Failed Pyeloplasty in Children: Revisiting the Unknown

Rodrigo L. P. Romao, Martin A. Koyle, Joao L. Pippi Salle, Abdulhakim Alotay, Victor H. Figueroa, Armando J. Lorenzo, Darius J. Bagli, and Walid A. Farhat

OBJECTIVE	To perform a critical analysis of the management of the pediatric failed pyeloplasty in a large tertiary center. The ideal approach to this rare entity is not well established.
METHODS	Retrospective record review of children undergoing pyeloplasty from 2000 to 2010. All cases that required any type of reintervention, excluding stent removal, were analyzed. Data collected included: demographics, indication for and modality of the initial surgery, presence of crossing vessels, mode of diagnosis of failure, and type(s) of reintervention with the correspondent success rate(s).
RESULTS	Overall, pyeloplasty failure rate was 27 per 455 patients (5.9%). Age, initial indication for pyeloplasty, and modality of surgery (open vs laparoscopic) yielded similar failure rates. Indications for reintervention were as follows: worsening asymptomatic hydronephrosis 16 of 27 (59%), pain 7 of 27 (26%), urosepsis 2 of 27 (7.5%), and others 2 of 27 (7.5%). Eight of 27 (30%) improved with 1, 14 of 27 (52%) had 2, and 5 of 27 (18%) required 3 reinterventions, respectively. Mean interval between the first operation and subsequent interventions was 19.3, 24.9, and 27 months for the first, second, and third reinterventions, respectively. Modalities of reintervention with respective success rates were as follows: double J stent insertion 16% (6%), endopyelotomy 18% (50%), redo pyeloplasty 12% (92%), and ureterocalicostomy 4% (100%). Only 1 patient (7%) was documented to have a missed crossing vessel. All patients were stable and doing well after a mean follow-up of 56 months after the first operation.
CONCLUSION	According to this series, more invasive and definitive techniques, such as redo pyeloplasty and ureterocalicostomy, are more successful than minimally invasive ones to treat failed pyeloplasty and should probably be offered sooner rather than later. UROLOGY 82: 1145–1149, 2013. © 2013 Elsevier Inc.

Epidemiologic studies suggest that widespread dissemination of prenatal ultrasound has not led to an increase in the absolute number of pyeloplasties being performed. Nonetheless, a trend toward intervention at an earlier age has been identified.[1,2] There are no reports addressing whether pyeloplasties performed in infants or young children yields a different failure rate from those performed in older patients.

The pediatric pyeloplasty is a highly successful procedure. Success rates in excess of 90% are uniformly reported, regardless of the technique used to perform the procedure (open surgery, trans and retroperitoneal laparoscopy, or robotic-assisted).[3-8] Nevertheless, a 5%-10% failure rate has been consistently described in published reports,[9-12] and the ideal approach to the small subset of patients with a failed pyeloplasty is yet to be determined.

Interventions for failed pyeloplasty range from minimally invasive, endourologic procedures such as stent insertions and endopyelotomy to more extensive and challenging surgery such as redo pyeloplasty and ureterocalicostomy.

The goal of this study was to perform a critical analysis of the results of the surgical management for pediatric failed pyeloplasty in a large tertiary care center. The main research question to be addressed was as follows: is there an optimal clinical pathway or surgical technique to manage pediatric patients with a failed pyeloplasty? We hypothesize that more extensive surgical interventions, such as redo pyeloplasty or ureterocalicostomy, provide better long-term results and success rates than endourologic ones.

METHODS

A database containing information on patients undergoing pyeloplasty in a Canadian tertiary care center from 2000 to 2010 was reviewed retrospectively. Inclusion criteria for this study was any surgical intervention after pyeloplasty, excluding double J stent removal. Institutional review board approval was obtained.

Table 1. Pyeloplasty failure rates stratified by age

Groups	Pyeloplasty Failure Rate	Percentage (%)
0-1 y	9/171	5.3
1-5 y	8/115	7
>5 y	10/168	5.9

Table 2. Pyeloplasty failure rates stratified by initial indication for surgery

Groups	Pyeloplasty Failure Rate	Percentage (%)
Worsening antenatal hydronephrosis	15/230	6.5
Pain	9/128	7
Incidental finding	3/38	6.9

Table 3. Indications for reintervention after pyeloplasty

Signs/Symptoms	Rate	Percentage (%)
Worsening asymptomatic hydronephrosis	16/27	59
Pain	7/27	26
Urosepsis	2/27	7.5
Others	2/27	7.5

The following data were collected: demographics, indication for initial pyeloplasty, modality of initial surgery (open or laparoscopic), presence of crossing vessels on the first operation and subsequent interventions, method of failure diagnosis, indication for reintervention, type(s) of reintervention with correspondent success rate(s), time elapsed between first pyeloplasty and subsequent reintervention(s), length of follow-up, and resolution of symptoms/obstruction. When available, nuclear scan data on progression of differential function after pyeloplasty were obtained.

Reasons to define pyeloplasty failure were as follows: worsening hydronephrosis after pyeloplasty in asymptomatic patients with ureteropelvic junction (UPJ) obstruction diagnosed after antenatal suspicion, persistence of symptoms (ie, pain) that led to the first operation, and arising of *de novo* symptoms such as pain or urinary tract infections after the initial pyeloplasty. In our institution, patients are uniformly followed up for 3-4 months after stent removal with an ultrasound; however, there is no standardized approach for diagnosis and treatment of the failed pyeloplasty. Therapeutic procedures offered at the discretion of the attending surgeon were as follows: cystoscopy with double J stent insertion, endoscopic endopyelotomy, open or laparoscopic redo pyeloplasty, and ureterocalicostomy.

Failure rates between age groups, right and left side, indication for, or modality of initial surgery were compared using Fisher's exact test.

RESULTS

During the study period, 455 patients underwent pyeloplasty and 27 failed pyeloplasty (5.9% overall failure rate). Most failures were on the left side (21 of 27; 78%); however, this was not different from the entire sample laterality rate (287 of 455; 63%; $P = .18$ NS). There was no difference in failure rates when patients were divided by age or initial indication for pyeloplasty (Tables 1 and 2). Open (20 of 330) and laparoscopic (7 of 115) pyeloplasties yielded identical failure rates (6%).

Table 3 depicts the indications for reintervention; asymptomatic worsening hydronephrosis followed by pain were the most prevalent ones. Overall, 21 patients had a nuclear scan before reintervention, and 7 of 21 (33%) had a documented decrease in differential renal function by at least 5%. All 7 patients with documented decrease

in renal function had at least 2 interventions. Of the 27 patients, 8 (30%) improved with only 1 intervention, 14 (52%) required 2 interventions, and 5 (18%) had 3 interventions. Supplementary Figure 1 shows the breakdown by reintervention procedures. Mean and median intervals between the initial pyeloplasty and subsequent interventions are depicted in Table 4. According to our data, there was no evidence that procedures undertaken earlier after an unsuccessful pyeloplasty led to a higher success rate (27 months vs 17 months for successful vs unsuccessful reintervention procedures, respectively; $P = .13$).

Modalities of reintervention with respective success rates are shown in Table 5. For patients undergoing endopyelotomy, there was no association between time elapsed since initial pyeloplasty and success of the procedure. In fact, there was a trend toward a longer interval between initial pyeloplasty and endopyelotomy in patients where the procedure was successful (mean 22 months vs 12 months in the unsuccessful group; $P = .07$). Only 2 of 12 redo pyeloplasties were done laparoscopically, and 1 patient (7%) was documented to have a missed crossing vessel. All patients were stable, asymptomatic, and with no evidence of persistence obstruction and/or worsening hydronephrosis after a mean follow-up of 56 months (range, 15-122) after the first operation.

COMMENT

In our study population, more definitive surgical procedures such as redo pyeloplasty and ureterocalicostomy were more effective approaches to failed pyeloplasty than endourologic ones such as double J stent insertion and endopyelotomy, thus confirming our hypothesis. Furthermore, patient age, initial indication for pyeloplasty, and modality of surgery (open vs laparoscopic) did not seem to interfere with the pyeloplasty failure rate.

Success rates greater than 90% for the pediatric pyeloplasty using open and minimally invasive techniques have been widely reproduced.[3,4,9,10,12-14] However, the optimal management for the small but steady subgroup that sustains a pyeloplasty failure remains elusive.

The previously suggested concept that younger age patients (ie, infants) would be a risk factor for pyeloplasty failure[12] was not supported by our data. In terms of management, it has been suggested that endopyelotomy, although of limited value as a primary treatment option for pediatric UPJ obstruction, would be an effective tool

Table 4. Time to reintervention using initial pyeloplasty as baseline

Number of Interventions	Mean (mo)	Median (mo)	Range (mo)
First reintervention (n = 27)	19.3	8	1-117
Second reintervention (n = 19)	24.9	24	5-77
Third reintervention	27.4	16	10-80

Table 5. Modalities of reintervention after pyeloplasty with respective success rates

Procedure	Number of Interventions	Success Rate
Double J stent	16	2/16; 6%
Endopyelotomy	18	9/18; 50%
Redo pyeloplasty	13	12/13; 92%
Ureterocalicostomy	4	4/4; 100%

for the failed pyeloplasty, with a recent report depicting a 94% success rate.[15] Nevertheless, our group has reported previously that redo pyeloplasty was superior to endopyeleotomy when the 2 procedures were selectively compared,[13] and other investigators have similarly reported modest success rates for the endourologic approach, thus raising caution about its use.[16]

Intuitively, it makes sense to expect that earlier recognition and intervention for the failed pyeloplasty would yield better results, especially in the context of minimally invasive options, such as endopyelotomy. Interestingly, according to our data, endopyelotomies performed longer after the initial pyeloplasty tended to be more successful. Furthermore, the lack of association between time elapsed since initial pyeloplasty and success rate of the different reintervention procedures casts doubt on the aforementioned assumption.

Thomas et al[10] reported on 105 pyeloplasties with a failure rate of 7.7%; similarly to our experience, those authors found that more invasive reinterventions (redo pyeloplasty and ureterocalicostomy) yielded a 100% salvage rate as opposed to endourologic ones (5 attempts at balloon dilatation, 1 successful and 1 unsuccessful attempt at endopyelotomy). In the series by Helmy et al,[9] 16 of 18 failures after 590 pyeloplasties (3% failure rate) were managed with successful redo open procedures (pyeloplasty or ureterocalicostomy), with 2 patients undergoing nephrectomy. Lindgren et al[17] recently reported on similar success rates for redo pyeloplasty and ureterocalicostomy performed robotically.

Inserting a stent when faced with a severely dilated collecting system after pyeloplasty seems reasonable from 2 different perspectives: first, one would hope that stent insertion could represent a definitive intervention through dilatation of the stenotic area and maintenance of patency, as the healing process takes place around it. In addition, stent insertion may decompress the system and buy time to decide on a definitive approach while keeping the patient unobstructed. The first assumption is not supported by our data, because only 2 of 16 patients improved with stent insertion alone. Taking into consideration that 1 of 3 of our failed patients who had a nuclear scan demonstrated a decline in function >5% and the interval between the pyeloplasty and a second reintervention (assuming the first to be a temporary stent insertion, which was the option in most of our patients) was on average 24 months, it becomes hard to argue for a "temporizing approach". Furthermore, if a more invasive and definitive technique (eg, redo pyeloplasty or ureterocalicostomy) is likely to be required, it is probably easier to perform the operation on a very dilated system rather than a decompressed one, not to mention all the unpleasant symptoms and chronic inflammation (which in turn will make redo procedures more challenging) that may be associated with prolonged stenting.

Certain limitations of our study should be acknowledged; first, the study design (case series) does not allow broad recommendations to be made in terms of the management of the failed pyeloplasty in children. However, because the failure rates are very low, it is unlikely that large controlled trials comparing different approaches will ever be feasible, and knowledge derived from multiple series such as ours and others might help clinicians make informed decisions when dealing with such patients. Second, there was not a uniform approach to the failed pyeloplasty in terms of diagnostic studies and surgical interventions, with those being largely based on the attending surgeon's individual preferences; therefore, it is hard to know for sure whether the population studied was really homogeneous. Nonetheless, this is a recurring problem with UPJ obstruction, because many patients undergoing surgery are asymptomatic, and there is no consensus whatsoever about the indications for surgery and criteria for success/failure determination after surgery in patients with antenatally diagnosed hydronephrosis/UPJ obstruction.

CONCLUSION

According to our series, more invasive and definitive techniques, such as redo pyeloplasty and ureterocalicostomy, were more successful than minimally invasive ones to approach the failed pyeloplasty and should probably be offered sooner rather than later. It is reasonable to expect complete improvement in the vast majority of patients after reintervention.

References

1. Capello SA, Kogan BA, Giorgi LJ Jr, et al. Prenatal ultrasound has led to earlier detection and repair of ureteropelvic junction obstruction. J Urol. 2005;174:1425-1428
2. Wiener JS, Emmert GK, Mesrobian HG, et al. Are modern imaging techniques over diagnosing ureteropelvic junction obstruction? J Urol. 1995;154:659-661.
3. Salem YH, Majd M, Rushton HG, et al. Outcome analysis of pediatric pyeloplasty as a function of patient age, presentation and differential renal function. J Urol. 1995;154:1889-1893.

4. Seixas-Mikelus SA, Jenkins LC, Williot P, et al. Pediatric pyelo-plasty: comparison of literature meta-analysis of laparoscopic and open techniques with open surgery at a single institution. *J Urol.* 2009;182:2428-2432.

5. Penn HA, Gatti JM, Murphy JP, et al. Laparoscopic versus open pyeloplasty in children: preliminary report of a prospective randomized trial. *J Urol.* 2010;184:690-695.

6. Braga LHP, Lorenzo AJ, Bägli DJ, et al. Comparison of flank, dorsal lumbotomy and laparoscopic approaches for dismembered pyelo-plasty in children older than 3 years with ureteropelvic junction obstruction. *J Urol.* 2010;183:306-311.

7. Blanc T, Muller C, Abdoul H, et al. Retroperitoneal laparoscopic pyeloplasty in children: long-term outcome and critical analysis of 10-year experience in a teaching center. *Eur Urol.* 2012;63:565-572.

8. Minnillo BJ, Cruz JAS, Sayao RH, et al. Long-term experience and outcomes of robotic assisted laparoscopic pyeloplasty in children and young adults. *J Urol.* 2011;185:1455-1460.

9. Helmy TE, Sarhan OM, Hafez AT, et al. Surgical management of failed pyeloplasty in children: single-center experience. *J Pediatr Urol.* 2009;5:87-89.

10. Thomas JC, DeMarco RT, Donohoe JM, et al. Management of the failed pyeloplasty: a contemporary review. *J Urol.* 2005;174:2363-2366.

11. Braga LHP, Lorenzo AJ, Bägli DJ, et al. Risk factors for recurrent ureteropelvic junction obstruction after open pyeloplasty in a large pediatric cohort. *J Urol.* 2008;180:1684-1687; discussion 1687-8.

12. Lim DJ, Walker RD. Management of the failed pyeloplasty. *J Urol.* 1996;156:738-740.

13. Braga LHP, Lorenzo AJ, Skeldon S, et al. Failed pyeloplasty in children: comparative analysis of retrograde endopyelotomy versus redo pyeloplasty. *J Urol.* 2007;178:2571-2575; discussion 2575.

14. Valla JS, Breaud J, Griffin SJ, et al. Retroperitoneoscopic vs open dismembered pyeloplasty for ureteropelvic junction obstruction in children. *J Pediatr Urol.* 2009;5:368-373.

15. Kim EH, Tanagho YS, Traxel EJ, et al. Endopyelotomy for pediatric ureteropelvic junction obstruction: a review of our 25-year experi-ence. *J Urol.* 2012;188:1628-1633.

16. Veenboer PW, Chrzan R, Dik P, et al. Secondary endoscopic pyelotomy in children with failed pyeloplasty. *Urology.* 2011;77:1450-1454.

17. Lindgren BW, Hagerty J, Meyer T, et al. Robot-assisted laparoscopic reoperative repair for failed pyeloplasty in children: a safe and highly effective treatment option. *J Urol.* 2012;188:932-937.

APPENDIX

EDITORIAL COMMENT

This series of 455 patients undergoing pyeloplasty contains 27 patients (5.9%) in whom the procedure failed. This failure rate is consistent with that described in the published data and with that of most pediatric urologists. How one handles such a patient can be a vexing problem, made more difficult by the variability in management.

The authors have attempted to analyze the best way to approach the problem of the failed pyeloplasty. Their conclu-sion that the best way to address this problem is with a repeat pyeloplasty or by ureterocalicostomy might have been reached using incorrect assumptions and faulty logic.

The meantime to the first intervention in their series was 19 months and then later for subsequent interventions. The problem with claiming that treatment other than repeat open surgery is the most efficacious way to manage failed pyeloplasty rests with their delay in intervention. Had intervention occurred earlier, other treatment modalities, some minimally invasive, might have been successful. But, by the time that intervention occurred in this series, no treatment other than open surgery could have possibly succeeded, because by then there was fixed fibrosis that could only be managed with redo surgery. Consequently, it is hard to understand why the authors would have had any expectation that simply placing a stent through the repair would be successful.

The only comment that the authors can make with validity is that when a late pyeloplasty failure is encountered, interven-tions other than repeat surgery are unlikely to succeed.

The unanswered question is if these patients were identified earlier, could less invasive means be implemented to salvage the original surgery? The authors report that they evaluated their patients after pyeloplasty with ultrasound between 3 and 4 months after stent removal. They did not indicate how long the stent remained after surgery. This long delay from the time of the initial surgery might be the reason why minimally invasive treatments were less successful.

The authors stated the conclusion that earlier recognition of a failure and earlier intervention would lead to more successful outcomes was not supported by their data with regard to endopyelotomies. It is difficult to reconcile their claim, because they had 44% success rate with endopyelotomy as an initial intervention for first time failures and a 50% success rate after the second attempt at postpyeloplasty intervention.

Another modality that the authors mentioned in the discussion, but did not use in their series is retrograde balloon dilation at the ureteropelvic junction. The authors implied that this was an ineffective procedure, but the referenced series re-ported only 5 patients who had this done with just 1 success. The timing of the balloon dilation was not specified, but it would seem that early identification of a failure would be important with this modality as well, inasmuch as dilation of a fixed scar would likely be ineffective.

The authors should be commended for attempting to deter-mine the best way to address the failed pyeloplasty, but their conclusions appear to be applicable only to patients who are late failures.

Hal Craig Scherz, M.D., Georgia Urology, Pediatrics, Atlanta, GA

REPLY

We appreciate the reviewer's comment and acknowledge that one has to be cautious when drawing conclusions from the data presented. The mere fact that this is a retrospective case series certainly limits the generation of broad recommendations. The concern pertaining to the interval between initial pyeloplasty and reintervention(s) is reasonable, but some points deserve further clarification.

First, our time to reintervention was not significantly different from other reports (Thomas et al[1] — mean 13 months, Helmy et al[2] — mean 26 months, Veenboer et al[3] mean — 21 months). Second, Table 4 demonstrates clearly that using the mean to

report the time to reintervention is inadequate, because the distribution of the variable is quite irregular (mean 19 months; standard deviation 26 months) and spans from 1 to 117 months after pyeloplasty. The median time to the first reintervention was 8 months in our series, which we believe most pediatric urologists would agree could not be considered a long time since the initial procedure.

We agree that endourologic approaches to the failed pyeloplasty (ie endopyelotomy) would likely have better results when instituted early on after failure, however, our data show otherwise. Endopyelotomy (endoscopic intervention) performed earlier showed a trend toward higher failure rates than those performed later (see "Results" section; $P = .07$). This could be because the patients treated earlier had a longer stricture or other unpredictable factors that precipitated failure.

Finally, our conclusions that more definitive surgical therapy such as redo pyeloplasty offers better outcomes when treating the failed pyeloplasty are in line with those of other reports focusing on this topic with the exception of 1 single study by Kim et al,[4] in which secondary endopyelotomy was associated with a 92% success rate. If other investigators were able to reproduce such high success rates, there definitely would be equipoise to justify further investigation, specifically comparing that modality with redo pyeloplasty. Nonetheless, the rarity of pyeloplasty failure associated with its lack of diagnostic consensus makes a randomized trial on this topic virtually impossible to be conducted. As we move forward, to determine the best approach to this rare yet steadily present problem, our suggestions from a research perspective would be to answer these 2 questions:

1. How early can we identify a failed pyeloplasty? To answer this question and to define objective markers of pyeloplasty failure in asymptomatic patients, we recently described a sonographic measurement based on postoperative anteroposterior diameter of the renal pelvis[5] as a predictor of failure.

2. Is endourologic intervention or other minimally invasive approaches after failed pyeloplasty an alternative to redo pyeloplasty? To answer this question, prospective data collection on failed pyeloplasties, (time to failure, intraoperative findings, type of reintervention, and other patient-specific variables) with outcomes are warranted.

Rodrigo Romao, M.D., IWK Health Centre, Dalhousie University, Halifax, NS, Canada

Walid A. Farhat, M.D., The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

References

1. Thomas JC, DeMarco RT, Donohoe JM, et al. Management of the failed pyeloplasty: a contemporary review. *J Urol.* 2005;174:2363-2366.
2. Helmy TE, Sarhan OM, Hafez AT, et al. Surgical management of failed pyeloplasty in children: single-center experience. *J Pediatr Urol.* 2009;5:87-89.
3. Veenboer PW, Chrzan R, Dik P, et al. Secondary endoscopic pyelotomy in children with failed pyeloplasty. *Urology.* 2011;77:1450-1454.
4. Kim EH, Tanagho YS, Traxel EJ, et al. Endopyelotomy for pediatric ureteropelvic junction obstruction: a review of our 25-year experience. *J Urol.* 2012;188(4 suppl):1628-1633.
5. Romão RLP, Farhat WA, Pippi Salle JL, et al. Early postoperative ultrasound after open pyeloplasty in children with prenatal hydronephrosis helps identify low risk of recurrent obstruction. *J Urol.* 2012;188:2347-2353.