also in open procedures [11].

Patients with A-P pelvic diameters < 40 mm were excluded from our study. Although some of the most compromised kidneys have small pelvises and severe calyceal dilatation, these kidneys either do not require a pelvic reduction or it is practically impossible during pyeloplasty. To avoid bias we did not include such patients at the start.

The main expectation from a successful pyeloplasty is to preserve or improve the split function. In our study, US scans and DTPA renography performed pre- and 6 months postoperatively did not show any significant difference between the two groups with regard to A-P diameter, split function, GFR and urinary drainage curve. Pyeloplasty without renal pelvis reduction did not result in higher rates of reobstruction. Limited information is available focusing on the effect of pelvic reduction during pyeloplasty in the pediatric population. *Stein et al.* [12] evaluated the role of pelvic reduction in a retrospective study. However, the main evaluation criterion was the intravenous pyelography. They did not detect any significant advantage of pelvic reduction in their study. More recently, *Reismann et al.* published findings supporting the aforementioned study. They did not exhibit any benefit of pelvic reduction against pelvis-sparing including the split renal function [11]. Another study done on 42 patients divided into reduction and non-reduction groups has also revealed no effect of pelvic reduction on differential renal function and A-P pelvic diameter at the 6th postoperative month, although the A-P diameter decreased significantly in the pelvic reduction group compared to the pelvis-sparing group on the 1- and 3-month US scans. However, the difference was not significant in the 6th month [9]. The renal washout time (T½) on renography, in the same study, was significantly improved in both groups but was significantly better in the reduction group when compared to the pyeloplasty group without reduction. This is different from our study in which the drainage curve was improved significantly postoperatively but without a significant difference between groups [9]. Similar to our results, *Reismann et al.* reported

Table 2 Postoperative parameters.

	Group A (18 patients)	Group B (17 patients)	p value
Postoperative UTI	7 (38.8%)	6 (35.2%)	0.1
A-P renal pelvic diameter	26.35 ± 0.949 mm	30.8 ± 1.556 mm	1
Postoperative GFR	41.7 ± 19.34 ml/min	38.1 ± 23.23 ml/min	0.5
Differential renal function	42.4 ± 22.13%	38.8 ± 19.66%	0.17

All numbers indicate mean values.

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a similar renal washout time in their pelvic reduction and pelvis-sparing groups [11].

Pelvic reduction during pyeloplasty will inevitably have some effect on the early postoperative results. In fact, it may take up to 3—5 months for the repaired UPJ to recover near normal peristalsis according to two relatively recent experimental studies [13,14].

There was no significant improvement in differential function or GFR postoperatively in either group in our study. Dismembered pyeloplasty seems to preserve but not to improve the preoperative renal function, as described in other studies [11,15—17].

What this study brought to our approach is that excision of large portions of renal pelvis during pyeloplasty is not desirable. When the renal pelvis is not surgically reduced, it reduces itself by 6 months. However, if the pelvis is reduced and hydronephrosis and calyceal dilatation still persist in the early postoperative period, one should beware of a failure. If the pelvis is not reduced, hydronephrosis is less likely to represent a surgical failure.

Although the follow-up period was relatively short to detect final improvement of different parameters, it was sufficient to ensure that no significant difference was detected between the two groups in up to 6 months.

Conclusions

In this randomized prospective study, our data showed, on a functional basis, that excision of the pelvis is not necessary in dismembered pyeloplasty procedures. We had similar surgical outcomes for patients in the pelvic reduction and pelvis-sparing groups.

Conflict of interest/funding

None.

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