Predictors of Recurrence and Complications in Pediatric Pyeloplasty

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OBJECTIVE To assess the predictors of recurrence and complications, we retrospectively analyzed our experience in primary pediatric pyeloplasty. Management of pyeloplasty failure is challenging both for patients and for surgeons, especially in pediatric cases. Early detection of recurrence and early manipulation may help preserving renal function.

METHODS We analyzed 490 renal units who underwent primary dismembered pyeloplasty with eligible data between June 2001 and October 2016 retrospectively. Patient's demographic features, operative data, clinical findings, complications, and recurrence rates were evaluated.

RESULTS Mean age at operation and the mean follow-up time after pyeloplasty was 33.9 (±43.5) and 47.6 (±37.7) months. Our recurrence and complication rates were 6.7% and 11.4%, respectively. Urinary tract infection (7.8%), diversion-related complications (1.8%), and urinoma (1.4%) were the most common complications. Presence of preoperative diversion ($P = .020$) and presence of early complications ($P < .001$) after pyeloplasty were significantly related to recurrence. Complication rates were found less in children with transanastomotic diversions ($P = .002$) and children without preoperative diversion ($P = .005$). The analysis of patients in chronological order revealed an increase in prenatal diagnosis in the recent years ($P < .001$). Recurrence and complications were not related to age, gender, side, preoperative radionuclide renal scan results, hydronephrosis grade, surgery type, and surgical findings.

CONCLUSION Early postoperative complication is a predictor of recurrence after pediatric pyeloplasty. Transanastomotic diversion reduces the complication rates. Presence of a preoperative diversion increases both complication rates and recurrence rates after pyeloplasty. UROLOGY 126: 187–191, 2019. © 2019 Elsevier Inc.

Many different surgical approaches for ureteropelvic junction (UPJ) obstruction have been suggested from nondismembered, flapping techniques to minimal invasive methods in years, where the dismembered pyeloplasty is still the most popular and effective approach. The Anderson-Hynes dismembered pyeloplasty is proven to be successful up to 98%.[1]

Despite the good results of dismembered pyeloplasty, in failed cases it is challenging to achieve success with further surgeries. The proposed etiology for pyeloplasty failure is urinary extravasation, prolonged urinary diversion, uncorrected prior anatomy (missed crossing vessels or long segment involvement) and age less than 6 months at initial surgery.[2,3] Various perioperative and patient-related factors affect the success of pyeloplasty.

Identifying the risk factors for complications and recurrence provides better management of pyeloplasty because further treatment of failed pyeloplasty is challenging. We hypothesized that age of the patient, perioperative complications, and diversions may have affect on recurrences. For better assessment of the pyeloplasty failure, we retrospectively analyzed our pyeloplasty practice and outcome.

MATERIALS AND METHODS

We evaluated children (15 years and younger) who underwent primary dismembered pyeloplasty between June 2001 and October 2016 retrospectively after local ethics committee's approval. All secondary cases, ectopic kidneys, nondismembered pyeloplasties, adult patients, and patients lacking postoperative follow-up were excluded. After exclusion of secondary cases (39 children) and cases with missing data (18 children), 490 renal units were included to our study.

Pyeloplasty decision has been made by ultrasound and radionuclide renal scans. Criteria for surgery were progressive hydronephrosis in serial ultrasounds, progressive loss of renal function on radionuclide renal scan, and symptomatic patients. All children had undergone Anderson-Hynes dismembered pyeloplasty after visualizing the collecting system by a retrograde pyelography (RGP). RGP was performed in order to assess the presence of any rotational abnormality, accompanying ureterovesical stenosis, and the length of the narrow segment. Surgery type (via flank incision,

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dorsal lumbotomy, or laparoscopic approach), postoperative diversion type, removal time of the diversion, and decision of performing RGP during removal of the internal stent were determined regarding patient's features and operator's choice. Foley catheter was placed in every patient for 2-5 days. Patients were given antibiotics until urethral catheter or the external diversion removal. Postoperative urinary tract infection was considered when the child becomes febrile and urinalysis revealed infection. Percutaneous nephrostomies (PCNs) were removed under scopic guidance after confirming the contrast passage through the anastomosis line, and internal stents were removed under general anesthesia. Oral antibiotics were prescribed for 7-10 days postoperatively. Patients were evaluated with routine ultrasounds within 2-6 weeks after stent removal postoperatively, and radionuclide scans were performed to patients with sustaining or increasing hydronephrosis. In children with sufficient reduction in hydronephrosis and without symptoms after the surgery, decision of radionuclide scanning is left to parental preference in order to decrease the hospital related stress. Pyeloplasty outcomes were reviewed by regression of hydronephrosis and anteroposterior pelvic diameter, change in split function, improvement of symptoms, recurrence of UPJ obstruction, atrophy of the operated kidney, need for nephrectomy due to nonfunctional kidney. Recurrence was defined as the progressing hydronephrosis in association with no improvement in renal scans. The diagnosis of fail was made with persistent hydronephrosis after 4 weeks past the diversion removal. Nephrectomy was performed to patients with renal function less than 10% on radionuclide scan, whom are symptomatic and/or suffering recurrent urinary tract infections. The data were also classified into 4 equal numbered groups chronologically in order to investigate whether any changing trends were present.

RESULTS

Mean age of children at operation was 33.9 (±43.5) months. Data analysis revealed that UPJ obstruction was observed 63.9% (n = 313) in the left side. A total of 69.2% (n = 339) of children were male, 30.8% (n = 151) were female. The initial diagnosis of 300 patients was prenatal and 52 patients were diagnosed incidentally. Eighty-three children presented with lumber pain, 40 with urinary infection, and 8 patients were presented with nephrolithiasis. Three hundred and seventy-eight children underwent dorsal lumbotomy (median age: 7 months), 103 children underwent flank pyeloplasty (median age: 45 months), and 9 children had laparoscopic pyeloplasty (median age: 129 months). Intrinsic factors were detected in 458 patients (93.5%) and crossing vessels were seen in 23 patients (4.7%). In 96.3% of children (n = 463), diversions passing through the anastomosis (double-J stent [DJS] or ureteral catheter) had been used where the remaining had no diversion or PCN placed postoperatively (18 patients had PCN, 9 patients had no diversion). Choice of diversion was always transanastomotic stents whenever possible, for some patients in whom stent was not able to pass through the ureterovesical junction PCN was applied. Forty-one children had diversion preoperatively (29 had PCN and 12 DJS). Preoperative diversions were preferred in patients with high-grade hydronephrosis and in small newborns. Our mean follow-up time after pyeloplasty was 47.6 (±37.7) months.

Twenty renal units had intrarenal pelvis and the remaining presented with normal pelvic anatomy or extrarenally enlarged pelvis (n = 470). Fifteen (%3.1) children had solitary kidney. Twenty-nine (%5.9) children had bilateral hydronephrosis and 18 of them needed bilateral pyeloplasty.

All patients were followed-up by ultrasonography and 116 (23.7%) patients had postoperative control scintigraphy. During the removal of the DJS, in 71 children RGP was performed due to surgeon's decision at the same session. The recurrence rates for patients who did not undergo RGP at DJS removal was 5.3% (22/419), whereas the figure was 8.8% (5/57) for patients who had spontaneous drainage at RGP (P = .353). Fourteen patients did not show spontaneous drainage and were restented subsequently, 6 cases (42.9%) developed recurrence at follow-up.

Our complication rate was 11.4%. Urinary infection (7.8%), diversion-related complications (1.8%), and urinoma (1.4%) were the most common complications. There were no significant relation between complication presence and gender, age at operation, side of UPJ obstruction, presence of prenatal hydronephrosis, hydronephrosis grade, obstruction cause (intrinsic, crossing vessels etc.), surgical method (flank vs dorsal lumbotomy) and bilaterality (Table 1). The complication rate in transanastomotic diversion (a DJS or a ureteral catheter from renal pelvis to external urethral meatus) group was 10.4% (n = 48/463) and PCN group's complication rate was 33.3% (n = 6/18; Table 1). Complication rates according to diversion type (transanastomotic vs PCN) revealed a significant difference favoring transanastomotic diversions (chi-square test, P = .003). Also between pyeloplasties with DJS and with ureteral catheter groups, there were less complications observed in the DJS group but the significance was marginal (9.4% vs 17.9%, chi-square test P = .05; Table 1). Patients with preoperative diversions and also patients with preoperative external diversions presented higher complication rates as 27.6% and 22%, respectively (chi-square test P = .005 and P = .027, respectively; Table 1). In patients who were ≤6 months, presence of external diversion was marginally significant for complication rates (27.8% vs 11.5%, chi-square test; P = .051)

Our UPJ obstruction recurrence rate was 6.7% (n = 33) after primary pyeloplasty. Of these failed pyeloplasties, 16 patients were treated after secondary surgery where 7 patients needed third intervention, 9 patients needed fourth intervention, and 1 patient suffered 4 recurrences. Sixteen renal units deteriorated to atrophic kidney during follow-up and 6 of them underwent nephrectomy. We found no significant relation between gender, presence of prenatal hydronephrosis, age at operation, side of UPJ obstruction, preoperative function in radionuclide scan, preoperative supranormal function, preoperative hydronephrosis grade, obstruction cause, pelvic structure (extrarenal-intrarenal), surgical method, bilaterality, and recurrence (Table 1). Diversion type (transanastomotic vs PCN and DJS vs ureteral catheter) was not found to be an affecting factor for recurrence (Table 1). Children smaller than 6 months and older showed similar recurrence rates (Table 1). Recurrence was more common in patients who experienced early complications postoperatively (chi-square test P < .001). Recurrence rate was 21.4% in patients who developed complications where in other cases recurrence rate was 4.8%. Patients with preoperative diversions and also patients with preoperative external diversions presented higher recurrence rates as 14.1% and 17.2%, respectively (chi-square test P = .035 and P = .020, respectively, Table 1). In patients who were ≤6 months, presence of external diversion was significantly important for recurrence (22.2% vs 3.4%, Fisher's exact test; P = .010). The earliest recurrence was observed in the first month after initial pyeloplasty and the latest recurrence was seen in the postoperative 91 months. Mean time to recurrence was 18.8 (±22.4) months (Fig. 1)

The chronological data were analyzed by dividing patients into 4 equal numbered groups. The prenatal diagnosis of UPJ obstruction

Table 1. Possible factors those may affect the complication and recurrence rates (P values marked in bold are <0.05)

Parameters		Complication (%)	*P*	Recurrence (%)	*P*
Gender	Male	13.0	.106*	6.5	.746*
	Female	7.9		7.3	
Side of obstruction	Left	10.5	.413*	6.4	.685*
	Right	13.0		7.3	
Prenatal diagnosis	+	11.8	.713*	7.6	.348*
	−	10.8		5.4	
Age at operation	<6 months old	13.3	.305*	5.9	.538*
	≥6 months old	10.3		7.3	
Supranormal function	+	9.6	.754*	5.4	.909*
	−	10.9		5.1	
Hydronephrosis grade	Grade 1-2	3.1	.134*	0	.248†
	Grade 3-4	11.8		6.7	
Obstruction cause	Intrinsic	11.8	.535*	6.3	.639*
	Crossing-vessels	4.3		4.3	
	External	14.3		14.3	
Pelvic structure	Intrarenal	5	.716†	15	.145†
	Extrarenal	11.7		6.4	
Surgical method	Flank	9.9	.518*	6.9	.765*
	Dorsal lumbotomy	12.2		6.1	
UPJ obstruction bilaterally	Bilateral	17.2	.310*	3.4	.467*
	Unilateral	11.1		6.9	
Diversion type	Transanastomotic	10.4	**.003***	6.5	.870*
	PCN	33.3		3.8	
Transanastomotic diversion type	DJS	9.4	.052*	6.8	.694*
	Ureteral catheter	17.9		5.4	
Preoperative diversion	+	27.6	**.005***	14.1	**.035***
	−	10.4		6.0	
Preoperative external diversion	+	22	**.027***	17.2	**.020***
	−	10.5		6.1	
Scintigraphic function	>20	11.7	.612†	5.3	1.000†
	≤20	0		0	

* Chi-square test.
† Fisher's exact.

founded to be increasing in recent years. Prenatal diagnosis rates were 37.7% in the first group, 66.4% in the second group, 68.6% in the third group, and 75.2% in the last group (chi-square $P < .001$). The most preferred diversion through years was founded to be the transanastomotic type in chronological statistics (chi-square test $P < .001$). The complication rates according to chronological allocation were 17.9%, 8.1%, 11.5%, and 8.2%, respectively. Complication rate was higher in the first quartile but the difference was not significant between groups (chi-square $P = .054$). Also recurrence rates were similar between groups; 5.7%, 7.3%, 4.9%, and 9%, respectively (chi-square $P = .587$).

COMMENT AND CONCLUSION

Predicting the recurrence of pyeloplasty and treatment of the failed cases are challenging. Risk factors for recurrence of UPJ obstruction were studied poorly in the literature as the largest pediatric cohort is reported by Braga et al[3] They reported the results of 401 consecutive open Anderson-Hynes dismembered pyeloplasty with a recurrence rate of 5.2%. Although their recurrence rate was slightly lesser than ours, their follow-up period after pyeloplasty is shorter (36 months). Unlike our practice of performing routine RGP before open pyeloplasty, Braga et al performed RGP in 48.6% of their patients. Similar to our findings they also did not find any relation between age, prenatal diagnosis, and hydronephrosis grade. They reported significantly higher rate of recurrence in patients operated via dorsal lumbotomy and in patients lacking preoperative RGP. In our pyeloplasty series, we did not find any marked difference between dorsal lumbotomy and flank operations. We certainly consider doing a preoperative RGP in younger patients and in whom dorsal lumbotomy would be preferred. They founded no significant difference between stented and nonstented pyeloplasties in their series. Due to the limited number of stentless pyeloplasties in our data, we have not been able to show a relation to recurrence.

In a study of Lim et al, they suggested that age younger than 6 months and postoperative prolonged urinary drainage may affect the pyeloplasty failure.[4] Our results showed no significant relation between young age (age at operation <6 months) and UPJ obstruction recurrence similar to the report of Thomas et al.[2]

A study conducted on 167 unilateral giant hydronephrosis showed no significant difference in pyeloplasty outcomes for renal parenchymal thickness improvement and long-term differential renal function based on preoperative nephrostomy.[5] On the contrary, having a preoperative PCN or any diversion was founded as risk factors for both complication and recurrence in our data.

Some authors suggest that the missed crossing-vessels are also responsible for recurrence in pyeloplasty, especially in retroperitoneal cases.[2,6] Braga et al reported 2 of

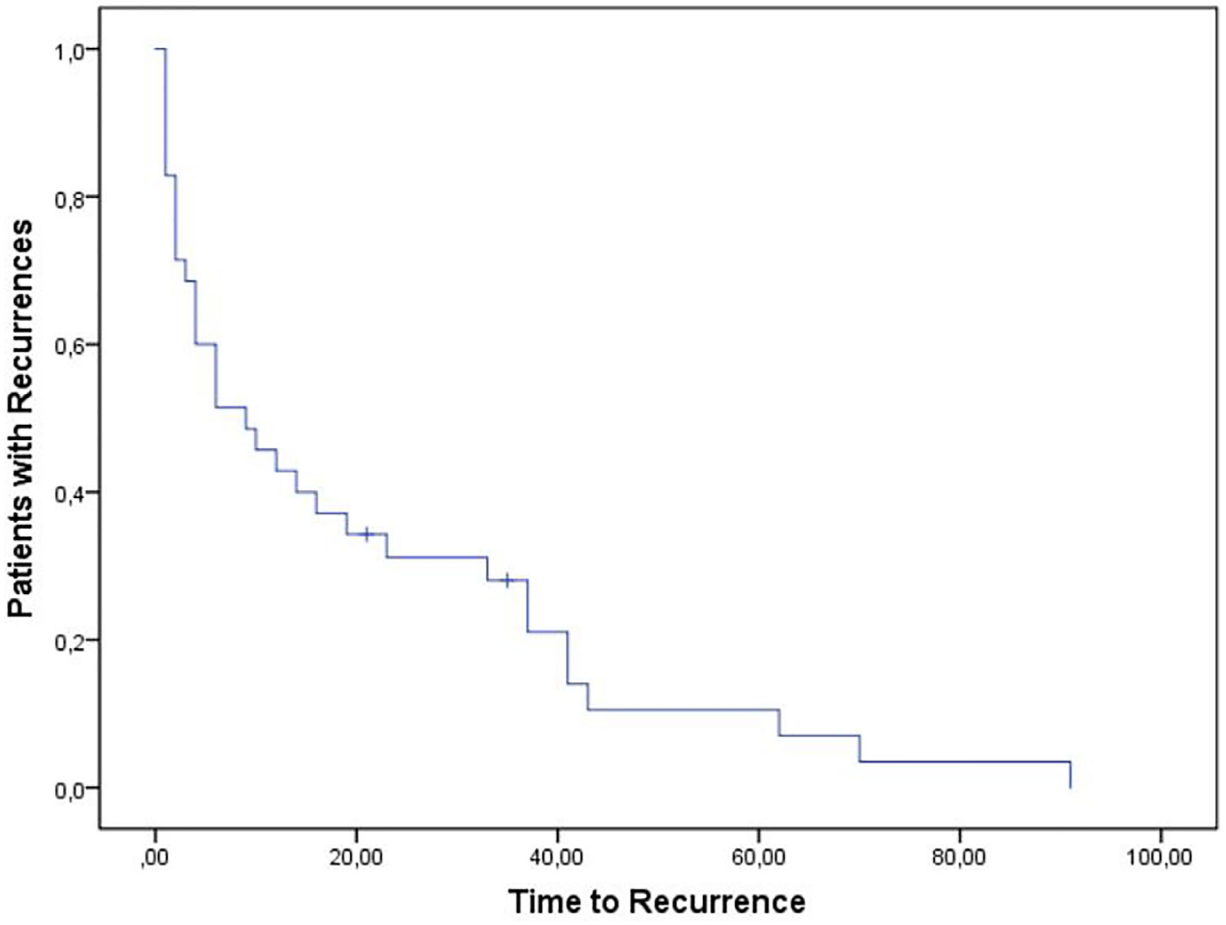

Figure 1. Graph of time to recurrence.

21 children, Helmy et al reported 1 of 18 missed crossing-vessels in their studies.[3,7] But in our series of 490 children whom majority were operated retroperitoneally, we encounter no missed crossing-vessels in our series. This finding clears out the surgeon related mistakes and it could be postulated that the recurrence is mostly related to healing failure or the pathologic ureter.

The association of higher rate of complications and recurrences with preoperative diversion is an interesting finding. According to our observations, the long standing preoperative diversion, especially the PCN, causes thickening of the renal pelvis wall and the thickness discordance between pelvis and thin wall of ureter may be a causative factor for postoperative problematic epithelialization. Another factor may be that preoperative diversion is generally the required for severely affected hydronephrotic kidneys which have less chance to structural resolution. Complications as urinary extravasation and urinary tract infection may cause the perianastomotic fibrosis and worsen the healing period.

Psooy et al suggested 2 years, Bansal et al suggested 3 years of follow-up after pyeloplasty for recurrence risk.[8,9] In our study, we experienced UPJ obstruction recurrence even after 7.5 years. To detect late recurrences, it is our practice to follow patients until puberty considering the growth rate of children.

We evaluated the predictive effect of having a routine RGP during stent removal on postoperative recurrence. We detected that the recurrence rates were similar in patients who have not undergone RGP during stent removal and patients who had spontaneous drainage at RGP. Therefore, we do not recommend routine control RGP. We believe that this practice depends on the surgeon's preference and may be performed if there is a doubt or concern about the initial operation.

Our study's main limitation had been the retrospective set-up. Many other predictors of pyeloplasty outcome were suggested by other authors like pelvis/cortex ratio, cortical thickness, and early postoperative renogram were not evaluated since we did not have these data in all our patients.[10-12] Moreover, we are aware of the weakness that the number of patients with preoperative or postoperative external diversion was little which makes our comparative statistical analysis a bit questionable.

Surgical treatment of UPJ obstruction gives good results in any age and hydronephrosis grade. Recurrences were closely related to the presence of early postoperative complication and diversion type. Placing temporarily preoperative diversions (either internal or external) should be discouraged since the postoperative complications and recurrences develop more. However, use of postoperative transanastomotic diversions is advantageous in terms of complications.

Disclaimer. No organization or any other individuals other than authors contributed to our study.

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