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Three step dilation in flank-free oblique supine modified lithotomy position for supine percutaneous nephrolithotomy: Single centre experience

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Abstract
Objective: To evaluate the feasibility, safety, and efficacy of three-step dilation in flank-free oblique supine modified lithotomy (FOSML) position in supine percutaneous nephrolithotomy (PCNL).
Materials and Methods: A total of 79 patients underwent supine PCNL in the FOSML position between April 2018 and July 2019. Out of these patients 4 patients were excluded as they were operated on intravenous urography without prior NCCT KUB study and 1patient underwent additional surgery along with PCNL. Remaining 74 were considered eligible for inclusion in the study. Parameters evaluated for the study were stone characteristics; fluoroscopy time for renal access, total operating time, preoperative and postoperative hemoglobin concentrations puncture attempts, tract dilatation failures, complications, and transfusions.
Results: Mean fluoroscopy access time was 131.28 seconds with an average stone size of 2.53 cm. Infracostal puncture was performed in 62 and the remaining 12 patients underwent supracostal access. Mean hemoglobin reduction was 1.27 gm %. Major complications were blood transfusion in 9 patients and ICD insertion in 1 patient. The mean duration of hospital stay was 71.52 hours.
Conclusion: The Technique of three-step dilatation for supine PCNL in the FOSML position is safe, cost-effective, and offers shorter renal access time and operative time. This technique is an inexpensive alternative to other dilatation techniques.

Keywords: flank-free oblique supine modified lithotomy, Dilatation technique, Supine percutaneous nephrolithotomy, safety, guidewire Level of evidence: 4

Introduction
Achieving ideal renal access is one of the important steps in performing PCNL surgery. Multiple techniques have been described to dilate the nephrostomy tract. It can be done with Amplatz dilators (serial polyurethane co-axial dilators), balloon dilators, and Alken dilators (telescoping metallic co-axial dilators) [1]. Use of an Amplatz dilator set or metal incremental dilators has been associated with longer exposure to fluoroscopy and is also considered time-consuming. Balloon dilatation is considered safest but it is associated with high consumable cost [2]. During PCNL surgery we have noticed that guidewire passing through Amplatz sheath into the collecting system for safe access often hinders retrieval of stone fragments and many times comes out during stone extraction using forceps. To avoid these disadvantages associated with the above-mentioned techniques and guidewire associated inconvenience we decided to adopt three-step dilatation techniques for supine PCNL in flank-free oblique supine modified lithotomy (FOSML) position. The objective of this study was to evaluate the feasibility, safety, and efficacy of three-step dilation in FOSML position. To our knowledge, no published data have used this dilation technique in FOSML position.

Materials and Methods
This study has been approved by the Institutional ethics committee. The database was prospectively created for all patients undergoing supine PCNL in the FOSML position from April 2018 to July 2019. Patients operated based on Intravenous Urography without prior NCCT KUB and additional surgeries along with PCNL were excluded. The variables accessed for the study were stone size, stone Hounsfield unit, number of puncture attempts, puncture site (infracostal or supracostal), calyx punctured, surgical time, radiation exposure time to achieve access starting from calyceal puncture to the placement of the Amplatz sheath, and preoperative and postoperative hematocrit values, the number of blood transfusions, major complications, duration of hospital stay. Operations were performed by four different urologists with vast experience in the field of Endourology.

Technique
Patient Position
Before positioning the patient, marking of important Surface landmarks (Ribs, Iliac crest, and Posterior axillary lines) were done. The patient is turned lateral (90°) towards the contralateral side and upper back is rested against padded support. Both Lower limbs are supported and fixed on lithotomy stirrups and ipsilateral buttock rests on soft Pad. Ipsilateral lower limb is slightly extension on hip with knee partially flexed and goes down below the level of the table. The contralateral lower limb is kept in a conventional

lithotomy position with flexion abduction, external rotation at hip and flexion at the knee (Figure 1) [3].

Fig 1: Flank free oblique supine modified lithotomy position to achieve renal access for supine PCNL.

Puncture

The triangulation method was adopted for puncture under Fluoroscopic Guidance, puncture was always behind the Posterior axillary line (Figure 2).

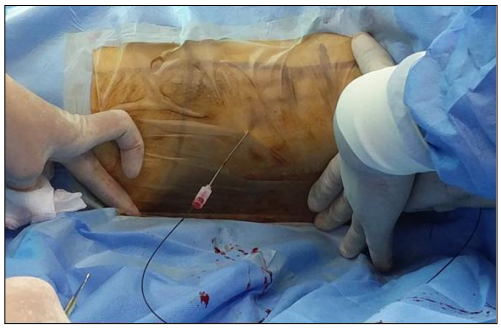

Fig 2: Renal puncture achieved behind posterior axillary line by triangulation technique.

Dilatation

After Initial puncture skin is further incised according to amplatz sheath size. Dilatation was achieved in three steps. The first step involved passing of Alken Needle, cannula over the guidewire to the desired position, and an additional safety guidewire is passed through the cannula (Figure 3a). Alken Needle, cannula helps in negotiating oblique tracts through tough fibrous tissue as it is made of stainless steel. The second step involved passing of guide rod to the target site through the cannula and removal of alkens Needle, canula, and securing safety guidewire (Figure 3b). In Third step tract dilatation is done with Amplatz Dilator (24 Fr) over guide-rod and amplatz sheath is secured over it (Figure 4). Guidewire used for tract dilatation is removed to facilitate faster gravitational removal of stone fragments. Additional safety wire adjacent to amplatz is kept secure throughout the procedure for a safe fluoroscopic repositioning of amplatz sheath in case of it amplatz displacement from calyceal system (Figure 5).

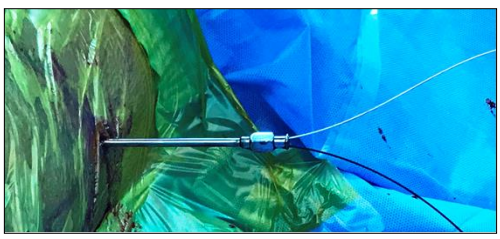

Fig 3a: First step of dilatation showing passing of Alken needle, cannula over guidewire to the desired position, and additional safety guidewire is passed through the cannula.

Fig 3b: Second step showing passing of guide rod to the target site through the cannula and removal of alkens needle, cannula and securing safety guidewire.

Fig 4: Third step in tract dilatation is done with Amplatz Dilator (24 Fr) over guide-rod and amplatz sheath is secured over it.

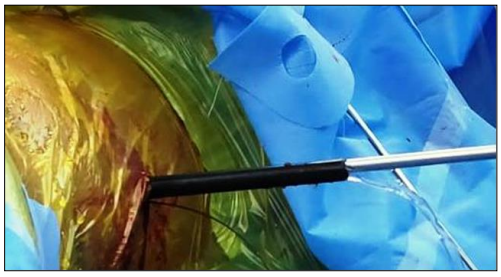

Fig 5: Guide wire used for tract dilatation is removed. Additional safety wire adjacent to amplatz is kept secured throughout the procedure for a safe fluoroscopic repositioning of amplatz sheath.

Results

The mean stone size was 2.53 cm with a mean Hounsfield unit of 1333.01. Only 6 patients required more than one renal access tract due to a large stone burden and the remaining 68 had a single tract approach. Attempts required to puncture the pelvic calyceal system had an average of 1.59 attempts. Mean fluoroscopic time to achieve percutaneous renal access was 127.07 seconds (sec) in single tract PCNL and 185.75 sec in more than 1 tract. The combined meantime was 131.28 sec. Relook PCNL was done in 1 patient due to a large stone burden and 2 patients underwent tubeless PCNL. Infracostal renal access was more common than supracostal, 62, and 12 respectively, and Mean operative time was 54.18 sec. Out of 74 patients 5 patients were readmitted, 3 patients required blood transfusion, and 2 admitted with complaints of fever. In total 9 patients required blood transfusion and mean hemoglobin reduction was 1.27 gm%. Most of the patients were discharged on the second postoperative day and the mean duration of hospital stay was 71.52 hours.

Discussion

Dilatation of nephrostomy tract is the most crucial step of PCNL and balloon dilatation is considered as gold standard [4]. Routine use of balloon dilators is associated with high consumable cost which is difficult to achieve in centers with limited funds and also it does not allow additional safety guidewire insertion without an additional step [5]. In a study done by Ahmed Sakr *et al*. [6] percutaneous renal access was

achieved by telescopic telescoping Alken's metal dilators in supine PCNL with fluoroscopy time of 4.8 ± 2.1 minutes. In the current study mean fluoroscopy time to achieve percutaneous renal access was 127.07 seconds which is significantly shorter than the above-mentioned study.

However, in a study done by Youness *et al*, [1] percutaneous renal access was achieved by single-step dilatation with 25 fr amplatz dilator on alkens guide had mean fluoroscopy access time of 25 ± 17 sec with total fluoroscopy time 142 ± 54 seconds which is shorter than our study. We believe in our technique additional safety guidewire is inserted and guidewire is kept beside amplatz sheath which makes procedure safe and allows unrestricted removal of stone fragments which may be responsible for longer access time.

With improvements and innovations in supine PCNL techniques and its accessories there is a reduction in the duration of hospital stay for the procedure. A study done by Ng *et al*, [7] in 2004 had 8.7 days as the mean duration of hospital stay and Neto *et al*, [8] in the year 2007 showed its reduction from 8.7 days to 5.4 days. In the current study mean duration of hospital stay was 71.52 hours (2.98 days). which is lower than the most published literature on supine PCNL except study done by Shoma *et al*, [9] which had a mean hospital duration of 2.5 days.

Conclusion

Three-step dilatation technique for supine PCNL in the FOSML position is feasible, safe, and effective as other techniques of tract dilatation. Keeping guidewire besides amplatz sheath instead of percutaneous access tract has the advantage of unhindered stone extraction and shorter procedure time. The cost-effective nature of accessories involved in these techniques makes it ideal for institutions with limited funds.

Conflict of Interest: None as Declared

Contributor ship

VS, FS, and AS researched literature and conceived the study. VS was involved in protocol development, gaining ethical approval, patient recruitment and data analysis. VS and RY wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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