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ORIGINAL ARTICLE

Standard Versus Tubeless Percutaneous Nephrolithotomy in Children: A Comparative Study at Tertiary Care Centre

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ABSTRACT

Background: Percutaneous nephrolithotomy is a urological technique advocated to extract kidney and proximal ureter calculi. Various strategies evolved throughout time as a result of experiences and new instruments. Tubeless PCNL is chosen over traditional PCNL due to fewer post-operative problems, a shorter patient hospital stay, and shorter procedure duration. This is the first of its kind study, to our knowledge in paediatric population in our setup.

Objective: To compare the outcomes of standard versus tubeless percutaneous nephrolithotomy in children.

Material and Methods: This prospective descriptive comparative study conducted at Department of Paediatric Urology, Institute of Kidney Disease, Peshawar; from October 2021 to September 2022 consisting of 100 patients. Patients in the age range of 4 to 14 years with renal or ureteric stones were arbitrarily assigned to two groups. Group A underwent through standard PCNL and group B underwent through tubeless PCNL. Outcomes of both groups were compared in terms of operative time, post-op pain and post-op complications. All the data was analyzed through SPSS version 24.

Results: Mean age of the patients in group A and B was 9.12±2.07 years and 8.68±1.82 years respectively. The mean operation time, hospital stay in group A (standard PCNL) and B (tubeless PCNL) were 86.06 ±7.20 minutes, 6.46±.97 days and 83.68 ±3.81 minutes and 3.42±.81days respectively. The mean VAS pain scores in group A and group B were 6.24 ± .71 and 3.70 ± .81 respectively. Post operative complications were less seen in the tubeless PCNL.

Conclusions: Tubeless PCNL is a safe technique having shorter operative time while post-operatively associated with shorter hospital stay and fewer complications as compared to standard PCNL.

Keywords: Renal Stones, Standard PCNL, Tubeless PCNL, Outcomes

Abbreviations: PCNL=Percutaneous Nephrolithotomy, VAS=Visual Analogue Scale

INTRODUCTION

Nephrolithiasis is a frequent medical condition that generally manifests as an acute emergency.[1] Renal colic is the most common presenting complaint, affecting around 5-12% of the population at some point in their lives.[2] Though nephrolithiasis is more common in adults, the condition is now frequently observed in children as well.[3] The underlying pathology of stone formation in both age groups is same with calcium stones accounting for approximately 80% of renal stones, while calcium oxalate stones account for 80% of all calcium stones.[4] Symptomatic nephrolithiasis with blockage should be surgically treated. There are several surgical methods used to treat nephrolithiasis. The methods for removing the kidney stone include extracorporeal shock wave lithotripsy, ureteroscopy, percutaneous antegrade ureteroscopy, percutanous nephrolithotomy (PCNL), and open or laparoscopic surgical removal.[5-7]

Percutanous nephrolitholthmy is a minimally invasive surgical technique employed for the treatment of significant renal and proximal ureteric stones.[8,9] The procedure was first described Fernstrom and Johansson in 1976 for the management of renal culculi.[10] It is also treatment modality adopted in situations where ESWL failure to retrieve the stone. The regular PCNL technique and the tubeless PCNL approach are the two main approaches employed in this process.[11] In the traditional PCNL, a nephrostomy tube is put post-operatively for drainage, however the nephrostomy tube is not implanted for drainage in the Tubeless PCNL. In the tubeless PCNL, fibrin Glue injections are utilized to close the nephrostomy tract.[12] According to the Meta analysis by Wang et al it was shown that the tubeless PCNL have less pos operative complication, less Hospital stay and less need of post operative analgesia.[13]

Literature analysis reveal that both procedures are commonly practiced all over the world in adult population, however, there is scarcity of knowledge when coming to its application in the pediatric population. This aim of this study is to know the comparative outcomes of the standard tube PCNL and Tubeless PCNL in children in our local population.

METHODOLOGY

This was a prospective descriptive comparative study was conducted at department of Pediatric Urology, Institute of Kidney Disease, Peshawar from October 2021 to September 2022. Total 100 patients were included and arbitrarily divided into two groups. Group A underwent standard PCNL technique while the Group A underwent tubeless PCNL. Patients aged 4 to 14 years old with stones less than 3cm in size, no residual stones post-operatively confirmed on fluoroscopy, and a single puncture tract were included in the study, while patients with a deranged coagulation profile, a single kidney, a deranged renal functions test, being unfit for anaesthesia, and having bilateral renal calculi were excluded. All featured patients provided permission from the hospital's ethics committee as well as informed written consent.

All the participants in the research provided a complete history, clinical examination, and routine pre-operative investigations. The stone position and size were determined using a computed tomography scan. Anesthesiologist performed pre-anesthesia evaluation. Patients in group A received regular PCNL whereas group B received tubeless PCNL.

Age, gender, side of the stone (Right or Left), size of the stone, operation time, Pain scores (Visual Analog Scale), hospital stay, and complications post-operatively were all documented in the pre-designed proforma. SPSS 24 was used to analyze all of the data. Mean and standard deviation of quantitative variables were computed. For qualitative variables, frequencies and percentages were computed. Statistical tests of significance included chi square test for qualitative variables and independent sample t test for quantitative variables. P value ≤0.05 was set as statistically significant.

RESULTS

The mean age of group A patients who underwent standard PCNL was 9.12±1.82 while the mean age of group B patients who underwent Tubeless PCNL was 8.68±2.07 **(Table1).**

Table 1: Age (mean and standard deviation)

Ages	Mean ± standard deviation
Group A	9.12±1.82
Group B	8.68±2.07

The frequencies and percentages of the age group 8 to 10 years was more in both the groups. Group B had 64% patients from the age group 8 to 10 years and group B had 72% patients from the age group 8 to 10 years **(Table 2).**

Table 2: Frequency and percentage of the age groups

	Group A	Group B
	Frequency (Percentage)	Frequency (Percentage)
Age < 8 years	10(20%)	8(16%)
Age 8 – 10 years	32(64%)	36(72%)
Age >10 years	8(16%)	6(12%)

Patients who underwent standard PCNL were 52% females and 48% were males. While in Tubeless PCNL 60% were females and 40% were males **(Table 3).**

Table 3: Gender (Frequencies and percentages)

	Group A	Group B
Female	26 (52.0%)	30(60.0%)
Male	24 (48.0%)	20(40.0%)

60% of the stones were on right side of the body in group A and 50% were on right side in group B (**Table 4).**

Table 4: Side of the stone

	Group A	Group B
	Frequency (Percent)	Frequency (Percent)
Right side	30(60%)	25 (50%)
Left side	20(40%)	25 (50%)

The mean of the size of the stones in group A was 2.1300±.38 and group B was 2.25 ±.33 which were not statistically significant (**Table 5).**

Table 5: Size of the stone

	Group A	Group B
	Mean± Std. deviation	Mean ± Std deviation
Size of the stone (cm)	2.1300±.38	2.25 ±.33

The mean operation time of group A was 86.06 ±7.20 minutes and group B was 83.68 ±3.81 minutes. Although the operation time of tubeless PCNL was short as compared to the standard PCNL but it was not statistically significant (**Table 6).**

Table 6: Operation time (min)

	Mean ± standard deviation
Group A(min)	86.06 ±7.20
Group B (min)	83.68 ±3.81

Visual analogue scale (VAS) for pain assessment was used on second post operative day. The mean of VAS of group1 was 6.24 ± .71 and group2 was 3.70 ± .81. The VAS difference in groups was statistically significant (**Table 7).**

Table 7: Visual Analogue scale for pain assessment

	Visual Pain Analogue Score	P value
	Mean ± standard deviation	
Group A	6.24 ± .71	0.001
Group B	3.70 ± .81	

The mean of hospital stay in Group 1 patients was 6.46±.97 days and in Group 2 were 3.42±.81 days. The hospital stay in the patients underwent standard PCNL was significantly more as compared to the tubeless PCNL (**Table 8).**

Table 8: Post Operative Hospital stay

	Group 1	Group 2	sig
	Mean± Std. deviation	Mean± Std. deviation	
Hospital stay	6.46±.97	3.42±.81	0.001

Post-operative problems were more common in the standard PCNL. In the conventional PCNL, 22 of 50 patients had no issues, but in the tubeless PCNL, 36 of 50 patients had no significant problems. Fever was the most prevalent consequence in both cases. 9 patients with conventional PCNL got fever, whereas 4 patients with tubeless PCNL developed fever after surgery. Urinary leak was found in 8 individuals with conventional PCNL and 2 patients with tubeless PCNL. PCNL site infection was more common in the standard PCNL. PCNL site infection occurred in 7 patients using the usual procedure, whereas only 4 individuals used the tubeless PCNL. Two individuals with tubeless catheters had haemorrhages. PCNL site infection was observed in 7 patients using the traditional approach, but only in 4 patients who underwent the tubeless PCNL. Hematoma was observed in two patients with tubeless PCNL, however only one patient with conventional PCNL developed hematoma **(table 9)**

Table 9: Post operative Complications

	Group A(Standard PCNL) (n)	Group B (Tubeless PCNL)(n)
No complications	22	36
Fever	9	4
Hematoma	1	2
PCNL site infection	7	4
UTI	3	2
Urinary Leak	8	2
Total	50	50

DISCUSSION

PCNL is a contemporary world procedure for removing renal or proximal ureter stones larger than 2cm. With time and expertise, other PCNL approaches are introduced. Every method has pros and cons. One way is the normal procedure, and the other is the tubeless technique, in which a nephrostomy tube is not implanted post-operatively, reducing the risk of infection.[14,15] Wickham pioneered tubeless PCNL in 1984, which is now widely used due to less postoperative problems and a shorter hospital stay for patients.[16]

In our study, we assessed patient variables such as age, gender, side of the stone, and stone size in both groups. Group 1 had regular PCNL, whereas Group 2 had tubeless PCNL. The demographics of both groups were not statistically significant (Table 1-5). Other authors found that the demographics of the patients in both the regular and tubeless PCNLs were not statistically significant.[17-20]

The operative time for a surgery is quite significant, and it has certain merits if the process is completed in a limited time duration, and there is a substantial difference in both operations. In our study, there was no statistically significant difference between the two groups (table 6). Many writers found no significant differences between these two approaches, while Singh et al discovered a substantial difference.[21] In our study, the time of operation in the tubeless PCNL was shorter than the usual, and most other studies have shown the similar result.[22,23]

In our study, pain was assessed using a visual analogue scale (VAS). The mean VAS in the standard group was 6.24.71 and 3.70.81 in the tubeless group, with a significant difference detected in both patient groups. According to our findings, the tubeless PCNL is less painful. Many authors have reported similar findings.[24,25]

In our study, the post-operative hospital stay was much shorter in the tubeless PCNL (Table 8). Other authors found that the hospital stay with the tubeless PCNL was shorter than in the regular PCNL.[26,27]

Both conventional and tubeless PCNL are linked with postoperative concerns. However, as compared to tubeless PCNL, standard PCNL had more complications. The most prevalent consequence in both procedures was fever, which was more likely with the conventional PCNL. Similarly, urine leakage was more prevalent in the standard PCNL (Table10). Borges et al found that fever was not statistically significant in a six-study meta-analysis.[28]

CONCLUSION

Based on our findings, we conclude that tubeless PCNL is a safe procedure with a shorter operation time, a statistically significant shortened hospital stay, and a low Visual Analogue Scale score for pain after surgery in children with renal or proximal ureteric stone. Tubeless PCNL is associated with fewer post-operative problems than standard PCNL.

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