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Comparative study of standard, tubeless and totally tubeless PCNL for renal stones

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Abstract
Percutaneous nephrolithotomy (PCNL) is the standard treatment for renal stones. To reduce the pain and morbidity after standard PCNL because of nephrostomy tubes, various modifications of PCNL are developed. We did a comparative study on standard PCNL, tubeless PCNL and totally tubeless PCNL.
Materials and Methods: A total of 60 patients were randomized into three groups of 20 each: standard PCNL with nephrostomy tubes (Group 1), tubeless PCNL with ureteric stent and no nephrostomy (Group 2), and totally tubeless PCNL without ureteric catheter or nephrostomy (Group 3). The outcomes measured were hemoglobin (Hb) drop, hemorrhage, need for blood transfusion, pyrexia, urine leak, pain score, analgesic requirement, and duration of hospital stay.
Results: In all the three groups, hemorrhage, Hb drop, need for blood transfusion, and postoperative pyrexia were not significantly different. Standard PCNL group had significant postoperative urinary leak which was not present in the other two groups. The analgesic requirement and duration of hospital stay of was significantly less in tubeless and totally tubeless groups compared to the standard.
Conclusions: PCNL is the standard treatment for renal stones. Standard PCNL can be modified to reduce complications and early recovery. Totally tubeless PCNL significantly reduced postoperative pain, urine leak and morbidity compared to the standard PCNL.

Keywords: renal stone, PCNL, totally tubeless PCNL

Introduction
Treatment of renal stones have become less invasive and safer. PCNL is minimally invasive treatment modality with decreased morbidity compared to open surgery. It was first introduced in 1976 [1]. Complications of PCNL include bleeding, pyrexia, incomplete stone removal etc [2]. Technological advances has reduced these morbidities associated with PCNL. Better optics, improved lithotripsy technologies and refinement of surgical steps improved surgical success and decreased complications. In the standard PCNL, at the end of the procedure a nephrostomy tube is placed. Morbidities associated with nephrostomy tube are infection, pain, urine leak, bleeding and prolonged hospital stay [3]. There are studies which show that smaller nephrostomy tubes are as effective as larger ones [4]. Introduction of insertion of DJ stent lead to Tubeless PCNL. Stent related problems faced were urinary frequency, urgency, nocturia, pain and hematuria [5]. Totally tubeless PCNL avoids insertion of nephrostomy tube and DJ stent. We conducted this study to compare standard, tubeless and totally tubeless PCNL. We studied the safety and morbidity of these techniques in treatment of renal stones.

Material and Methods
This is a comparative study conducted at tertiary hospital attached to medical college. The inclusion crieteria were size <3cm, single puncture tract, complete clearance of stones on fluoroscopy and nephroscopy and intact pelvicalyceal system at the end of the procedure. Patients with renal anatomical abnormalities, staghorn calculus, active urinary tract infections, coagulopathy and those who were unfit for GA were excluded from the study. Preoperative evaluation included blood and urine routine examination, renal function test, urine culture, coagulation profile and IVP/ CT scan.
Standard surgical techniques were used. After painting and draping, ureteric catheter was introduced into renal pelvis. Patient was turned prone. Under C-arm guidance renal puncture was performed with 18G IP needle. Tract was dilated to 30 F with metal alken dilators. Nephroscopy was done. Stones were fragmented with pneumatic lithotripsy and removed with grasper.
The patients were divided into 3 groups. In Group 1 patients nephrostomy tube of 14F was introduced. In Group 2 patients DJ stent was inserted without nephrostomy tube. For Group 3 patients no tube was inserted. 25 patients were included each group.

Results
The demographic characterestics of the patients in the groups were comparable and given in table 1. The complications and outcome of the PCNL are listed in Table 2.

Table 1: Demographic characterestics

Patient characteristic	Standard group 1	Tubeless group 2	Totally tubeless group 3	Total
Sex				
Male	20	19	21	60
Female	5	6	4	15
Age groups				
20-40 years	10	13	16	39
41-60 years	15	12	9	36
Side				
Right	12	10	14	36
Left	13	15	11	39

Table 2: Outcome and complications

Variables	Standard	tubeless	totally tubeless	total	p
Hemorrhage	2	2	2	6	
Blood transfustion	2	1	1	4	
Pyrexia	3	1	2	6	
Urine leak	10	0	0	10	
Hemoglobin drop (G%)	1.13	1.45	1.22		0.69
Pain score	6.2	4.6	3.2		0.001
Duration of hospital stay(hours)	98	74	58		0.001

The mean drop in hemoglobin was not statistically significant.

Two patients from each group had significant bleeding post operatively. Blood transfusion was needed in four patients. Pyrexia was developed in 6 patients. The differces in blood transfusion and pyrexia was not statistically significant.

Urine leak was developed in standard PCNL in 10 patients. Most of the urine leak lasted only few hours. None of the had persistant urine leak. Tubeless PCNL and totally tubeless PCNL patients had no urine leak. The difference was statistically significant. P=0.310.

Pain is a morbidity after any surgery. Pain is less with totally tubeless PCNL. It is found to be statistically significant with p=0.001.

There is significant difference in hospital stay between the groups. The standard PCNL patients required 98 hours of hospital stay. Totally tubeless patinets reduced it to 58 hours.

Discussion

Fernstrom and Johansson first described PCNL forrenal stones in 1976 [1]. Since then PCNL has been standard treatment for large renal stones. There has been advances in techniques in PCNL. Technological advances as helped in miniaturization of instruments. Traditionally, after removal of the stones, a nephrostomy tube is inserted. Nephrostomy tube helped in tamponade of bleeding, tract recovery, guide second look nephroscopy if needed and drainage of urine [6]. Desai *et al.* showed that smaller caliber tubes were equally effective and patient had less pain, decreased need of analgesics and reduced hospital stay [7].

Wickham *et al.* in 1984 described first totally tubeless PCNL [8]. Bellman *et al.* in 1997 decribed tubeless PCNL where ureteric stent was placed at end of procedure without placing a nephrostomy tube [9]. Many of the studies have reported advantages of totally tubeless PCNL since then [10].

Hemorrhage is a significant complication in PCNL, some of the patients requiring blood transfusion [11]. In our study, bleeding was not statistically different in the three groups. Total of six patients had significant bleeding, four requiring blood transfusion. Totally tubeless PCNL is equal to other procedures in bleeding.

Conclusion

PCNL has been standard treatment for renal stone. Tubeless and totally tubeless PCNL are modifications in the standard PCNL technique. It decreases hospital stay, postoperative pain, analgesic requirement, urine leak and patient can be discharged early. Whenever feasible, tubeless PCNL is the choice of technique for removal of renal calculi.

Fever and urinary leak are complications of standard PCNL. Residual stone fragments is a cause for postoperative fever. Stone burden composition of stone did not influence the incidence. Urine leak could be due to retained fragments, blood clots, infundibular narrowing etc. In our study there was significant decrease in urine leak with tubeless and totally tubeless PCNL compared to standard PCNL.

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