

THE EFFECT OF PYELOPLASTY ON RENAL CORTICAL THICKNESS IN THE PEDIATRIC POPULATION WITH URETEROPELVIC JUNCTION OBSTRUCTION

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INTRODUCTION

The most important functions of kidneys are the filtration of blood, removal of wastes and delivering these wastes through the ureter to the bladder. Any blockage from the kidney through the ureter to the bladder is called ureteropelvic junction obstruction (UPJO).¹ This condition is a common aetiology for hydronephrosis in children.² The diagnosis of UPJO involves the clinical assessment, ultrasonography, CT scan, and nuclear scan of kidneys.³ The etiology of UPJO is not fully understood yet, and intrinsic and extrinsic factors can play a role.⁴ Due to this obstruction, back pressure within the renal pelvis causes progressive renal damage and deterioration of its function.⁵ In the absence of treatment for UPJO can lead to severe hydronephrosis complications like hematuria, urinary tract infections, deteriorated renal function and ultimately renal failure.⁶ Pyeloplasty is a surgical technique for treating pediatric UPJO, which is indicated in up to 50% of cases and has a success rate of up to 95%.^{7,8} The prime objective of pyeloplasty is the relief of the discomfort of UPJO symptoms and

ABSTRACT OBJECTIVES

To determine the effect of pyeloplasty on renal cortical thickness in the pediatric population with ureteropelvic junction obstruction (UPJO).

METHODOLOGY

This retrospective study examined the renal cortical thickness in 100 pediatric patients diagnosed with ureteropelvic junction obstruction (UPJO). The study employed a non-probability consecutive sampling technique to select participants. Inclusion criteria encompassed children below five years of age, of both genders, with Pakistani nationality, and availability of both pre-and post-operative ultrasound data. Cases presenting with ureterovesical junction obstruction or vesicoureteral reflux were excluded from the analysis. Data collection involved gathering information on age, gender, and cortical thickness, with renal cortical thickness assessed through ultrasonography. A paired t-test was employed to compare the renal cortical thickness between the preoperative assessment and the 3-month follow-up.

RESULTS

The females were 40(40%) and males were 60(60%). The mean age was 33.51±22.91months. The mean cortical thickness before pyeloplasty was 5.23±0.93mm and 8.25 ± 2.34mm after pyeloplasty. The renal cortical thickness in both genders significantly increased to 3mm (p<0.001). The cortical thickness before pyeloplasty was 5.23±0.93mm, and after was 8.25±2.34mm.

CONCLUSION

Renal cortical thickness can be improved after pyeloplasty in patients with ureteropelvic junction obstruction.

KEYWORDS: Pyeloplasty, Ureteropelvic Junction Obstruction, Renal Cortical Thickness

prevention of deterioration of renal function.^{9,10} Previous literature reported that improved renal cortical thickness could be seen after pyeloplasty.^{11,12} The increase in renal cortical thickness post-pyeloplasty has significant clinical implications. It suggests that surgical intervention effectively resolves the obstruction and promotes renal recovery. Renal cortical thickening indicates restoring normal kidney architecture and improved renal function. Monitoring changes in renal cortical thickness serves as a valuable indicator of the success of pyeloplasty and the overall health of the kidney.¹³ But there is a lack of research on our population. The results can be variable across the populations due to genetic and ethnic factors and clinicians skills. The findings from these previous studies provide a basis for the present retrospective study, which aims to investigate the changes in renal cortical thickness further following pyeloplasty in pediatric patients with UPJO. By analyzing the preoperative and 3-month postoperative renal cortical thickness measurements, this study seeks to contribute to the existing body of literature and provide additional evidence regarding the beneficial effects of pyeloplasty

on renal cortical thickness. This study aimed to determine the effect of pyeloplasty on renal cortical thickness in the pediatric population with ureteropelvic junction obstruction.

METHODOLOGY

This retrospective study was conducted on 100 Pediatric patients with UPJO presented to the OPD of the Pediatric Urology unit at the Institute of Kidney Diseases, Peshawar, from January 2020 to May 2022. After obtaining ethical approval (No.49-ERB/2022) from the hospital, ethical committee data were collected from records available in the department. The diagnosis of participants was made through ultrasonography and clinical assessment. The inclusion criteria were children below five years, both genders, Pakistani nationals, and pre-and post-operative ultrasound available. The cases with ureterovesical junction obstruction or vesicoureteral reflux were excluded. The data were collected on age, gender, and cortical thickness. Cortical renal thickness was measured on ultrasonography by a pediatric urologist. Data were analyzed in R programming version 4.1.2. Mean and SD was measured for numerical data like age, BMI, weight, height, and renal cortical thickness. Percentages and frequencies were calculated for categorical data like gender. A paired t-test was applied to compare renal cortical thickness pre- and post-operative. $P \leq 0.05$ was the level of significance.

RESULTS

The females were 40(40%) and males were 60(60%). The age was 33.51 ± 22.91 months. The mean cortical thickness before pyeloplasty was 5.23 ± 0.93 mm and 8.25 ± 2.34 mm after pyeloplasty. The mean body weight and height are given in Table 1. Overall and in both gender, the renal cortical thickness significantly increased to 3mm ($p < 0.001$). In the overall sample, the cortical thickness before pyeloplasty was 5.23 ± 0.93 mm and 8.25 ± 2.34 mm Table 2.

Table 1: Mean and SD of Body Weight, Height, BMI, and Cortical Thickness After and Before

Characteristic	Mean \pm SD
Age (months)	33.51 \pm 22.91
Body weight (Kg)	14.31 \pm 7.95
Height (m)	0.91 \pm 0.09
BMI (kg/m ²)	18.19 \pm 11.19
Cortical thickness before Pyeloplasty (mm)	5.23 \pm 0.93
Cortical thickness after Pyeloplasty (mm)	8.25 \pm 2.34

Table 2: Comparison of Cortical Thickness After and Before Pyeloplasty in Overall and Both Genders

Cortical Thickness	After	Before	P-Value*
Overall	8.25 \pm 2.34	5.23 \pm 0.93	<0.001
Male	8.35 \pm 2.45	5.33 \pm 0.96	<0.001
Female	8.09 \pm 2.18	5.09 \pm 0.87	<0.001

Paired t-test

DISCUSSION

This study aimed to determine the effect of pyeloplasty on renal cortical thickness in the pediatric population with ureteropelvic junction obstruction. The obstruction of the urinary flow from the pelvic cavity to the proximal ureter is called Ureteropelvic junction obstruction. In this obstruction, back pressure due to pelvic resulting in continuous damage of renal parenchyma and adversely affects its function. This condition can be found in adults and children but is more lethal in the pediatric population. Due to advancements like ultrasonography and MRI, early diagnosis of Ureteropelvic junction obstruction is possible.^{14,15} The increase in the thickness of the renal cortex can be a good sign of improvement in renal function after pyeloplasty. After the resolution of renal obstruction, kidney function and anatomy recovery happened.¹⁶ Huang et al., in their study employed renal biopsy to predict renal function recovery after pyeloplasty and noted improvement in renal function.¹⁷ In our study, we used ultrasonography and avoided biopsy due to invasiveness. Secondly, we conducted this study on available records and are not performing biopsy as a routine procedure. Our study showed that pyeloplasty can increase renal cortical thickness. Similar results were reported by previous studies.^{18,19} Chalheopanyarwong et al. In a retrospective study, the change in renal cortical thickness after pyeloplasty was examined in pediatric patients with ureteropelvic junction obstruction.¹⁹ Thirty-eight patients who underwent pyeloplasty between 2005 and 2019 were included, and their renal parenchymal thickness change was assessed using generalized estimating equations. The results revealed a significant improvement in renal cortical thickness during the follow-up period, with a calculated change of 0.0373 mm per month. Interestingly, the age at the time of surgery did not significantly impact the improvement in renal cortical thickness. Factors such as creatinine clearance, pre-operative anteroposterior diameter, and pre-operative renal differential function were positively associated with renal cortical thickness, while body weight, presentation with an abdominal mass, and a history of infection were negatively associated with a decrease in renal cortical thickness. Our findings indicate that pyeloplasty contributes to the long-term improvement of renal cortical thickness, and specific pre-operative

factors can influence this outcome. Improvement in renal cortical thickness can indirectly suggest successful post-operative outcomes and enhance renal function. Following the correction of the obstruction, renal function has the potential to recover, particularly in patients with favourable pre-operative renal function. The restoration of kidney function may align with the nephron mass, which can be accessed through cortical thickness measurements.²⁰ Huang et al. utilized renal biopsy to predict recovery capacity, where sclerotic glomeruli indicated severe kidney injury and declined renal function.¹⁷

LIMITATIONS

This study, despite its valuable objectives, is not without limitations that should be acknowledged. Firstly, one notable limitation is the relatively small sample size. The study was conducted on 100 pediatric patients with ureteropelvic junction obstruction (UPJO), which may limit the generalizability of the findings to a larger population. A larger sample size would have allowed for more robust statistical analyses and potentially strengthened the study's conclusions. Another limitation of this study is its retrospective design. Retrospective studies rely on existing data, which may introduce inherent biases and limitations in data collection. The reliance on medical records and previously recorded information could lead to incomplete or missing data, potential selection bias, and limited control over variables of interest. Furthermore, a retrospective design can also be susceptible to recall bias or misinterpretation of past events. To overcome these limitations and further validate the findings, a prospective randomized controlled trial (RCT) would be beneficial. RCT would involve randomly assigning patients to different treatment groups, such as pyeloplasty and a control group, and following them over time. This design allows for better control of bias and confounding factors and the collection of more reliable and standardized data. Additionally, an RCT would provide stronger evidence-based statistics, improving the reliability and validity of the study's findings.

CONCLUSIONS

With the limits of this investigation, it can be concluded that renal cortical thickness can be improved after performing pyeloplasty in patients with ureteropelvic junction obstruction.

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