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Observational prospective study for surgical outcome and anesthetic feasibility of tubeless and totally tubeless supine PCNL: A single centre initial experience

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ABSTRACT

Objective: To evaluate surgical outcome and spinal anesthetic feasibility of supine percutaneous nephrolithotomy (PCNL) by tubeless and totally tubeless method.

Material and methods: This observational study included a totally 53 patients. Initial diagnosis of renal stone was based on urinary ultrasonography, kidney, ureter and bladder X-ray, and later confirmed by computed tomography urography. PCNL was done with the patient in Galdakao-modified supine Valdivia position. Nephrostomy was not done using tubeless method, while in totally tubeless method instead of insertion of double j stent, ureteral catheterization was done and the ureter catheter was kept for <24 hours. During postprocedural period, patients were observed for development of fever, perinephric collection, need for blood transfusion and duration of hospital stay.

Results: Patients aged between 14 and 75 years were included in the study. Out of totally 53 patients, supine tubeless PCNL was done in 23 patients while 30 were operated using totally tubeless method. Twenty-nine patients were induced by spinal anesthesia and 24 by general anesthesia. Stone sizes were found to be in the range of 1.4cm to 5.1 cm. Forty-six (86.7%) patients were managed by inferior calyceal puncture. Three patients required double puncture in whom 2 had developed perinephric collection. Complete stone clearance achieved in 49 (92.4%) patients. Four patients developed fever and 2 cases required one unit blood transfusion postoperatively.

Conclusion: Tubeless and totally tubeless supine PCNL is technically feasible with good surgical outcomes and can be done under spinal and general anesthesia in properly selected patients.

Keywords: Percutaneous nephrolithotomy; renal calculus; supine position.

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Introduction

Percutaneous nephrolithotomy (PCNL) is considered as the treatment of choice for stone bigger than 2 cm in size including staghorn calculi. Goodwin et al.[1] had done first percutaneous nephrostomy (PCN) to drain a hydronephrotic kidney. Renal stones were first removed through the nephrostomy tract by Fernstrom and Johanson in 1976.[2] Prone position is the most commonly used position for PCNL although it is associated with restricted ventilatory capacity[3], circulatory difficulties and raised intraocular pressure[4] and almost impossible in some skeletal deformities.[5] Various other positions were defined in the literature including supine[5], lateral decubitus (flank)[6], split-leg[7] and reverse lithotomy[8] positions. PCNL in the supine position was first described by Valdivia et al.[9]. Later on a new position was described after doing some modification in the original Valdivia (supine Valdivia and modified lithotomy positions). The patient was placed at slightly contralateral decubitus position with sand bag placed to raise flank, ipsilateral leg is extended with contralateral leg abducted and flexed.[10] It has many advantages over prone position like low pressure in pelvicalyceal system, simultaneous access to upper and lower tract, better airway control, milder retrocolon injury and better safety profile in cardiac and respiratory patients.[11-14] The term "tubeless PCNL" was first used by Bellman et al.[15]. In this technique nephrostomy tube was not ap-

plied instead double j stents were placed for internal drainage of renal pelvis.[16] Some authors reported another technique for totally tubeless PCNL in which without nephrostomy, urethral and ureteral catheter were placed for maximum 24 hours only.[17,18] In this study we analyse the surgical outcome and spinal anesthetic feasibility of both tubeless and totally tubeless supine PCNL.

Material and methods

Study was conducted between January 2016 to March 2017 in urology department of Institute of Post Graduate and Medical Education and Research Kolkata. All patients who presented with renal stones with sterile urine during this period were included in the study. Patients with age less than 12 years, bilateral stone disease, previously operated or with uncontrolled coagulopathies were excluded. Patients with lesser stone burden (<3 cm), single inferior calyceal stone were chosen for spinal anesthesia. Informed written consent from patients and parents of children, and clearance from institutional ethical committee (IPGME&R/IEC/2017/013) were obtained.

Preoperative: Patients were evaluated by history taking, clinical examination. Ultrasonography (USG) kidney, ureter, bladder (KUB), Computed Tomography (CT) urography. Stone size of multiple stones was determined by sum of all stones.[19]

Peroperative: Patients were placed in Galdakao-modified supine Valdivia position. For patients who were scheduled for bilateral procedure this position was not used. Surface marking of posterior axillary line, iliac crest and 12th rib was done (Figure 1). Legs were flexed from hip and knee joints with the contralateral leg more elevated and ipsilateral more descended. Cystoscopicaly ureteral catheter was introduced into desired pelvicalyceal system (PCS). Calyx was punctured initially with puncture needle under fluoroscopic guidance 20°below the horizontal line. Thirty French single-step corkscrew dilator was used to dilate the tract. Stones were fragmented by pneumatic lithoclast. After fluoroscopic confirmation of stone clearance, routine retrograde pyelogram was done to rule out PCS injury. Decision for totally tubeless PCNL was taken at the end of procedure when there was a clear vision, without any evidence of PCS injury, only mild hematuria and lack of residual fragments on fluoroscopy while patients with larger stone burden, and PCS injury were reserved for tubeless PCNL. Nephrostomy was opened only in patients with matrix stones or when a second-look surgery was required. Amplatz sheath was then removed after observing any hematuria or tract bleeding. Nephrostomy site was closed after inserting a ureteral catheter (totally tubeless) or a DJ (double J) stent (tubeless). Ureteral catheters were removed within less than 24 hours in totally tubeless PCNL.

Postoperative: Patients were followed up for the onset of fever, requirement for blood transfusion and development of perinephric collection by USG after 12 hours. Patients were finally discharged in afebrile condition with the dry nephrostomy site. Stone-free status was confirmed by CT imaging 4 weeks after the procedure. Statistical analysis of data was done using a 2007 version of statistical package for windows.

Results

A totally of 53 patients were operated in supine position among them two patients had horseshoe kidney and one patient had kyphoscoliosis. Patient characteristics are shown in the Table 1 and stone characteristics in Table 2. Twenty-nine (54.7%) patients were operated using spinal anesthesia and due to large stone burden 24 (45.3%) patients were operated under general anesthesia (Table 3). Operative time was defined from starting of cystoscopy to closure of nephrostomy site. Mean operative time was 57±12.3 minutes which ranged from 34 min to 90 min (Table 4). Inferior calyceal puncture was performed in 46 cases. Three cases required double puncture (inferior + middle) while 4 were managed using middle calyceal puncture. Four patients were found to have residual calculi (>5 mm) which were managed by extracorporeal shock wave lithotripsy. Complete clearance without significant stone size was achieved in a totally of 49 (92.4%) patients. Complications were classified according to Clavien-Dindo Classification. Four patients (7.5%) developed >38˚C fever for >48 hours which were managed by full course of antibiotics. Two patients (3.7%) required blood transfusions. There was no colon injury, nephrostomy leak or deep vein thrombosis in any patient. Conversion to open surgery was not needed in any case. Table 2, 3 shows the anesthetic and surgical outcomes using different variables.

Discussion

Every operative technique evolves with time and this is applicable for PCNL too. Tubeless supine PCNL largely addresses two problems of conventional PCNL, the first one is placement of nephrostomy tubes and the second one is change of patient position. Another session of DJ stent removal is not required in patients who are operated by totally tubeless method. Many authors have worked on supine PCNL but data is lacking regarding tubeless supine and totally tubeless supine PCNL.

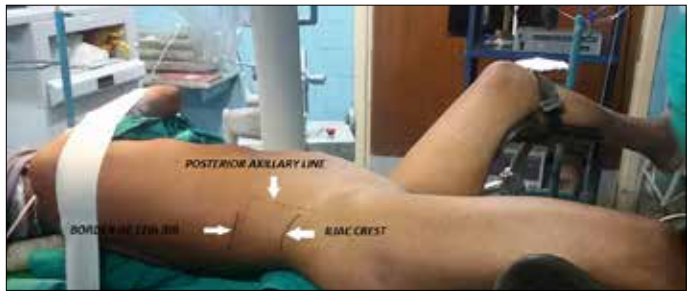

Figure 1. Supine percutaneous nephrolithotomy position showing contralateral leg more elevated and flexed. Surface marking of 12th rib, posterior axillary line and iliac crest is shown

Table 1. Characteristics of the patients

Variables	Mean±SD	Range
Age (year)	42±13.4	14-75
Male, n (%)	39 (73.6)	
Female, n (%)	14 (26.4)	
Right kidney, n (%)	26 (49.1)	
Left kidney, n (%)	27 (50.9)	

Table 2. Stone characteristics

Stone size (mm)	Mean±SD	Range (cm)
Overall	2.8±0.9	1.4-5.1
Tubeless	3.41±0.87	1.9-5.1
Totally tubeless	2.47±0.69	1.4-4.3
S.A.	2.39±0.63	1.4-4.8
G.A.	3.47±0.82	1.9-5.1
Stone site	n	%
Inferior calyx	25	47.1
Pelvis	13	24.5
Middle calyx	4	7.5
Inferior calyx + pelvis	8	15.0
Inferior calyx + middle calyx	1	1.8
Inferior calyx + middle calyx + pelvis	2	3.7

SA: spinal anesthesia; GA: general anesthesia

Table 3. Distribution of patients according to types of anesthesia and procedures

	Anesthesia		
	G.A.	S.A.	Total
Tubeless supine PCNL	14	9	23
Total tubeless supine PCNL	10	20	30
Total	24	29	53

SA: spinal anesthesia; GA: general anesthesia; PCNL: percutaneous nephrolithotomy

It has been already proved that supine PCNL is equally effective and safe as prone PCNL.[6] Tubeless and supine modifications incorporate beneficial effect of both surgeries than conventional prone PCNL. In our study we performed 53 tubeless or totally tubeless supine PCNLs. Single puncture was done in 50 (94.3%) patients while 3 patients required double puncture. Forty-six (86.7%) patients were managed by inferior calyceal puncture which is at higher rates compared to relevant reports in the literature ranging between 72 and 70.8 percent.[12,20]

Overall mean operative time was 57±12.3 minutes (range:34-90 minutes). For tubeless and totally tubeless PCLs mean operative times were 62.91±11.9, and 52.50±10.7 minutes, respectively. Possible explanation for shorter operative time of totally tubeless PCNL would be that this procedure did not incorporate insertion of double j stenting. Other studies reported mean operative times ranging between 67.1±19.2 and 78.93±3.8 minutes with tubeless supine PCNL.[20,21]

Table 4. Operative and postoperative variables

Variables	Mean±SD	Range
Operative time in minutes (overall)	57.0±12.3	34-90
S.A.	55.43±13.24	34-90
G.A.	53.92±11.03	38-84
Tubeless	62.91±11.90	41-90
Totally tubeless	52.50±10.72	34-78
Hospital stay (days)	3.5±0.66	2.4-6.2
Post op complication	**Number**	**%**
Fever	4	7.5
Perinephric collection	3	5.6
Blood transfusion (one unit)	2	3.7

SA: spinal anesthesia; GA: general anesthesia

In our study (Table 4) only 2 (3.7%) patients received blood transfusion which is comparable to available literature indicating requirement for blood transfusion in 2.5-4% of the relevant patients.[12,20] Regarding Two (3.7%) patients developed complication of perinephric collection which was managed conservatively. Previous studies reported the incidence of perinephric collection ranging between 0.5% and 2.5 percent.[12,20] Reason for this could be access tract dilatation with 30 Fr dilators. A totally of 4 patients (7.5%) developed postoperative fever which was comparable to 5.8% incidence of postoperative fever mentioned in the literature.[20]

There are very few studies concerning the role and outcome of regional anesthesia in supine PCNL.[22] But in our best knowledge there is no data available in the literature regarding anesthetic outcome for supine totally tubeless/tubeless PCNL. Our study enlightens the role of regional anesthesia (spinal with epidural) in said procedures. Twenty-nine (54.7%) out of 53 patients were operated by spinal anesthesia with epidural block. Mean stone size for the patients who received regional anesthesia was 2.3±0.63 cm and mean operative time was 55.45±13.24 minutes (Table 3, 4).

In conclusion, various studies have shown that supine PCNL is a safe and effective procedure. Our study shows that supine totally tubeless or tubeless PCNL is surgically feasible and can be performed under spinal anesthesia if done in properly selected

patients. Since it was a single-centre study with small sample size, validation of our assertions will require conduction of multi-institutional studies.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Institute of Post Graduate Medical Education and Research (IEC/2017/013).

Informed Consent: Written informed consent was obtained from patients, and parents of children who participated in this study.

Peer-review: Externally peer-reviewed.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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