Original Article

Evaluation of the Outcome of Pyeloplasty in Children with Poorly Functioning Kidneys due to Unilateral Ureteropelvic Junction Obstruction

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Aim: To analyze the outcome of upfront pyeloplasty in kidneys of children with unilateral ureteropelvic junction obstruction (UPJO).

Materials and Methods: Thirty-three consecutive cases with split renal function (SRF) of ≤20% on dynamic renal scintigraphy (DRS) underwent upfront pyeloplasty with a nephrostomy tube and trans-anastomotic stent. Outcome was analyzed based on symptomatic relief, nephrostomy output, surgical complications and changes noted in pre-and post-operative findings on renal ultrasound (US), and DRS.

Results: The most common symptom was abdominal lump in <5-year age group (79%) and abdominal pain in >5-year age group (93%). Postoperatively, symptoms were relieved in all (100%), parenchymal thickness (PT) on US improved in 82% and SRF improved significantly (>5%) in 75.8% of patients. The improvement was more significant in patients with abdominal lump and large kidneys. The mean nephrostomy output showed an inverse relationship with age at pyeloplasty and a direct correlation with the change in PT and SRF. The degree of improvement in SRF also was inversely related to the age at pyeloplasty with a significantly better outcome in <2-year-age. Although age at pyeloplasty, nephrostomy output and change in PT individually showed significant correlation with change in SRF, multiple regression analysis showed PT as the only significant factor.

Conclusion: Upfront pyeloplasty should be the first option in children with poorly functioning kidneys as it has a favorable outcome in almost all the cases with a very low incidence of complications. The degree of improvement in SRF can be predicted by the nephrostomy output and improvement in PT on US.

Keywords: Nephrectomy, poorly functioning kidneys, pyeloplasty, unilateral ureteropelvic junction obstruction

INTRODUCTION

Ureteropelvic junction obstruction (UPJO) is the most common form of obstruction in the upper urinary tract.¹ Surgical repair is indicated for obstructive renal pelvic drainage curve and progressive deterioration of renal function on dynamic renal scintigraphy (DRS).² Significantly compromised renal function is not uncommon, and there is no consensus on ideal management for this subset. Most of the related studies are retrospective with only 2 major prospective studies.³,⁴ Recommendations for split renal function (SRF) <10% range from nephrectomy⁵,⁶ to

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upfront pyeloplasty\cite{24,7-9} with an intermediate approach of a preliminary percutaneous nephrostomy (PCN) to identify those who will benefit from pyeloplasty.\cite{3,10,11} Considering the morbidity associated with maintaining PCN and difficulty during pyeloplasty due to fibrosis in such patients, upfront pyeloplasty seems a more amicable option with promising outcome in few recent studies.\cite{14,8,9} In this prospective observational study, we analyzed the short- and intermediate-term results of primary pyeloplasty in kidneys with unilateral UPJO and poor function (SRF ≤20%), with a special focus on kidneys with very poor function (SRF ≤5%).

**Materials and Methods**

The study included 33 consecutive cases of congenital unilateral UPJO with SRF ≤20% managed during the 20-month period from December 2017 to July 2019. Institutional Ethical Committee clearance was obtained. We excluded the patients with a failed previous pyeloplasty, pyonephrosis, calculi, solitary kidney, duplex kidney, and any associated ureteral or bladder anomalies. Preoperative ultrasound (US) findings were recorded as Society of Fetal Urology (SFU) grading of hydronephrosis\cite{12} along with the morphologic parameters which included the anteroposterior diameter (APD) of renal pelvis, calyceal dilatation, renal parenchymal thickness (PT) in mm, parenchymal appearance, and any bladder or ureteral abnormalities.\cite{13} Renal parenchyma was labeled as “papery thin” if the thickness was <1.5 mm. DRS with F-0 protocol was done for objective assessment of function and drainage of the affected kidney. The choice of radiopharmaceutical employed was, to some extent, dependent upon institutional availability. Tc-99 m LL-Ethylene dicysteine was used in 15 patients (45.45%) and Tc-99 m diethylene triamine pentacetic acid in 18 patients (54.54%). A drainage curve may not be elicited on DRS due to poor function, so SFU Grade-3/4 hydronephrosis with no ureteral dilatation on US was considered enough for diagnosis in such cases. Based on preoperative SRF, the patients were categorized into three groups: Group 1 (≤5%); Group 2 (>5–≤10%); and Group 3 (>10–≤20%). All patients underwent open Andersen-Hynes dismembered “reduction” pyeloplasty irrespective of age and function,\cite{14} performed by experienced surgeons beyond the learning curve, using standard techniques. A trans-anastomotic stent (3–5 Fr umbilical catheter) and a nephrostomy tube (8–12 Fr Foley’s catheter) were placed along with a perinephric drain intraoperatively. The perinephric drain was removed if the 24-h drain output was minimal. The average daily urine output from the nephrostomy (ml/kg/hour) was also charted from the day of full oral feeding (without intravenous supplementation), usually postoperative day (POD) 3, till the nephrostomy was clamped. Postoperatively, we recorded any complications such as anastomotic leak or perirenal collection and the POD on which the perinephric drain, trans-anastomotic stent and nephrostomy tube were removed.

During follow-up, postoperative US was done at 6 weeks and 3 months and DRS at 3 months. A cut-off of 5% improvement in postoperative SRF was considered significant.\cite{3,13} Essential indicators for a successful outcome were asymptomatic patient and stabilization or improvement in renal morphology on US, which may or may not be supported by improvement in postoperative SRF (>5%) and drainage pattern in view of poor function of the affected kidney. With respect to renal morphology, stabilization meant no further deterioration, i.e., no increase in APD + calyceal dilatation and no decrease in PT; and improvement meant decrease in APD (besides intraoperative reduction) + calyceal dilatation and increase in PT. The follow-up DRS was done with the same radiopharmaceutical used during preoperative evaluation for that patient, respectively.

Statistical analysis was performed using the statistical package for social sciences (SPSS version 16). Qualitative variables were analyzed using Chi-square Test/Fisher Exact Test while quantitative variables were subjected to unpaired t-test and Mann–Whitney Tests. Data was expressed as mean, standard deviation (SD), and range. Pearson’s or Spearman’s correlation test were used and a P < 0.05 was taken as statistically significant.

**Observations And Results**

There were 29 male and 4 female patients (M:F = 7.25:1), age ranging from 2.5 months to 12 years (mean ± SD: 5.34 ± 3.72 years); Table 1 mentions the characteristics noted: approximately one-third (27.3%) <2-year age (n = 9), abdominal lump was the most common presentation, abdominal pain was present in almost all patients >5-year age (n = 13/14; 92.9%) whereas abdominal lump was predominant in <5-year-age (n = 15/19; 79%) and left side was the most common. All patients were normotensive with normal renal biochemistry and sterile urine cultures. On preoperative US, all patients had SFU grade-4 HN with no ureteric dilatation. The distribution based on age and SRF depicted did not show any significant association on Chi-square test of independence, X²/2, N = 33) =1.303, P = 0.86. The drainage pattern could not be commented upon in eight patients due to poor function (0% in five and 1.32%, 4.6%, and 5.2% in three). One (3%) patient had an ectopic kidney. The affected kidney was small in five patients (15.2%); all were >5 years old, and...
two (6.1%) had crossing lower polar vessel (extrinsic UPJO). No statistically significant correlation was found ($P = 0.375$) between size of affected kidney with UPJO and preoperative SRF.

Postoperative period was uneventful in most of the patients. Drain was removed on POD-3/4 in 32 patients (97%) and 10th POD in one patient with prolonged drain output. Nephrostomy tube was removed by POD‑8 in 30 patients (90.9%) and on the 12th–16th POD in three patients (9.1%). These three patients included the patient with prolonged drain output and two patients who developed an abdominal lump and pain on clamping the nephrostomy tube necessitating another week of nephrostomy drainage.

**Follow-up**

All patients had complete resolution of symptoms and signs at 6 weeks, except two (6.1%) in whom resolution occurred at 3 months. Postoperative asymptomatic culture-positive urinary tract infection (UTI) (one fungal UTI) was recorded in four (12.1%) patients during the first 6 weeks of follow-up and in one patient (3%) on 3-month follow-up.

**Ultrasound findings [Table 2]**

All the patients had stable morphologic parameters in postoperative US, except one in whom PT decreased from 2 mm to 0 mm (papery-thin). Postoperatively, APD remained stable and the overall improvement in PT was statistically significant in all. PT improved in 81.8% ($n = 27/33$) patients. On comparing findings in patients <2-year to those >2-year of age: (1) Increased incidence of papery thin parenchyma revealed weak significance $\chi^2 (1, N = 33) = 1.35$, $P = 0.24$. (2) Improvement in PT was not statistically significant ($P = 0.789$), (3) In kidneys with papery thin parenchyma, apparently better results in <2-year age group ($n = 4/5$ vs. 5/8) did not reach statistical significance $\chi^2 (1, N = 13) = 0.44$, $P = 0.51$.

**Dynamic Renal Scan findings [Table 2]**

Significant improvement of >5% was noted in 25/33 (75.8%) patients. In all 3 preoperative SRF groups, the overall improvement in mean SRF was
statistically significant, the maximum improvement being in Group 3 (>10–≤20%) patients ($P = 0.0001$). Among the various clinical presentations, it was more significant ($P = 0.002$) for the 19 cases with abdominal lump. 78.6% large kidneys (22/28) showed significant improvement in postoperative SRF compared to 60% (3/5) small kidneys which was weakly significant ($P = 0.11$).

Although SRF showed significant (>5%) improvement in 25 (75.8%) patients, the drainage improved in only 14 of these patients (42.4%). In the remaining 11 (33.3%), drainage did not improve, but the PT showed significant improvement ($P < 0.05$) corresponding with that in SRF. [Table 3] This discrepancy between improvement in SRF and drainage was significant ($X^2 [1, N = 33] = 7.584, P = 0.006$).

Both postoperative SRF and drainage did not improve in 8/33 (24.2%) patients [Table 4]. Six of these (75%) were >5-year-age. In these eight patients, 2 had small kidneys (including 1 with a lower polar crossing vessel), while 6 had a large kidney. The average nephrostomy urine output from these kidneys was also significantly lower (average 0.51 ± 0.49; range 0.09–1.5 ml/kg/h) as compared with the remaining 25 patients (1.40 ± 0.52 ml/kg/h; range 0.31–2.55 ml/kg/hr) ($P = 0.0002$). Despite insignificant

| Variables   | Preoperative | At 6 weeks postoperative | At 3 months postoperative | Preoperative versus 6 weeks postoperative | Preoperative versus 3 months postoperative |
|-------------|--------------|---------------------------|---------------------------|------------------------------------------|-------------------------------------------|
| APD (cm)    | 5.01±2.68    | 2.83±1.69                 | 2.53±1.67                 | <0.001                                   | <0.001                                   |
| PT (mm)     | 2.43±3.02    | 5.04±3.78                 | 5.41±3.98                 | <0.001                                   | <0.001                                   |
| DRS SRF (%) |              |                           |                           |                                          |                                          |
| SRF (%)     | Mean preoperative SRF (%) | Mean postoperative SRF (%) | $P$                      |                                          |                                          |
| Group-I     | 7 (21.21)    | 0.84±1.72                 | 13.64±11.45               | 0.0314                                   |                                           |
| Group-II    | 6 (18.18)    | 7.9±1.6                   | 13.12±4.5                 | 0.0410                                   |                                           |
| Group-III   | 20 (60.60)   | 15.24±3.09                | 26.83±10.06               | 0.0001                                   |                                           |
| Overall     | 33 (100)     | 10.85±6.49                | 21.54±10.50               | <0.001                                   |                                           |

SRF: Split renal function, PT: Parenchymal thickness on ultrasound, US: Ultrasound, DRS: Dynamic renal scintigraphy, APD: Anteroposterior diameter

| SRF groups               | PT at (mean±SD) | $P$ | SRF (mean±SD) | $P$ |
|--------------------------|-----------------|-----|---------------|-----|
| Group-I (n=1)            | 2               | NA  | 0             | 13.8 NA |
| Group-II (n=4)           | 3.2±1.69        | 5.18±0.57 | 0.04 | 7.6±1.7  | 15.55±3.22 | 0.01 |
| Group-III (n=6)          | 2.18±2.05       | 4.117±3.1 | 0.022  | 15.3±3.12 | 28.13±10.97 | 0.0506 |
| Total (n=11)             | 2.35±1.95       | 4.8±2.46 | 0.0028 | 10.97±5.64 | 22.25±10.454 | 0.0026 |

SRF: Split renal function, PT: Parenchymal thickness on ultrasound, SD: Standard deviation, NA: Not applicable

| Age          | Clinical presentation | Preoperative PT | Preoperative SRF | Postoperative SRF | Nephrostomy output (ml/kg/hr) |
|--------------|-----------------------|-----------------|-----------------|-----------------|------------------------------|
| 2.5 months   | Abdominal lump        | 0               | 0               | 14              | 7.6                          | 2.55                         |
| 2.5 years    | Abdominal pain+lump   | 0               | 3.3             | 9.7             | 8.65                         | 1.5                          |
| 5 years      | Abdominal pain+lump   | 0               | 8               | 7               | 7.9                          | 0.58                         |
| 5 years      | Abdominal pain+lump   | 0               | 2.7             | 0               | 2.7                          | 0.09                         |
| 5 years      | Abdominal pain+lump   | 0               | 0               | 0               | 4                            | 0.11                         |
| 11 years     | Abdominal pain (small kidney+Lower polar vessel) | 6.2 | 6.6 | 4.6 | 5 | 0.2 |
| 11 years     | Abdominal pain+lump   | 2               | 0               | 20              | 15                           | 0.18                         |
| 12 years     | Abdominal pain (small kidney) | 12 | 10 | 20 | 24 | 0.9 |

SRF: Split renal function, PT: Parenchymal thickness on ultrasound
Improvement in SRF; all had symptomatic relief with stable postoperative renal APD and 50% \((n = 4/8)\) had improvement in PT on follow-up. Although not statistically significant \(X^2 (2, N = 33) = 1.35, P = 0.51\), 7 of these 8 (87.5%) patients were >2-year-old; 6 (75%) were >5-year-age.

Drainage did not improve in 19/33 patients (57%); 10/13 (76.9%) with preoperative SRF ≤10% and only 9/20 (45%) with preoperative SRF >10%. This difference was moderately significant \(X^2 (1, N = 19) = 3.287, P = 0.07\) indicating more potential for improvement of drainage in better functioning kidneys. Eleven of these 19 patients (58%) had statistically significant improvement in postoperative PT and SRF \((P < 0.05)\).

In the remaining 8 cases, there was a marginal increase in SRF (<5%) in five patients (15.2%) including the two small kidneys, and a decrease in the SRF in only three patients (9.1%). Amongst the 3/8 patients (37.5%) with decreased function, in one patient (2.5-year-old), although SRF decreased marginally from 9.7% to 8.6% the PT increased from 0 to 3 mm; in another patient, the SRF dropped from 14% to 7.6% with no improvement in PT (papery-thin; 0 mm), while in the third patient, SRF dropped from 20% to 15% with a decrease in PT from 2 mm to 0 mm.

**Mean postoperative nephrostomy output**

The mean postoperative nephrostomy output (ml/kg/hour) on full oral diet was \(1.24 \pm 0.67\) (95% confidence interval [CI] -1-1.48). Spearman correlation showed a strong direct correlation with change in SRF \((r_s (31) = 0.39, P = 0.03)\) and change in PT \((r_s (31) = 0.49, P =0.002)\) and a strong inverse linear and monotonic relation with age \((r_s (31) = -0.35, P=0.024)\).

**Findings in patients with very poor function preoperative split renal function <5% (Group 1; \(n = 7\)) [Table 5]**

One patient had small kidney with marginal improvement in SRF. Five (71.4%) had no uptake on DRS. Four patients from this group showed significant (>5%) improvement in postoperative SRF and on comparing their mean nephrostomy urine output (1.4–1.95 ml/kg/h) with those in whom SRF did not improve significantly (0.09–0.2 ml/kg/h), the difference was statistically significant \((P = 0.0001)\).

**Kidneys with papery thin parenchyma**

Following pyeloplasty, on relating the data (non-parametric) in all patients \((n = 33)\) for improvement in SRF with that in PT, Spearman’s rank correlation test result was highly significant \((P = 0.006)\). On further categorization, in kidneys with papery thin parenchyma \((n = 13)\) this correlation had weak association \((P = 0.19)\), whereas it was highly significant in kidneys without papery thin parenchyma \((P = 0.001)\). The comparison of improvement in SRF between those with and without papery thin parenchyma was

![Image](image-url)

**Figure 1:** Relationship of Nephrostomy output with the three factors as labeled. Please note that Age at pyeloplasty had an inverse correlation.
not significant on Mann–Whitney U-test (U = 84, z-score = 0.94, P = 0.17).

**Comparison between Age groups <2-year versus >2-year**

Nephrogenesis completes in utero by 36 weeks of gestation and postnatal renal maturation reaches maximal functional capacity by 2 years of life. This forms the scientific basis for all efforts to prevent or limit renal injury before the age of 2-year. The glomeruli reach adult size by 3½ years of age and may allow for a window period to limit renal injury.[16] So, we compared the outcomes in <2-year age group with older age groups. The odds for >5% improvement in SRF was 3.3 times higher in <2-year age, but this was not significant on Chi-square test $X^2 (1, N = 33) = 1.16, P = 0.28$. The apparently better outcome with respect to SRF in <2-year age group i.e., $15.37 \pm 13.59$ (95% CI, 4.92–25.82), than that in >2-year age group i.e., $8.81 \pm 8.03$ (95% CI, 5.42–12.2), was statistically significant ($U = 67.5, P = 0.05$). The nephrostomy output was significantly higher in <2-year age group (z-score = –2.06, P = 0.02). There was no significant difference in the improvement of PT at 3 months following pyeloplasty between the two age groups ($P = 0.79$).

On analyzing effect on improvement in SRF individually, Mann–Whitney U-test was significant for the three factors-age at pyeloplasty ($P = 0.006$), improvement in PT ($P = 0.00005$), and nephrostomy output ($P < 0.00001$), whereas Spearman’s correlation test was strongly significant for improvement in PT ($r_s (31) = 0.43, P = 0.006$) and nephrostomy output ($r_s (31) = 0.39, P = 0.01$) and less significant for age at pyeloplasty ($r_s (31) = –0.25, P = 0.08$) [Figure 2]. Multiple regression analysis for these three factors predicting the improvement in SRF revealed weak significance (right tailed, $F [3,29] = 2.33, P = 0.1$).

**Table 5: Findings and results in patients with preoperative split renal function<5% (n=7)**

| Age (years) | Clinical presentation | Preoperative PT (mm) | Postoperative PT (mm) | Preoperative SRF (%) | Postoperative SRF (%) | Drainage | Nephrostomy output (ml/kg/h) |
|-------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|----------|-----------------------------|
| 2           | Abdominal lump         | 0                    | 7.6                   | 0                    | 35                    | Slow     | 1.95                        |
| 2           | Abdominal pain+lump    | 0                    | 4.7                   | 1.32                 | 15                    | Slow     | 1.62                        |
| 4           | Incidental detection   | 2                    | 19                    | 0                    | 13.8                  | Couldn’t be commented upon due to poor uptake | 1.7|
| 5           | Abdominal pain+lump    | 0                    | 0                     | 0                    | 4                     | Poor uptake | 0.11|
| 5           | Abdominal pain+lump    | 0                    | 2.7                   | 0                    | 2.7                   | Poor uptake | 0.09|
| 7           | Incidental detection   | 0                    | 7                     | 0                    | 20                    | Slow     | 1.4                         |
| 11          | Abdominal pain         | 6.2                  | 6.6                   | 4.6                  | 5                     | Poor uptake (small kidney) | 0.2|

SRF: Split renal function, PT: Parenchymal thickness on ultrasound. Please note that all the 4 patients with significant improvement in Postoperative SRF also had higher nephrostomy output (highlighted in bold)

**Figure 2:** Individual Spearman Correlation of the three factors as labeled with the Change in split renal function on follow-up dynamic renal scintigraphy. Please note that Age at pyeloplasty had an inverse correlation.
explaining only 11% change in SRF; overall regression with backward stepwise method showed “improvement in PT” to be a significant predictor (overall regression: right tailed, F [1,31] = 4.87, P = 0.035) [Figure 3]. The interaction of “nephrostomy output” with “age at pyeloplasty” was strongly significant (P = 0.04) than with the “change in PT” (P = 0.1) explaining 24% of change in the postoperative SRF (F [5,27] = 3.03, P < 0.03). In kidneys without papery thin parenchyma, nephrostomy output emerged as a moderate predictor for change in SRF on multiple regression analysis with a coefficient of multiple correlation (R) = 0.54 (F [1,18] = 7.51, P = 0.01), whereas none of these three factors were significant for kidneys with papery thin parenchyma on multiple regression.

**Discussion**

The symptomatic relief in all and low incidence of perioperative complications (5/33; 15.1%) concurred with other studies.[2-4,9] Stabilization of postoperative APD noted in all our patients has also been observed by Abdelaziz et al.[4] in patients with SRF <10%. Since we did reduction pyeloplasty, postoperative stabilization of the reduced size of APD with improvement in PT and symptomatic relief in all were important markers of success corroborated by improved SRF in 76% of our patients, compared with other studies.[5,15] In the remaining patients, despite insignificant improvement in postoperative SRF, symptoms were relieved in all with stabilization of renal APD and improvement in PT in 50% cases on follow-up, favoring upfront pyeloplasty. Abdelaziz et al. considered APD and SRF to assess outcome; interestingly drainage curve could be obtained on DRS in all patients with SRF <10%, which was not the case in our study.[4]

The findings of abdominal lump mostly in <5-year age with significant improvement in postoperative SRF and presence of all the small kidneys in >5-year age group indicate more potential for improvement in younger patients.[3,17] The gross hydroureter in the abdominal lump may reflect the existing capability to produce urine and latent renal reserve.[4] We noted better outcome in SRF of patients presenting with abdominal lump and large kidneys, similar to Menon et al.[3] Mean nephrostomy output was also significantly high in our patients with large kidneys (P = 0.02).

In our study, kidneys with moderately impaired function (SRF >10–<20%) showed more significant improvement similar to the findings of Castagnetti et al.[18] However, few recent studies have observed better outcome even with SRF <10%.[2,3,8] Furthermore, in kidneys with detectable PT, improvement in SRF was statistically significant; thus indicating more potential for improvement.

In a review of the interpretation of DRS in children with hydroureteros, Eskild-Jensen et al. stated that the drainage curve may give an erroneous impression of continuing obstruction postoperatively.[19] It is of interest to note that drainage did not improve in almost half of our patients with improved SRF (n = 11/25; 44%). Studies suggest that renal pelvis APD stabilization and/or improvement in postoperative SRF are more important markers of success than improvement in drainage patterns on DRS.[2,20,21] This may imply that improvement in drainage may take a longer time to reflect on DRS.

![Figure 3: Change in parenchymal thickness on follow-up ultrasound was the only significant factor affecting the change in split renal function on follow-up dynamic renal scintigraphy on multiple regression analysis of the three factors found to have significant correlation individually.](image-url)
Including those \((n = 5)\) with minor improvement (<5%) of postoperative SRF but stabilization/improvement of renal morphology on US and symptomatic relief, overall outcome was favorable in 30/33 cases (90.9%) commensurate with the available literature.[2,3,4]

Although weakly significant, the apparent inverse relationship of age at pyeloplasty with improvement in SRF indicates possibility of poor outcome in older children. Nephrostomy output may indicate the potential for improvement as it had a significant direct correlation with the improvement in SRF. Multiple regression analysis identified following important factors to be significant in predicting the overall outcome-improvement in PT \((P = 0.04)\) and the interaction of nephrostomy output with age at pyeloplasty \((P = 0.04)\) and improvement in PT \((P = 0.1)\); although the individual association with the three factors was strongly significant.

Our finding of improvement in approximately 60% of patients with very poor preoperative SRF \((n = 7)\) or with papery thin parenchyma \((n = 13)\), does not support the recommendation of primary nephrectomy in such patients[5] and favors renal preservation in kidneys with <10% SRF.[2-7,9] Nephrectomy following an interim PCN, with SRF <10%, varied from 15% to 29.4% in two studies.[3,10] In our patients with SRF <10% \((n = 13/33; 39.4\%)\), PCN might have identified 5/13 (38.5%) with insignificant improvement in SRF. The nephrostomy output was significantly low in these five patients \((U = 5.5, z\text{-score} = 2.05, P = 0.04)\) and all were >2-year-age. But all are asymptomatic with stable renal morphology on US; this along with morbidity associated with PCN favors our approach.[10,11,22] Nephrectomy can always be performed later if it becomes necessary.[2,4]

Complete resolution of symptoms and stable renal morphology was observed in all. Our follow-up was limited at 3 months. Studies in patients with SRF <10% suggest maximal improvement occurred early after relief of obstruction and then tended to plateau.[3,4,7] The postnatal phase of development in kidneys provides the opportunity to prevent further damage to the latent functional reserve.[16,23] Despite protection due to antenatal compensation by the unaffected kidney, the possibility of continuing renal hyperfiltration injury requires yearly follow-up renal scans.[9,15]

The limitations of our study were a small number of patients and a lack of long-term follow-up. Due to unavailability of the same radiopharmaceutical during DRS in all the patients, during follow-up DRS, we ensured to use the same radiopharmaceutical which was used preoperatively in the respective patient to allow a fair assessment.

**Key Messages**

1. We recommend upfront pyeloplasty for all unilateral ureteropelvic junction obstruction in children with poorly functioning kidneys \((SRF<20\%)\), including those with very poor function \((SRF<5\%)\) and papery thin parenchyma because a successful outcome is very likely in majority with a low incidence of perioperative complications.

2. Kidneys with papery thin parenchyma have less potential for improvement.

3. Young age favors better outcome. Age is also inversely related to the nephrostomy urine output from the affected kidney.

4. Postoperative nephrostomy urine output and improvement in PT appear to be good predictors of degree of improvement in split renal function on dynamic renal scintigraphy.

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**Conflicts of interest**

There are no conflicts of interest.

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