

## Research Article



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# EFFICACY AND SAFETY OF TUBELESS MINI PERCUTANEOUS NEPHROLITHOTOMY IN PEDIATRIC POPULATION: AN INSTITUTION BASED CLINICAL STUDY

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## ABSTRACT

**Introduction:** A gold standard treatment for treating complex and simple renal stones is PCNL (Percutaneous nephrolithotomy) having a success rate of more than 90%. Since its introduction, various refinements and modifications have been done in PCNL to reduce hospital stay, mortality including small nephroscope and working sheath, excluding nephrostomy tube use, PCNL with general anesthesia, and nephrostomy tract sealing.

**Aim:** The present study was conducted to assess the efficacy and safety of tubeless mini percutaneous nephrolithotomy (PCNL).

**Material and method:** The present retrospective clinical study was conducted on subjects having upper ureteric or renal calculi undergoing tubeless mini PCNL where postoperative and intraoperative events were assessed and the results were formulated.

**Results:** The study analyzed 450 study subjects of 10 to 15 years and the mean age of  $12.04 \pm 3.62$  years. The postoperative complications were also assessed in the present study. Fever was the most common complication seen in the study subjects, which was seen in 2.88% (n=13 study subjects followed by hematuria in 1.77% (n=8) study subjects. Other complications seen in the present study were sepsis, colonic injury, and pleural injury each seen in 0.88% (n=4) of study subjects. On assessing the stone-free rate in the study subjects, it was seen that residual stones were seen in 5% (n=22) study subjects, and a complete stone-free rate was seen in 95% (n=428) study subjects

**Conclusions:** The present study concludes that PCNL is a safe and effective treatment with less morbidity and a good clearance rate when conducted by surgeon expertise in the field.

**Key Words:** Percutaneous nephrolithotomy (PCNL), tubeless, renal stone, ureteral stones

## INTRODUCTION

Renal stones have a high prevalence of approximately 15% and vary based on geographic area, race, gender, and age with a high recurrence rate of nearly 50%. Renal stones have great variation based on geographic area and socioeconomic culture. A high prevalence of renal stones is seen in Kutch and Saurashtra of Gujarat, known as the stone belt of India. Renal stones are commonly seen in the developed countries.<sup>1</sup>

Renal stones are treated by various treatment strategies including ESWL (extracorporeal shock wave lithotripsy), RIRS (retrograde intrarenal surgery), and PCNL (percutaneous nephrolithotomy). With miniature instruments, decreased postoperative pain, less blood loss, and less renal damage are seen leading to a modified PCNL technique known as mini PCNL. Mini PCNL lacks a clear definition and is used to access below 20Fr or above 20 Fr. Some literature data suggest its range from 11-20 Fr and others from 14-20 Fr.<sup>2</sup>

Placement of the nephrostomy tube following standard PCNL results in adequate urinary drainage, preservation of renal access in cases where second surgery is needed, and hemostatic tamponade. Previous literature data had confirmed the efficacy and safety of using tubeless PCNL as it uses less analgesic dose and less hospital stay with less morbidity.<sup>3</sup>

The present study was conducted to assess outcomes and safety of tubeless mini percutaneous nephrolithotomy in an institution-based setup.

## **MATERIAL AND METHODS**

The present retrospective clinical study was conducted to assess outcomes and safety of tubeless mini percutaneous nephrolithotomy in an institution-based setup. The study was carried out at Department of Paediatrics Dr Vasant Rao Pawar Medical College And Research Centre Nashik, Maharashtra. The study population was comprised of the subjects visiting the outpatient department of urology of the institute. The study included a total of 450 subjects from both genders who underwent tubeless mini PCNL.

The inclusion criteria for the study were subjects having calculi in kidneys not exceeding 2cm or calculi in the upper ureteric area, subjects having normal coagulation profile, and negative urine culture. The exclusion criteria were subjects with an active urine infection, alteration in renal anatomy including pelvic kidney, subjects with associated comorbidities that might hamper surgery including respiratory and cardiac complications, calculi more than 2cm, and staghorn calculus.

The subjects who underwent tubeless mini PCNL in the study period were included. After explaining the detailed study design, informed consent was taken from all the subjects in both verbal and written form. After inclusion, detailed medical history was recorded followed by a physical and hematologic examination. Intravenous antibiotics for 5 days were given to subjects with a positive urine culture. Either CT (Computed Tomography) or IVU (Intravenous Urogram) was done to assess the stone site, size, and anatomy of the pelvicalyceal system to plan accurate access for the renal calculi. The stone size was measured by assessing the largest diameter of the stone, and in cases with multiple stones, the sum of each stone was measured. All subjects were surgically treated under general anesthesia and in the supine position.

At the beginning of the procedure, using cystoscopy, an open-end ureteric catheter was placed in all the subjects in the lithotomy position. A Foley catheter was used to secure the catheter and the subject was placed in the prone position. Percutaneous access was then made, the stone was fragmented with holmium laser or lithocast. The stone extraction was done using flushing, irrigation, and grasper. Fluoroscopy and endoscopy were used to confirm stone clearance. Following surgery, a ureteric catheter or DJ (Double J) was placed after surgery. Operative time was assessed from cystoscopy start to Amplatz sheath removal. Complications intraoperatively were assessed.

Complications in the study subjects assessed postoperatively were pain by VAS (Visual Analog Score), sepsis, and hematuria. Vitals and complications were also monitored. Complete stone removal was considered stone-free which was evaluated using KUB postoperatively after the procedure. Fever postoperatively was considered at the temperature of 38.5°C, sepsis as inflammatory response systemically with infection. After catheter removal on 2 days postoperatively, subjects were discharged.

## **RESULTS**

The present retrospective clinical study was conducted to assess outcomes and safety of tubeless mini percutaneous nephrolithotomy in an institution-based setup. The study included a total of 450 subjects from both genders who underwent tubeless mini PCNL. In 900 study subjects were within the age range of 10 to 15 years and the mean age of 12.04±3.62 years. There were 286 males and 164 females in the present study with 52.88% (n=238) stones on the right side and 38.22% (n=172) stones on the left side. The hardness of the stones was assessed based on Hounsfield units where stones less than 1000HU which were soft were excluded, and between 1000-2500 HU was included. There were 70% (n=315) subjects with stone hardness between 1000-1500HU, 26.88% (n=121) subjects from 1500-2000 HU, and least subjects from 2000-2500 HU with 3.11% (n=14) subjects (Table 1).

In the present study, among 450 subjects, 139 subjects had stones in the renal pelvis, 105 had in lower calyx with the renal pelvis, 89 subjects in the lower calyx, 22 subjects in the middle calyx, and 7 subjects in the superior calyx. Mean operative time in the present surgery was  $54.3 \pm 2.12$  minutes with a combination of 3 tracts, 2 tracts, and single-tract was used. Stone harpooning was done to avoid the number of tracts in various cases. The postoperative decrease in hemoglobin was 0.7g/dl which was not clinically significant. However, this decrease in hemoglobin was statistically significant.

The postoperative complications were also assessed in the present study. Fever was the most common complication seen in the study subjects, which was seen in 2.88% (n=13 study subjects followed by hematuria in 1.77% (n=8) study subjects. Other complications seen in the present study were sepsis, colonic injury, and pleural injury each seen in 0.88% (n=4) of study subjects (Table 2). On assessing the stone-free rate in the study subjects, it was seen that residual stones were seen in 5% (n=22) of study subjects, and a complete stone-free rate was seen in 95% (n=428) of study subjects as shown in Table 3.

## DISCUSSION

The present retrospective clinical study was conducted to assess outcomes and safety of tubeless mini percutaneous nephrolithotomy in an institution-based setup. The study included a total of 450 subjects from both genders who underwent tubeless mini PCNL. In 900 study subjects were within the age range of 10 to 15 years and the mean age of  $12.04 \pm 3.62$  years. There were 286 males and 164 females in the present study with 52.88% (n=238) stones on the right side and 38.22% (n=172) stones on the left side. The hardness of the stones was assessed based on Hounsfield units where stones less than 1000HU which were soft were excluded, and between 1000-2500 HU was included. There were 70% (n=315) subjects with stone hardness between 1000-1500HU, 26.88% (n=121) subjects from 1500-2000 HU, and least subjects from 2000-2500 HU with 3.11% (n=14) subjects. These stone characteristics were consistent with the findings of Ferakis<sup>4</sup> in 2015 and Jou YC et al<sup>5</sup> in 2006 where authors surgically treated subjects having comparable stone characteristics as in the present study.

In the present study, among 450 subjects, 139 subjects had stones in the renal pelvis, 105 had in lower calyx with the renal pelvis, 89 subjects in the lower calyx, 22 subjects in the middle calyx, and 7 subjects in the superior calyx. Mean operative time in the present surgery was  $54.3 \pm 2.12$  minutes with a combination of 3 tracts, 2 tracts, and single-tract was used. Stone harpooning was done to avoid the number of tracts in various cases. The postoperative decrease in hemoglobin was 0.7g/dl which was not clinically significant. However, this decrease in hemoglobin was statistically significant. These operative characteristics of the present study were in agreement with the findings of Zeng G et al<sup>6</sup> in 2013 and Zhu W et al<sup>7</sup> in 2015 where authors have reported similar operative and postoperative changes following surgical management of the renal stones.

On assessing the postoperative complications in the present study, it was seen that fever was the most common complication seen in the study subjects, which was seen in 2.88% (n=13 study subjects followed by hematuria in 1.77% (n=8) study subjects. Other complications seen in the present study were sepsis, colonic injury, and pleural injury each seen in 0.88% (n=4) of study subjects. On assessing the stone-free rate in the study subjects, it was seen that residual stones were seen in 5% (n=22) of study subjects and a complete stone-free rate was seen in 95% (n=428) of study subjects. These results were similar to the findings of Zhong Q et al<sup>8</sup> in 2013 and Ruhayel Y et al<sup>9</sup> in 2017 where authors have reported similar postoperative complications and stone-free rates as in the present study.

## CONCLUSION

Within its limitations, the present study concludes that PCNL is an effective and safe treatment modality for stone removal owing to its good stone clearance rates, minimal complications, and adequate hemostasis. However, the present study had a few limitations including small sample size, cross-section nature, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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**TABLES**

S. No	Hounsfield Units	Percentage (%)	Number (n=450)
1)	1000-1500	70	315
2)	1500-2000	26.88	121
3)	2000-2500	3.11	14

**Table 1: Distribution of study subjects based on Hounsfield units**

S. No	Postoperative complications	Percentage (%)	Number (n=450)
1)	Fever	2.88	13
2)	Colonic Injury	0.88	4
3)	Pleural Injury	0.88	4
4)	Hematuria	1.77	8
5)	Sepsis	0.88	4

**Table 2: Postoperative complication seen in the study subjects**

S. No	Stone free rates	Percentage (%)	Number (n=450)
1)	Residual stones	5	22
2)	Complete stone free	95	428

**Table 2: Stone Free rates as assessed in the study subjects**