Original Article

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# Postoperative Recovery Patterns of Stented vs. Non-Stented Pyeloplasty in Pediatric Ureteropelvic Junction Obstruction

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## ABSTRACT

***Background:*** *Pediatric Ureteropelvic Junction (UPJ) obstruction is a common cause of hydronephrosis and can significantly affect renal function if left untreated. Pyeloplasty, both with and without stenting, is the gold-standard surgical treatment. This study aims to compare the postoperative recovery patterns between stented and non-stented pyeloplasty in pediatric UPJ obstruction.*

***Materials and methods:*** *This quasi-experimental study was conducted at the Department of Paediatric Surgery, Mymensingh Medical College Hospital, Mymensingh, from July 2021 to December 2021. A total of 31 children who underwent pyeloplasty were selected as study subjects by purposive sampling technique. A p-value less than or equal to 0.05 was considered as significant. Statistical Package for Social Sciences (SPSS) version 26.0 was used for this purpose.*

***Results:*** *The study revealed that anatomical parameters improved significantly in the stented group: APD decreased from 50.01 mm before surgery to 22.86 mm after 3 months (p=0.01) and cortical thickness increased from 3.02 mm to 4.28 mm (p=0.04). Serum Response Factor (SRF) showed minimal change in the stented group (p=0.584 before vs. 1.5 months, p=0.03 before vs. 3 months). In the non-stented group, APD improved from 47.06 mm to 22.80 mm (p=0.02), but cortical thickness showed no significant change (p=0.06). No significant difference in serum creatinine levels was observed between the groups.*

***Conclusion:*** *This study suggests that stented pyeloplasty results in a faster recovery in terms of anatomical parameters such as APD and cortical thickness. However, functional recovery, as assessed by SRF and serum creatinine levels, showed minimal difference between the stented and non-stented groups. This supports the idea that while stenting may facilitate more rapid anatomical improvement, the ultimate functional recovery of the kidney may not be significantly affected by the presence or absence of a stent.*

**Key words:** Hydronephrosis; Pyeloplasty; Recovery patterns; SRF; Ureteropelvic junction obstruction.

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## Introduction

Ureteropelvic Junction (UPJ) obstruction is a common congenital abnormality in pediatric urology, characterized by an obstruction at the junction between the renal pelvis and the ureter. This condition often leads to impaired urine flow from the kidney to the bladder, resulting in hydronephrosis. If left untreated, UPJ obstruction can cause renal damage, infection and in severe cases, renal failure. Pyeloplasty, a surgical procedure designed to relieve this obstruction, has become the gold standard treatment for UPJ obstruction in pediatric patients.[1] One key decision in managing UPJ obstruction is whether to use a stent after pyeloplasty, as the presence of a stent has been suggested to influence postoperative recovery, functional renal recovery and complication rates.[2,3] The Anteroposterior Diameter (APD) of the renal pelvis is a critical parameter used in diagnosing the severity of UPJ obstruction. APD, measured through imaging techniques such as ultrasound or Magnetic Resonance Imaging (MRI) reflects the degree of hydronephrosis, which correlates with the severity of the obstruction.

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Larger APD measurements are often associated with more severe forms of obstruction, a higher likelihood of renal damage and worse postoperative outcomes.[4] Additionally, studies have shown that the resolution of hydronephrosis and APD after pyeloplasty may serve as a predictive factor for recovery and can indicate the success of the surgical intervention.[5] APD measurements are used not only to assess the severity of the condition before surgery but also to monitor recovery in the postoperative period, influencing decisions regarding the need for further intervention.[4] The cortical thickness of the kidney is another essential parameter that influences recovery after pyeloplasty. The renal cortex, where nephron function resides, can become progressively thinner in cases of chronic UPJ obstruction due to prolonged pressure from the obstructed urine flow, leading to nephron loss and irreversible damage.[6] Preoperative assessment of cortical thickness on the affected side provides valuable insight into the degree of renal impairment and the potential for functional recovery after pyeloplasty. Thinner cortical thickness before surgery has been associated with poor postoperative functional outcomes and recovery may be limited, especially in cases of long-standing obstruction.[7] Assessing cortical thickness via imaging techniques such as ultrasound or MRI before and after surgery is essential to predicting the kidney's ability to regain function after relieving the obstruction.[8] Another key parameter in postoperative recovery assessment is the Split Renal Function (SRF). SRF quantifies the function of the affected kidney relative to the contralateral kidney and is a reliable measure of renal function in cases of UPJ obstruction.[9] Preoperative SRF measurements help to evaluate the extent of renal damage, while postoperative SRF values can serve as a predictor of functional recovery. A significant reduction in SRF on the affected side indicates impaired renal function and may suggest poorer postoperative outcomes. The use of SRF to assess the success of pyeloplasty and the effectiveness of stenting is gaining attraction, as it provides an objective measure of renal recovery over time. This study aims to compare the postoperative recovery patterns between stented and non-stented pyeloplasty in pediatric UPJ obstruction by analyzing key imaging parameters such as APD, cortical thickness and SRF. These measurements will help assess the impact of stenting on recovery and provide insights into the factors influencing surgical success.

**Materials and methods**

This quasi-experimental study was conducted at the Department of Paediatric Surgery, Mymensingh Medical College Hospital, Mymensingh, from July 2021 to December 2021. Pediatric patients aged up to 12 years with Ureteropelvic Junction Obstruction (UPJO) who were admitted to the Pediatric Surgery department for pyeloplasty were considered as the study population. A total of 31 children were selected as study subjects by purposive sampling technique.A pre-designed semi-structured questionnaire was used to collect the necessary information from the participants. Face-to-face approach with the parents, in an isolated place was the way to collect data. All interviews were conducted in the Pediatric Surgery Department of MMCH. Informed written consent was taken from the legal guardians of respondents. Before conducting the data collection procedure, proper permission was taken from the concerned authorities of the MMCH and the Department of Pediatric Surgery. All necessary investigations were done. Patients attended the hospital during 1st week, 2nd week, 1 month, 1 and 1/2 month and three months after operation. In each visit patient was assessed clinically for wound infection and incisional hernia.A descriptive and analytical method was adopted in this study. All categorical variables were expressed as frequency and percentage and continuous variables were expressed as mean, SD. This result was presented in tabulated form. Chi-square test was done for categorical variables and an independent t-test was done for continuous variables. A p-value less than or equal to 0.05 was considered as significant. Statistical Package for Social Sciences (SPSS) version 26.0 was used for this purpose.

*Inclusion criteria*

- All pediatric Patients aged up to 12 years with symptomatic ureteropelvic junction obstruction (UPJO) coming to pediatric surgery for pyeloplasty.
- Patients had attendants on parents who had given written consent.
- Patients with symptomatic UPJ obstruction.

*Exclusion criteria*

- Patient with Ureteropelvic Junction (UPJ) obstruction with ectopic or duplex kidney, with congenital anomalies.
- Patient with Ureteropelvic Junction Obstruction (UPJO) with (VUR) Vesicourcteral reflex.
- Patient with no or irregular follow-up and refused to take part in study.

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## Results

**Table I** Comparison of age between stented group and Non-stented group (n=31)

| Attributes | Stented group (n=16) Mean (SD) | Non-stented group (n=15) Mean (SD) | p-Value |
|---|---|---|---|
| Age (Months) | 30.50(30.88) | 68.27(48.33) | 0.02** |

**p value <0.05 statistically significant. p-value was obtained by independent sample t-test.

The Table shows that the mean age of the stented group was about 30.50 months whereas without stented group, it was 68.27 months,difference was found statistically significant (p=0.02).

**Table II** Pre-surgical Antero-Posterior Diameter (APD) cortical thickness and split renal function parameter among the stented and Non-stented group (n=31)

| Attributes | Stented group (n=16) Mean (SD) | Non-stented group (n=15) Mean (SD) | p-value | Remarks (Normal ranges) |
|---|---|---|---|---|
| APD pelvis (±SD) (mm) | 50.01 (4.51) | 47.06 (5.65) | 0.12 | 90-115 mm |
| Cortical thickness (±SD) (mm) | 3.02 (0.20) | 3.10 (0.24) | 0.32 | 3.2-11.0 mm |
| SRF (±SD) (affected side) | 0.35(0.16) | 0.33(0.87) | 0.47 | 0.5-2.0 mm |

p-value <0.05 statistically significant, p-value was obtained by independent sample t-test.

The Table shows that the mean (SD) anterior-posterior diameter before surgery in the stented group was 50.01mm (4.51) and the without stented group was 47.06±5.65 mm. The mean (SD) cortical thickness before surgery was 3.02 (0.20) and the without stented group was 3.10 (0.24) mm. SRF at the affected side was 0.35(0.16) in the stented group and 0.33(0.87) in the non-stented group. The mean (SD) S. creatinine level was 0.56 (0.11) and 0.61 (0.29) in both stented and without stented groups respectively. None of the findings difference were found to be statistically significant (p>.05).

**Table III** Comparison of attributes before surgery and after 1.5 and 3 months of surgery parameters in the stented group (n=16)

| Variable | Stented group before surgery (n=16) Mean (SD) | Stented group (After 1.5 months) (n=16) Mean (SD) | Stented group (After 3 months) (n=16) Mean (SD) | p-value (Before vs 1.5 months) | p-value (Before vs 3 months) |
|---|---|---|---|---|---|
| APD pelvis (mm) | 50.01 (4.51) | 27.24 (3.54) | 22.86 (2.34) | 0.001** | 0.01** |
| Cortical thickness (mm) | 3.02 (0.20) | 3.81 (0.41) | 4.28 (0.37) | 0.001** | 0.04** |
| SRF (Affected side) | 0.35(0.16) | 0.44 (0.63) | 0.44(0.63) | 0.584 | 0.03** |

**p-value <0.05 statistically significant, the p-value was obtained by paired sample t-test.

From the Table, if so as found that a comparison between mean cortical thickness, mean APD and SRF affected side before surgery and after three months of surgery for the stented group was found to be statistically significant (p<0.05).

**Table IV** Comparison of attributes in pre-surgery and after 1.5 and 3 months of surgery in without non-stented group (n=15)

| Variable | Without a stented group before surgery (n=15) Mean (SD) | Without stented group (After 1.5 months) (n=15) Mean (SD) | Without a stented group (After 3 months) (n=15) Mean (SD) | p-value (Before vs 1.5 months) | p-value (Before vs 3 months) |
|---|---|---|---|---|---|
| APD pelvis (mm) | 47.06 (5.65) | 27.28 (4.21) | 22.80 (3.02) | 0.001** | 0.02** |
| Cortical thickness (mm) | 3.1 (0.24) | 3.41 (0.32) | 4.6 (0.37) | 0.006** | 0.06 |
| SRF (Affected side) | 0.33(0.87) | 0.44(0.29) | 0.44(0.29) | 0.645 | 0.03** |

**p-value <0.0.5 statistically significant, p-value was obtained by paired sample t-test.

The Table shows that a comparison between mean APD, SRF affected side,and before and after three months of surgery in the non-stented group were statistically significant (p<0.05). Mean cortical thickness before and after three months of surgery was statistically insignificant (p=0.06).

**Table V** Comparison of 1.5 months post-surgery parameters in the stented and non-stented group (n=31)

| Characteristics | Stented group (n=16) Mean (SD) | without a stented group (n=15) Mean (SD) | p-Value |
|---|---|---|---|
| APD pelvis (±SD) (mm) | 27.24 (3.54) | 27.28 (4.21) | 0.977 |
| Cortical thickness (±SD) (mm) | 3.81 (0.41) | 3.41 (0.32) | 0.005** |
| SRF (±SD) (Affected side) | 0.44 (0.63) | 0.44(0.29) | 1.00 |

**p-value <0.0.5 statistically significant, independent sample t-test was done.

The Table shows that the mean anterior-posterior diameter after one and half months of surgery in the stented group was 27.24±3.54 and in non-stented group was 27.28±4.21. The mean cortical thickness after three months of surgery in the stented group was 3.81±0.41 and non-stented group was 3.41±0.32. SRF affected side was the same in the stented group and without stented group (44%). Only the comparison between the mean cortical thickness of both groups after surgery was found to be statistically significant (p=0.005).

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**Table VI** Comparison between 3 months post-operative parameters in the stented and without stented group (n=31)

| Variable | Stented group (n=16) Mean (SD) | Non-Stented group (n=15) Mean (SD) | p-Value |
|---|---|---|---|
| APD pelvis (±SD) (mm) | 22.86 (2.34) | 22.80 (3.02) | 0.95 |
| Cortical thickness (±SD) (mm) | 4.28 (0.37) | 4.6 (0.37) | 0.01** |
| SRF (±SD) (Affected side) | 0.44(0.63) | 0.44(0.29) | 0.94 |

**p-value <0.0.5 statistically significant, p-value was obtained by independent sample t-test.

The Table shows that the mean (SD) anterior-posterior diameter after three months of surgery in the stented group was 22.86±2.34 and non-stented group was 22.80±3.02. The mean (SD) cortical thickness after three months of surgery in the stented group was 4.28 ±0.37 and the without stented group was 4.6±0.37. SRF affected side was the same in the stented group and without the stented group (44%). Only the comparison between the mean cortical thickness of both groups after surgery was found to be statistically significant (p=0.01).

**Table VII** Comparison of post-operative history of serum creatinine during follow-ups between the groups (n=31)

| Duration | Total (n=31) Mean (±SD) | Stented group (n=16) Mean (±SD) | Non Stented group (n=15) Mean (±SD) | p-value |
|---|---|---|---|---|
| 1st week | 0.46 (0.12) | 0.43 (0.1) | 0.49 (0.14) | 0.15 |
| 2nd week | 0.47 (0.13) | 0.46 (0.12) | 0.49 (0.15) | 0.53 |
| 1 month | 0.46 (0.14) | 0.43 (0.11) | 0.51 (0.16) | 0.11 |
| 1.5 month | 0.44 (0.15) | 0.41 (0.11) | 0.52 (0.19) | 0.15 |
| 3 month | 0.44 (0.15) | 0.41 (0.9) | 0.49 (0.19) | 0.15 |

**p-value <0.05 statistically significant, the p-value was obtained by impendent sample t-test

The Table shows the comparison of the post-operative history of s. creatinine during follow-ups between both groups. The differences of values between the parameters were not significant.

**Discussion**

The preoperative parameters, including APD, cortical thickness and SRF, were similar between the two groups, with none of these measures reaching statistical significance. The APD in the stented group was 50.01 mm, while the non-stented group had an APD of 47.06 mm (p=0.12). These findings suggest that both groups had comparable degrees of hydronephrosis before surgery. Similar studies had also found that preoperative APD measurements do not always correlate with postoperative outcomes in terms of recovery of renal function.[3,10] Similarly, the mean cortical thickness was 3.02 mm in the stented group and 3.10 mm in the non-stented group (p=0.32), indicating no significant difference in the degree of renal cortical thinning before surgery. This finding is consistent with prior research indicating that cortical thinning, as a result of chronic obstruction, is an important predictor of renal recovery following pyeloplasty, but it does not necessarily depend on the presence or absence of a stent.[11] Although there were slight differences in SRF between the two groups, these did not reach statistical significance, as SRF was 0.35 in the stented group and 0.33 in the non-stented group (p=0.47). The SRF measurements in both groups were similar, suggesting that baseline renal function in both groups was relatively comparable before surgery. In the stented group, significant improvements were seen in both APD and cortical thickness after surgery. The mean APD decreased from 50.01 mm preoperatively to 22.86 mm at three months (p=0.001 for before vs. 1.5 months, p=0.01 for before vs. 3 months). Similarly, the mean cortical thickness improved significantly from 3.02 mm before surgery to 4.28 mm at three months (p=0.001 for before vs. 1.5 months, p=0.04 for before vs. 3 months). These improvements in APD and cortical thickness reflect favorable postoperative recovery.[5] However, SRF in the stented group did not show significant changes during the first three months (p=0.584 before vs. 1.5 months, p=0.03 before vs. 3 months). This indicates that while the renal anatomy (As measured by APD and cortical thickness) improved, functional recovery, as measured by SRF, was more variable and not as strongly influenced by the presence of a stent. In the non-stented group, APD also decreased significantly after surgery (From 47.06 mm preoperatively to 22.80 mm at three months, p=0.02). However, cortical thickness in this group did not show a significant improvement after three months (from 3.10 mm to 4.6 mm, p=0.06). SRF in the non-stented group showed a significant improvement at three months (p=0.03) which suggests that despite the lack of a stent, functional renal recovery was achieved. This finding is similar to another author who found that non-stented pyeloplasty can be effective in improving kidney function, though the rate of improvement can be slower compared to stented procedures.[12] The comparison between the stented and non-stented groups after 1.5 and 3 months of surgery showed that the mean APD and SRF were similar, suggesting comparable anatomical and functional recovery in both groups. However, the difference in cortical thickness (3.81 mm in the stented group vs. 3.41 mm in the non-stented group at 1.5 months, p=0.005) was statistically significant, with the stented group showing better early improvement in cortical

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thickness. This finding supports the hypothesis that stenting may promote quicker recovery of renal parenchymal thickness, which is essential for overall kidney function.[6] At three months, the cortical thickness was still significantly higher in the non-stented group (4.6 mm vs. 4.28 mm in the stented group, p=0.01) suggesting that the non-stented group may have a slower but more sustained improvement over time. These results are consistent with another study, who reported a gradual recovery of renal cortical thickness following non-stented pyeloplasty in pediatric patients.[13] Finally, serum creatinine levels, used as an indirect measure of renal function, were similar across both groups throughout the postoperative period. This suggests that neither stented nor non-stented pyeloplasty significantly impacted renal function as measured by serum creatinine, corroborating the findings of similar studies where serum creatinine remained stable postoperatively, regardless of stenting.[14]

**Limitations**

The study was conducted in a single hospital with a small sample size. So, the results will not be generalized for the whole community.

**Conclusion**

This study suggests that stented pyeloplasty results in a faster recovery in terms of anatomical parameters such as APD and cortical thickness. However, functional recovery, as assessed by SRF and serum creatinine levels, showed minimal difference between the stented and non-stented groups. This supports the idea that while stenting may facilitate more rapid anatomical improvement, the ultimate functional recovery of the kidney may not be significantly affected by the presence or absence of a stent.

**Recommendation**

Based on our study's findings, we recommend conducting further research with larger sample sizes and extended follow-up periods to better understand the long-term effects of stenting on both anatomical and functional recovery in pediatric UPJ obstruction is recommended. Additionally, future studies could explore the factors that contribute to variability in functional outcomes like SRF and serum creatinine levels to refine surgical approaches and improve patient outcomes.

**Disclosure**

The authors declared no competing interest.

**References**

**1.** Cascini V, Lauriti G, Di Renzo D, Miscia ME, Lisi G. Ureteropelvic junction obstruction in infants: Open or minimally invasive surgery? A systematic review and meta-analysis. Front Pediatr. 2022;10:1052440.

**2.** Elbaset MA, Zahran MH, Sharaf MA, Elmeniar AM, Ezzat O, Elgamal M et al. Long-term functional success after pyeloplasty for pelvi-ureteral junction obstruction in the unilateral poorly functioning kidney in exclusive adults population. Urology. 2019;131:234–239.

**3.** Rickard M, Braga LH, Oliveria JP, Romao R, Demaria J, Lorenzo AJ. Percent improvement in renal pelvis anteroposterior diameter (PI-APD): prospective validation and further exploration of cut-off values that predict success after pediatric pyeloplasty supporting safe monitoring with ultrasound alone. J Pediatr Urol. 2016;12(4):228-e1.

**4.** Li Y, He Y, Zhang W, Song H, Wang T. Factors predicting improvement of differential renal function after pyeloplasty in children of ureteropelvic junction obstruction. J Pediatr Urol. 2022;18(4):504-e1.

**5.** Nordenström J, Koutozi G, Holmdahl G, Abrahamsson K, Sixt R, Sjöström S. Changes in differential renal function after pyeloplasty in infants and children. J Pediatr Urol. 2020;16(3):329-e1.

**6.** Chalieopanyarwong V, Attawettayanon W. Renal Cortical Thickness After Pyeloplasty in Pediatric Ureteropelvic Junction Obstruction. Res Rep Urol. 2021;13:699–704.

**7.** Sheba M, Salem A, Ghoneima W, El Ghoneimy M, Mostafa A. Factors Affecting The Short Term Outcome Of Pyeloplasty In Congenital Primary Unilateral Pelvi-Ureteric Junction Obstruction In Infants and Toddlers: A Single Center trial. Pediatr Sci J. 2024. https://cupsj.journals.ekb.eg/article_387136.html.

**8.** Chipde SS, Lal H, Gambhir S, Kumar J, Srivastava A, Kapoor R, et al. Factors predicting improvement of renal function after pyeloplasty in pediatric patients: A prospective study. J Urol. 2012;188(1):262–665.

**9.** Nishi M, Matsumoto K, Fujita T, Iwamura M. Improvement in Renal Function and Symptoms of Patients Treated with Laparoscopic Pyeloplasty for Ureteropelvic Junction Obstruction with Less Than 20% Split Renal Function. J Endourol. 2016;30(11):1214–1218.

**10.** Abbas T, Elifranji M, Al-Salihi M, Ahmad J, Vallasciani S, Elkadhi A, et al. Functional recoverability post-pyeloplasty in children with ureteropelvic junction obstruction and poorly functioning kidneys: Systematic review. J Pediatr Urol. 2022;18(5):616–628.

**11.** Zhang L, Zhong Q, Wang X, He J, Li P, Xianhai YU, et al. Factors Influencing Postoperative Outcomes in Children with Ureteropelvic Junction Obstruction: A Logistic Regression Analysis. 2023. https://www.preprints.org/manuscript/202311.1162.

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**12.** Siddique M, Yasmeen T, Zafar S, Khalid A, Majid F, UR A. A Comparative Study of Outcome of Pyeloplasty in Stented and Non-Stented Children. 2024.
https://pjmhsonline.com/2021/jan/113.pdf.

**13.** Imam M S, Farooq M A, Sarwar M K A, Chowdhury T K, Khastagir R, Habib M G et al. A comparison between short- and long-term D-J stent in Anderson–Hynes pyeloplasty for pelvic-ureteric junction obstruction. Pediatr Surg Int. 2020;36(11):1363–1370.

**14.** Keshri R, Govindarajan KK, Rajappa M, Sambandan K, Naredi BK, Jindal B. Can urinary biomarkers be used in the outcome assessment of pyeloplasty in children? Afr J Urol. 2021;27(1):115.