



## MANAGEMENT OF THE COMPLEX RENAL CALCULUS DISEASE: A PROSPECTIVE STUDY TO COMPARE THE OUTCOMES OF SINGLE TRACT PCNL VERSUS MULTI-TRACT PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

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**ABSTRACT** **Background:** During the last two decades, the management of calculus disease has vastly changed. Prior to these modifications all the kidney stones were managed by open pyelolithotomy or nephrolithotomy which caused a significant morbidity for the majority of the patient. **Methods:** This is a prospective study in 60 patients who were divided in to two groups each of 30 subjects, one group for single tract PCNL and other for multi-tract PCNL. Both the groups were compared in context of operative time, stone clearance, complications arising if any and any other post operative outcomes. **Results:** Most of patients were male (38) in the age group of 36-45 years. The mean size of the calculus was 26.11 mm (SD: 13.40). The mean tract dilatation was 23 and 24 mm in single tract and multi-tract PCNL respectively. Mean duration of surgery was 114.7 and 91.57 min in single and multi-tract PCNL. Stone clearance was not significantly different b/w both groups. Significant blood loss in multi-tract PCNL when both the procedures are compared. Post-operative S. urea and S. creatinine of both groups were similar. Multi-tract PCNL patients had greater incidence of fever, pain, post-operative complications and stayed longer in the hospital. **Conclusion:** In view of the findings of the study, single tract PCNL seems to be a better option in comparison to multi-tract PCNL.

**KEYWORDS :** PCNL, renal stone, nephrostomy, serum creatinine, calculus, radiolucent, radio-opaque stones

### INTRODUCTION:

Since Fernström first described percutaneous nephrolithotomy (PCNL) under radiological control in 1976, it has gradually evolved as the standard method for the treatment of large renal stones<sup>1</sup>. Complex renal stones often require multiple nephrostomy tracts, long operating time, and repeated procedures, which are associated with more access-related complications such as bleeding, infection, residual stones and deterioration in renal function. Nevertheless, according to the current guidelines, PCNL is still the first-line choice for the management of complex or staghorn renal stones<sup>2,3</sup>. With either method, the primary objectives are complete clearance of the stone with minimal morbidity.

PCNL has been conducted with patient in prone position<sup>4</sup>, which allows a wide and clearer view for kidney puncture, avoiding injuries and makes the puncture path short and in straight line. This prone position of the patient provides posterior access to the collecting system, thereby enabling operating surgeon to puncture a posterior calyx of the kidney through Brodel's avascular plane without significant renal hemorrhage & breach of peritoneum.

Multiple tract PCNL has been well established in the management of complex renal calculi<sup>5,6</sup>. Despite the proven advantages of this technique, it still remains under-utilized for the fear of complications involved with multiple punctures at the same time.

Complex renal stones usually refer to staghorn calculi, multiple stones or those associated with anatomical or functional abnormalities. Due to the complicated etiological factors, large stone burdens, high operation risks and high recurrence and residual calculi, it is always a challenge for surgeons to treat such stones.

PCNL is the gold standard in the management of staghorn stones and complex renal calculi according to the AUA and EAU guidelines for stone management<sup>7,8</sup>. In the treatment of complex renal calculi, the limiting factor is the morbidity associated with the establishment of multiple tracts.

### Methods:

The current study was a prospective study conducted in 60 patients who were divided in to two groups each of 30 subjects. One group included cases wherein single tract PCNL was performed whereas in the second group multi-tract PCNL was performed. Both the groups were compared in context of operative time, stone clearance, complications arising if any, etc.

Patients satisfying the inclusion criteria of having complex stones in the form of staghorn calculus, multiple stones and those associated with anatomical and functional abnormalities were included after obtaining due informed consent explaining them the objectives and procedure of the study in their native language. Those unwilling to give valid consent, those having positive culture growth, pregnant women and those with coagulopathies were not included in the study.

### RESULTS:

Most of the patients 38 of 60 were male (63.33%) and female were 22 in number (36.67%). Most of the patients (n=18) were in 36-45 age group (30%), followed by those between 26 to 35 years (n=14; 23.33%), 46 to 55 years (n=9, 15%), 16 to 25 years (n=8, 13.33%), 56 to 65 years (n=7, 11.67%) and 66 to 75 years (n=4; 6.67%).

Most of the patients had radio-opaque stones (86.67%) and rest were radiolucent (13.33%). The majority of the stones were located on right side at 56.67% and those on left were 43.33%. Types of calculus included partial staghorn in 17 patients (n=28.33%), multiple calculus in 27 patients (45%) and staghorn calculus in 16 subjects (25%). The mean size of the calculus was 26.11 mm (SD: 13.40). 13 and 5 subjects with partial staghorn calculus, 11 and 5 with staghorn and 6 and 10 with multiple calculus underwent single tract PCNL and multitract PCNL respectively.

The mean dilatation was 23 mm and 24 mm in single tract and multi-tract PCNL respectively. The largest tract in both the groups was 24 mm. The smallest tracts were 15.5 mm and 18 mm respectively in single tract and multi-tract PCNL.

	Single tract PCNL	Multi-tract PCNL	P value	Significance
Number of Punctures	30	30	--	--
Duration of Surgery (min)	91.57±23.16	114.7±28.82	0.001	Statistically significant

Tract Dilatation	23±1.94	24±1.27	0.19	Not statistically significant
Pre-operative S. creatinine	1.15±0.77	1.05±0.5	0.54	Not statistically significant
Post-operative S. creatinine	1.22±0.91	1.17±0.67	0.8	Not statistically significant
Pre-operative S. Urea	27.27±13.32	26.55±11.69	0.82	Not statistically significant
Post-operative S. Urea	27.67±16.44	26.17±13.45	0.7	Not statistically significant
Pre-operative Hb	12.93±1.43	12.3±1.58	0.11	Not statistically significant
Post-operative Hb	12.13±1.73	10.91±1.81	0.0098	Not statistically significant
Need for blood transfusions	1	2	0.55	Not statistically significant
Ancillary procedures	3	5	0.45	Not statistically significant
mean Hb drop (gm%)	0.8	1.39		
Mean duration of hospitalization (days)	3.2±0.48	3.73±0.78	0.002	Statistically significant
Incidence of fever	1	4	0.78	Not statistically significant
Pain	8	13	0.47	Not statistically significant
Post-operative complications	18	26	0.024	Statistically significant
Intra-operative bleeding	2	6	0.14	Not Statistically significant
Post-Op Clearance	22	27	0.25	Not statistically significant

Multi-tract PCNL took statistically longer duration of surgery than Single-tract. Stone clearance was not significantly different between those with Single tract PCNL vs those needing Multi tract PCNL with P value of 0.25.

### DISCUSSIONS:

PCNL is the gold standard in the management of staghorn stones and complex renal calculi according to the AUA and EAU guidelines for stone management<sup>7,10,14</sup>. Multiple tract PCNL has been well established in the management of complex renal calculi<sup>5,6</sup>. Despite the proven advantages of this technique, it still remains under-utilized for the fear of complications involved with multiple punctures at the same time. Cho HJ et al.<sup>9</sup> found a similar clearance rate with both the procedures. As observed from various studies, Single tract clearance has lesser morbidity, but gives suboptimal stone clearance and is advocated only for small burden staghorn stones<sup>10,11</sup>. In comparison to single tract approach, multiple tracts provide superior stone clearance<sup>11,12</sup>. However, we found a similar clearance between the two groups. Scoffone CM et al.<sup>13</sup> suggested use of single-tract PNL with adjunct procedures such as flexible ureteroscopy/nephroscopy may decrease the disadvantages of the multiple-tract PNL without compromising on stone-free rates as a further modification.

In a study by Khan G et al.<sup>15</sup> authors noted that renal stones are preponderant in males. Out of 70 patients in their study 62 were males (88.58%) and 8 females (11.42%). The mean age was 33 years in the study. In another study by Singla M et al.<sup>16</sup> 149 patients with staghorn calculi were evaluated. Of these 149 patients 118 men and 31 women, mean age 39.8 years, range 12 to 65 years were treated.

Cho HJ et al.<sup>17</sup> did not observe any difference between duration of hospitalization between the two procedures. In our study there were slightly higher number of complications in multi-tract PCNL and the drop in haemoglobin was higher in multi-tract group. This could have possibly led to over-all increased duration of hospitalization in our study. Cho HJ et al.<sup>17</sup> found a similar rate of complications in both the groups as our study. On contrary Verma A et al.<sup>18</sup> found in 110 patients that with timely multiple punctures done, there is neither significant haemoglobin fall nor creatinine rise.

Ketsuwan C et al.<sup>19</sup> conducted a study to evaluate perioperative factors associated with transfusion requirements during PCNL. The overall blood transfusion rate was 9.29%. Authors concluded that only the multiple tract punctures were associated with blood transfusion requirements in PCNL (P=0.038).

Pre-operative S. Urea of both groups were similar. Post-operative S. Urea of both groups was also similar. The P value was non-significant when both the groups were compared. Pre-operative S. creatinine of both groups were similar. Post-operative S. creatinine of both groups was also similar. The P value was non-significant when both the groups were compared. Akman et al.<sup>20</sup> compared the effect of multiple-tract PCNL in 413 patients and found no significant difference in the mean changes in the creatinine values between the multiple tract and single tract approaches. Liu and colleagues<sup>21</sup> showed in their retrospective analysis that the mean change of serum creatinine was not statistically significant between the two groups. On contrary Yadav R et al.<sup>22</sup> conducted a prospective study evaluating impact of percutaneous nephrolithotomy (PCNL) on renal function. They noted that post PCNL decrease in GFR worsened with an increasing number of accesses. Cho HJ et al.<sup>17</sup> noted that need for ancillary procedures was

more common in patients undergoing multiple-tract PCNL, however in our study, the difference was non-significant.

### CONCLUSION:

As observed from our study, stone clearance rate was similar in both the groups. In view of the findings of the study, single tract PCNL seems to be a better option in comparison to multi-tract PCNL in context of hospital stay, fall in haemoglobin after procedure and any complications occurring as a result of the procedure with similar stone clearance rates. We suggest conducting similar studies with a higher patient sample size to further evaluate conclusive evidence of superiority of single tract PCNL over multi-tract PCNL.

### Limitations Of The Study:

The sample size is small, complicated or high risk cases such as those with coagulopathies, those with positive culture growth, children, pregnant women were not included, lack of cost effective analysis, study is not blinded, ancillary procedures are not discussed, long term follow up was not performed with regard to any adverse events or procedure related complications.

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