



Asian Focus

Comparison of outcomes between 2 week versus 4 week stenting in pediatric pyeloplasty—A single centre observational study



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KEYWORDS

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Anderson-Hynes pyeloplasty;
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Outcomes

Abstract *Objective:* To compare the surgical outcomes, improvement in renal function and complications between early stent removal (2 weeks) and late stent removal (4 weeks) after pediatric open pyeloplasty.

Methods: A total of 72 open pyeloplasty were included in the study. Forty-three underwent late stent removal (Group 1) and 29 underwent early stent removal (Group 2). Pre-operative and post-operative follow-up data were compared to see the effect of early stent removal on the postoperative drainage pattern at 6 months after surgery and improvement in split function of affected kidney. The complications between the two groups were also compared.

Results: Both the groups were matched with respect to age, sex, side and antero-posterior diameter of pelvis. Pre-operative mean split function in Group 1 was 42% (26%–54%) while it was 39% (19%–42%) in Group 2 ($p=0.37$). Postoperative improvement in drainage pattern was seen in 69 out of 72 (96%) patients, 41 out of 43 (95%) in Group 1 and 28 out of 29 (97%) in Group 2. Improvement in split function occurred in 35 of 38 (97%) in Group 1 and 23 of 26 (88%) patients in Group 2 ($p=0.51$). Complications were seen in nine out of 72 (12.5%) patients. Incidence of complication in Group 1 was 16% (7/43) and Group 2 was 7% (2/29), and relative risk was 2.36.

Conclusion: A shorter duration of double J stenting is as effective as a longer stenting period in terms of surgical success outcomes and improvement in split renal function along with a decreased risk of stent related complications.

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1. Introduction

Hydronephrosis in children is a common urological condition and pelviureteric junction obstruction (PUJO) is the most common cause of hydronephrosis [1]. Anderson-Hynes pyeloplasty (AHP) first described in 1949 for the management of retrocaval ureter remains the gold standard for treatment of PUJO [2]. AHP though traditionally performed as an open procedure is nowadays also performed laparoscopically with comparable success rates [3]. However, there are a few unanswered questions regarding the surgical aspects of pyeloplasty; the most important of them is the duration of stenting the pelvi-ureteric anastomosis.

Most surgeons routinely stent the anastomosis with a double J stent (DJ stent) for a period of 4–6 weeks. There are few reports of early stent removal with good outcomes [4], however, there are no studies comparing the outcomes between two different duration of stenting following pediatric open pyeloplasty.

The purpose of our study was to compare the surgical outcomes, improvement in renal function and complications between early stent removal (2 weeks) and late stent removal (4 weeks) after pediatric open pyeloplasty, as it is still unclear whether stent duration plays a role in pediatric pyeloplasty outcome. The working hypothesis behind this is the fact that reducing the duration of stenting has comparable outcomes after laparoscopic/robotic pyeloplasty and hence it is believed that in open pyeloplasty reduced duration should have similar outcomes.

2. Patients and methods

This observational cohort study with retrospective and prospective data collection was conducted at a tertiary care pediatric surgical centre between 2014 and 2017. All children who underwent pyeloplasty and had a DJ stent inserted were included in the study. Patients in whom pyeloplasty was performed after percutaneous nephrostomy insertion for pyonephrosis, patients in whom a DJ stent could not be negotiated beyond vesico-ureteric junction and patients where the stents were spontaneously expelled in the post operative period were excluded from this study. The length of the DJ stent was calculated intraoperatively by passing a No. 5 infant feeding tube through the proximal end of ureter till it hit the uretero-vesical junction. The intravesical position of DJ was confirmed by free flow of urine through the proximal holes of DJ stent. A X-ray kidney ureter and bladder (KUB) was performed in the postoperative evening to visually confirm the presence of the lower end of the DJ stent in the bladder.

All relevant data with regard to the diagnosis, investigations, operative details and follow-up were collected from the departmental urology registry. The diagnosis of PUJO was confirmed by doing ultrasonogram (USG) kidney, KUB and diuretic renography. On USG the antero-posterior

(AP) diameter of pelvis was noted along with cortical thickness at the poles. Voiding cystourethrogram was done only for bilateral hydronephrosis. Surgery was performed in all patients with obstructive pattern of clearance on diuretic renogram irrespective of split function or symptoms, as a majority of our clientele is from the rural economically backward milieu who are lost to follow-up and later on land up with complications like lump, nonfunctioning kidney or pyonephrosis. Surgery on the other hand is a one time procedure with excellent outcomes. Written informed consents were taken in all patients.

Standard AHP was done through a small flank incision by the extraperitoneal approach. The anastomosis was performed with 5/0 Vicryl and an appropriate size and length DJ stent was inserted. A bladder catheter was left in all patients for 2 days. Group 1 had the stent removed at 4–6 weeks while Group 2 had the stent removed at 2 weeks. The stent was removed under a short general anesthesia using face mask. The follow-up protocol included a postoperative USG KUB and diuretic renogram at 6 months and at 12 months postoperatively. After 1 year the patients were put on yearly follow-up with USG KUB and diuretic renogram was done only if indicated.

The primary objective was to compare the drainage pattern on diuretic renogram performed at 6 months after surgery between both groups. The secondary objective were to assess the improvement in split function on the operated side and the postoperative complications between the groups. The data were assessed *post hoc*. Statistical analysis was performed with the SPSS software Ver. 20 (Armonk, NYC, USA) using standard *t*-test and Chi-Square tests. A $p < 0.05$ was considered to be statistically significant.

3. Results

A total of 84 cases of pyeloplasty were performed during the 4-year study period. Eight patients did not fit the inclusion criteria and were thus excluded from the study. Out of the remaining 76 patients, the first 47 patients were planned for stent removal at 4–6 weeks; however, four of them had spontaneous stent expulsion before 4 weeks (mean 17 days). These four patients on follow-up had outcome comparable to the other 43 patients (Group 1). Hence, the following 29 consecutive patients (Group 2) were planned for early stent removal (2 weeks). This formed the basis of this serendipitous study.

The median age at surgery in Group 1 was 9 months (3–132 months) while in Group 2 was 7 months (2–144 months); $p = 0.11$. The mean preoperative split renal function in Group 1 was 42% (26%–54%) while the mean split renal function in Group 2 was 39% (19%–42%); $p = 0.37$.

The mean preoperative AP diameter in Group 1 was 21.4 mm (12–70 mm) and Group 2 was 22.8 mm

(14–60 mm); $p=0.23$. Both groups were comparable in terms of gender, side of surgery, primary PUJO, antenatal diagnosis and crossing vessels (Table 1).

There were five cases of solitary kidney with PUJ obstruction among the 72 operated cases, three in Group 1 and two in Group 2. Out of the three solitary kidney in Group 1, one was a case of retrocaval ureter with PUJO and one had a multicystic dysplastic kidney (MCDK) on contralateral side. In Group 2 one case of solitary kidney was ectopically located in pelvis and the other was associated with MCDK on contralateral side.

Two patients in Group 1 and one patient in Group 2 had persistent obstruction in the follow-up renogram at 6 month and hence were considered as unsuccessful pyeloplasty. These patients did not show improvement in postoperative split renal function. Out of this one patient in Group 1 spontaneously resolved and had no obstructive pattern at 12 month diuretic renography while the other patient underwent redopyeloplasty and is under follow-up. The patient in Group 2 is still under follow-up as the renogram is due at 12 months. Hyperfunction seen on renogram in a few obstructed kidneys was probably due to the large dilated pelvis with consequent larger area in region of interest. The mean postoperative split renal function in Group 1 was 44% (21%–47%) and was 46% (23%–53%) in Group 2; $p=0.18$. The post surgery improvement in split renal function occurred in 92% (35/38) patients in Group 1 and in 88% (23/26) patients in Group 2; $p=0.51$. Postoperative mean AP diameter in Group 1 was 17.1 mm (10–24 mm) and in Group 2 was 20 mm (9–26 mm); $p=0.56$ (Table 2).

Nine patients developed complications, seven patients in Group 1 and two patients in Group 2 ($p=0.29$, relative risk: 2.36). Three patients in Group 1 and two patients in Group 2 had documented UTI (Clavien II) and two patients in Group 1 had increased frequency of micturition (Clavien II). None of the patients had preoperative UTI. All patients showed presence of the lower end of the DJ stent in the bladder on X-ray KUB performed on the postoperative evening, however, stent migration was observed in two patients of Group 1, and the stent had migrated into the pelvis in both cases (Fig. 1). One stent could be removed through PCN (Clavien IIIA) and reexploration was required for removing the stent in the other case (Clavien IIIB).

4. Discussion

Though Anderson-Hynes pyeloplasty has become established as the gold standard for management of PUJO, the issues of stenting the pelvi-ureteric anastomosis is still unresolved. The first issue at hand is whether a stent is required at all in the first place. Smith et al. [5] in a series involving 117 pediatric pyeloplasties showed comparable outcomes and complications between the stented and the unstented groups. The stented group had more UTI while the nonstented group had more urinary leaks. The hospital stay was also more in the stented group. In another study of 70 children, the overall resolution of hydronephrosis and complication rates were similar in the stented and the unstented groups [6]. Kumar and Mandhani [7] in their

Table 1 Preoperative characteristics.

	Group 1 (n=43)	Group 2 (n=29)	p-Value
Age, median (range), month	9 (3–132)	7 (2–144)	0.11
Gender, male:female (%)	34:9 (79%:21%)	24:5 (83%:17%)	0.43
Side, right:left (%)	17:26 (40%:60%)	11:18 (38%:62%)	0.46
Primary PUJO (%)	42 (98%)	29 (100%)	0.64
Preoperative split renal function, mean (range)	42% (26%–54%) ^a	39% (19%–42%) ^a	0.37
Preoperative APD on USG KUB, mean (range), mm	21.4 (12–70)	22.8 (14–60)	0.23
Antenatal diagnosis (%)	28 (65.1%)	20 (68.9%)	0.17
Crossing vessels (%)	4 (9%)	1 (3%)	0.40

APD, anteroposterior diameter; KUB, kidney ureter bladder; PUJO, pelvi-ureteric junction obstruction; USG, ultrasonogram.

^a Solitary kidney excluded.

Table 2 Postoperative characteristics.

	Group 1 (n=43)	Group 2 (n=29)	p-Value
Stent removal, median (range), day	37 (28–58)	14 (13–19)	NA
Postoperative split renal function mean (range)	44% (21%–47%) ^a	46% (23%–53%) ^a	0.18
Improvement in split renal function	35/38 ^b (92.5%)	23/26 ^b (88.0%)	0.51
Postoperative APD on USG KUB, mean (range), mm	17.1 (10–24)	20 (9–26)	0.56
Success rate, n (%)	41 (95)	28 (97)	0.64
Complications, n (%)	7 (16.0)	2 (6.8)	0.29
Length of hospital stay (mean±SD), day	3.16±0.12	3.09±0.8	0.27

APD, anteroposterior diameter; KUB, kidney ureter bladder; NA, not applicable; USG, ultrasonogram.

^a Solitary kidney was excluded.

^b Solitary kidney and obstructed patients were excluded.



Figure 1 Coiled double J stent in the pelvis.

limited series of 16 laparoscopic stentless pyeloplasties had 50% urinary leak in the pediatric population requiring restenting in the postoperative period.

The second unresolved issue is, if the stent is needed, then what stent would be ideal. The options are between DJ stent, nephrostomy tube and pyeloureteral stent. A prospective randomized study of 40 children comparing outcomes between nephrostomy and DJ stent showed comparable outcomes in both groups. However, there were more minor complications and more overall treatment cost in the DJ stent group in spite of decreased hospital stay [4]. Outcome analysis and cost comparison between DJ stent and external pyelo-ureteral stent showed similar outcomes in both groups though the overall treatment cost was lower in the pyelo-ureteral group and more importantly, the preclusion of a second anesthesia for the patient [8].

A large majority of the surgeons use DJ stent after pyeloplasty as they consider it the safest mode of stenting [9]. The DJ stent reduces the urinary leaks, decreases morbidity and reduces the hospital stay [10]. In addition the DJ stent splints the anastomosis thereby preventing

adhesions, maintains the ureter alignment and prevents kinking [11]. However, the third unresolved issue is with regards to the duration of safe DJ stenting. It is known that prolonged stenting may be associated with lower abdomen pain, urinary tract infection, loin pain due to reflux, fever, dysuria, urinary frequency and nocturia [12–14]. To the best of our knowledge no previous study has compared the outcomes based on the duration of DJ stenting in pediatric open pyeloplasty.

Our study of 72 children clearly shows that shorter stenting duration (2 weeks) was comparable in terms of success rate to a longer duration (4 weeks) of stenting. Both the groups were comparable in terms of age at surgery, pre-operative split renal function and gender distribution. Our overall success rate of 96% (69/72) is comparable to other studies in literature which quoted success rates of more than 90% [15,16]. We strictly defined success as a non-obstructive drainage pattern on diuretic renogram done 6 months postoperatively, though one of our patient who had obstruction in postoperative renogram at 6 month later had a nonobstructive drainage pattern at 12 month renal scan and the other was due for the second postoperative scan.

Surgery for PUJO may not significantly improve the existing split renal function in spite of improvement in the drainage pattern. In our study we had an overall improvement in 91% (58/64) of cases. This is comparable to other studies where the postoperative split functions did not improve remarkably in spite of a non obstructive drainage pattern [17].

Our overall complication rate was 12.5% (9/72) out of which one was Clavien IIIa and one was Clavien IIIb. There is a wide range of DJ stenting complication rates in literature ranging from 5% to 85%, depending on what needs to be counted as a complication [4,18]. There were two cases of proximal stent migration and both were seen in Group1 requiring some form of surgical intervention (relative risk=2.36).

Various reasons like shorter stent length, inadequate distal curve in the bladder and proximal curve in the upper calyx instead of the pelvis have been brought out for proximal stent migration [19,20]. While most of the studies do not implicate longer stenting as a cause of proximal migration, some studies like our study have shown that longer stenting may be a cause of migration proximally [21]. The caveat is that all these studies were on adults and the ureteric length measurement was based on retrograde pyelogram (RGP) or an intravenous urogram (IVU) which is generally not performed in pediatric PUJO. Our technique of real time measurement of ureteric length intra-operatively appears to be more objective compared with measurement of length based on a X-ray film. Again there are conflicting opinions regarding the mode of stenting, while on one hand retrograde approach was shown to be more reliable with lesser complications [22], on the other hand, antegrade stenting was faster with complication rates comparable to retrograde stenting [23].

The strengths of our study have been the relatively large number of patients considering the short study period. To the best of our knowledge this is the first study comparing outcomes of open pyeloplasty based on duration of DJ stenting in pediatric population. The limitations are that the study groups in spite of being statistically comparable

were not randomized, and the data were analysed retrospectively and that it was a single centre observation.

5. Conclusion

Based on this study we would like to state that a shorter duration of DJ stenting is comparable to a longer stenting period in terms of surgical outcomes and in addition has lesser stent related complications though not statistically significant. Further multicentric randomised controlled studies are required to give us a final answer on the subject of stent duration.

Author contributions

Study design: Santosh Dey, Venkat Shankar Raman.

Data acquisition: Tarun Peela, Karunesh Chand.

Data analysis: Santosh Dey, Naveen Chandra, Karunesh Chand.

Drafting of manuscript: Santosh dey, Venkat Shankar Raman.

Critical revision of the manuscript: Santosh Dey, Venkat Shankar Raman.

Conflicts of interest

The authors declare no conflict of interest.

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