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Effectiveness of Supine PCNL in Management of Staghorn Stone- An early experience

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Abstract

Introduction & Objectives: *Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure and the gold standard for kidney stone larger than 2cm and complex renal stone. Since it was first introduced, PCNL has been carried out in the prone position. In 1987, Valdivia Uria became the first to introduce PCNL in supine position. Supine PCNL is safe and effective. Good stone approaching calyceal puncture is the key point of success in supine PCNL. We aimed to prove the effectiveness of supine PCNL for management of staghorn stone.*

Methods: *This study is a prospective study conducted in Metropolitan speciality centre for kidney diseases & urology, Chattagram from January 2021 to October 2023. Total 291 patients underwent supine PCNL in which 26 cases were staghorn stone. Out of 26 patient, 6 cases were puncture through lower & middle calyx, rest 20 cases punctured through lower calyx only. All data were collected and statistically analyzed.*

Result: *In demographic characteristics, male was predominate (69.23%). In terms stone characteristics 11 cases were complete staghorn (42.30%) and 15 cases partial staghorn (57.7%). Mean operative time 81.92 min, blood transfusion 69.23%, stone clearance 98.53% , and hospital stay 1-2. No major complications were observed.*

Conclusion*: Supine position offers potential advantages of better ureteral access, patient handling, simultaneous retrograde and antegrade access, dependent track, easier air way control. Supine PCNL for staghorn stone is safe and effective interm of stone clearence and complications.*

Introduction :

Urinary calculi are the third most common disease of the urinary tract[1]. The prevalence of nephrolithisis varies from 1% to 20% and incidence depends on living environment, climate, age, sex, race, dietary and genetic factor.[2] Treatment of renal and upper ureteric stone varies on size, location and calyceal condition. Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure and the gold standard for kidney stone larger than 2cm and complex renal stone.[3] Since it was first introduced PCNL has been carried out in the prone position. This technique is popular with high stone free rate but not suitable for patient with obesity and cardiopulmonary problem, not only that in prone

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position, it need to change the patient position after ureteric catheterization[4]. In 1987, Valdivia Uria became the first to introduce PCNL in supine position[5].Compared to prone postion, supine percutaneous nephrolithotomy carries some potential advantages like- no need to position change after ureteric catheter placement, suitable for patient with obesity and cardiopulmonary problem, less operative time, minimize the risk of injury to musculoskeletal & nervous system.[6]Stone approaching good calyceal puncture is the key point of success in supine PCNL. We aimed to prove the effectiveness of supine PCNL for management of staghorn stone.

Materials and Methods:

This is a prospective study conducted in Metropolitan speciality centre for kidney diseases & urology, Chattogram from January 2021 to October 2023. Total 291 patient underwent supine PCNL, in which 26 cases were stag horn stone. Out of 26 patient,6cases were puncture through lower & middle calyx, rest 20 cases punctured through lower calyx only.

Selection criteria:

Inclusion criteria:

- Age more than 18 years
- Sterile urine.
- Functioning kidney.

Exclusion criteria:

- Coagulopathies
- Renal failure.
- Pregnancy.
- Hyperparathyroidism.
- Congenital anomalies of kidney.

We review the demographic characteristics, stone clearance, per- operative and post operative complications. All the patients of renal and upper ureteric stone evaluated by brief history, clinical examination and all routine necessary investigation like complete blood count, urine R/M/E & C/S, renal function test, USG of KUB, X-ray KUB, IVU, NCCT scan of KUB, chest x-ray, electrocardiogram.

All the patients were thoroughly examined to assess general condition & concomitant other diseases &advise for hospitalization. All the findings of history, examination and reports of investigations recorded in a data collection sheet prepared for this purpose. Informed written consent obtained from the patients after explanation of the ultimate outcome, complications and purpose of the study. They was informed of their right to withdraw from the study at any stage.

The modified supine position was employed using a special type of bag made of foam &lather under ipsilateral shoulder and buttock. Under general anesthesia patient was placein dorsal lithotomy position with the ipsilateral hip and knee flexed and the contralateral leg is abducted and supported in an extended position. Ipsilateral arm is supported with flexed elbow over chest. Before positioning, it is important to mark the tip of 12th rib, iliac crest and the posterior axillary line to maintain orientation. In first stage urethrocystoscopy & placement of ureteric catheter was done upto pelviureteric junction. Position was confirmed under fluoroscopic guidance. After retrograde pyelogram, desired calyceal puncture was performed under fluoroscopic guidance using 18gauge needle & confirmed by spontaneous flow of water or by aspiration. 0.035 hydrophilic guide wire was placed and confirmed position whether it pass into ureter or coiled in calyceal system. 24 fr amplatz sheath was placed after tract dilatation using single shoot fascial dilator. Lithotripsy was done by ultrasonic / pneumatic lithotripter. Fragmented stone was sucked / removed. Stone clearance was confirmed by fluoroscopy. After placing 5fr D-J stent, closure of wound was done without nephrostomy tube. Urethral catheter removed after 24-48 hours. Stich offed on 8th post-operative day and checked for wound infection, leakage. Cystoscopic removal of D-J stent was done after 2-3 weeks.

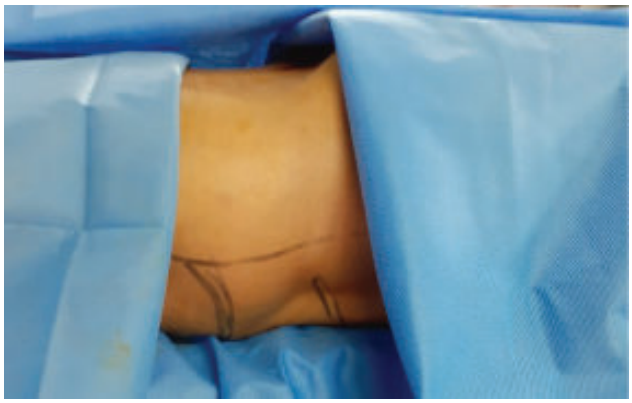

Table I : *Characteristics of the patients with staghorn stone (n=26)*

Characteristics	Frequency	Percentage
Age, years		
20-50 years	11	42.3
51-70 years	15	57.7
Sex		
Male	18	69.2
Female	8	30.8
Affected side		
Right	12	46.2
Left	14	53.8

Table II: *Characteristics of stones (n=26)*

Variables	Values
Staghorn types	
Complete, n (%)	11 (42.3%)
Incomplete, n (%)	15 (57.7%)
Stone size	
Mean ±SD, cm	4.34±0.59
Range, cm	3.30-5.20

Table III: *Per-operative & post-operative characteristics of the patients (n=26)*

Variables	Values
Operation time, minute	
Mean ±SD	81.92±7.76
Range	70.00-95.00
Need for blood transfusion, n, (%)	18 (69.2%)
Stone clearance (SFR)	98.53%
UTI	4 (15.40)

Results:

A total 26 patients, out of 291 was staghorn stone (8.9%) underwent supine PCNL.In demographic characteristics, male was predominate (69.23%) and 51-70 years age group of patient was high (57.7%). In terms of stone characteristics 11 cases were complete staghorn (42.30%) and 15 cases partial staghorn (57.7%), left sided stone case was predominate (53.8%) and mean stone size was 4.34±0.59 cm. Mean operative time 81.92±7.76min. Operative time was calculated from induction of anesthesia to completion of stent placement. blood transfusion 69.23%, stone clearance 98.53%. Stone free rate defined as residual fragment upto 4mm in diameter detected on X-ray, USG or NCCT. 2 patient (7.69%) required second stage of PCNL.

Hospital stay ranged from 1-2 day. Per and post-operative no major complications were observed. Post-operative 4 patient developed (15.4%) urinary tract infection that was treated conservatively by administrating injectable antibiotic.

Discussion:

A standard patient positioning and organization of operation room is important to complete a good surgery. Performing percutaneous nephrolithotomy with the supine technique- operative time,iatrogenic injury and morbidity is less. Simultaneously we can perform other endourological like- endoscopic combined intrarenal surgery &laparoscopic procedure. Short, horizontal, proper stone approaching tract creation between the skin and calyx is essential for

higher stone clearance rate and minimal complications. In supine PCNL we can freely move the endoscopic instrument due to more lateral puncture & away from lumber muscle and chance of colonic injury is less. Melo et al, reported no significant difference between supine and prone in terms of outcomes.[7]

The age range of patients was 20-70 years where highest percentage was 51-70 years patients. There was male predominance (69.2%) with male-female ratio 2.25:1. The age range of the present study is more or less comparable with study done by J E Abbott et at in 2015, age range were reported between 20-80 years.[8] Highest age was higher than present study.

Total 26 patients out of 291, stones completely occupy the entire collecting system (complete staghorn) was 42.3% patients and in the rest of the patients (57.7%) had partial staghorn stone. Singla et al, reported staghorn stone was 29.2%.[9] The mean stone size was 4.34(±0.59)cm and range between 3.30-5.20cm. Complete stone free rate at first session of supine PCNL was 92.31% and 7.69% patients needed second session for complete stone resolution. Addar A, et al showed that 8.95% patient require second stage of PCNL that is almost similar to present study.[10]McChyP,et al stated higher stone free rate in supine position[11].The stone free rate reported by Falahatkar et at,76.2%,Tefekil et at, 81.6%, Ranasinghe et al, supine vs prone 70% vs 50%, Soliman et al, supine vs prone 85% vs 38.9%.[12,13,14,15]

The mean operative time was 81.92(±7.76) minutes. No major complications observed. Blood transfusion was needed in69.2% patient. High transfusion rate is due to initially use of shock pulse lithotripter (Olympus) in high power mode and tight stone- epithelium adherence in complete staghorn cases. Even if we do the perfect, in PCNL no body is free from initial unnoticed parenchymal vascular injury. Mak et al, showed that 27.5% blood transfusion rate in supine group.[16]Sohail et al, reported mean operative time is 130 min, Daryanto et al and Mazzucchi et al, stated sorter operative time in supine in comparison of prone PCNL.[17,18,19.]

During post-operative period 4 patients (15.4%) developed urinary tract infection inspite of preoperative culture sensitive oral antibiotic therapy. Those cases manage by systemic antibiotic. Hospital stay range between 1 and 2 days. Birowo P et at, stated that major complication rate lower in supine group and no difference of hospital stay between prone and supine groups.[20]

Conclusion:

PCNL in supine position for staghorn stone is safe and effective. Due to anesthetic management, less radiation exposure, decrease intrarenal pressure and easier combined intrarenal surgery, PCNL in supine position gaining popularity. More over upper calyx can easily approachable through inferior calyceal access. Supine percutaneous nephrolithotomy for staghorn stone is effective in terms of stone clearance and complications.

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