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ORIGINAL ARTICLE

Safety and efficacy of prone percutaneous nephrolithotomy (PCNL) in morbidly obese patients.

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ABSTRACT… Objective: To present our experience regarding the safety and efficacy of prone PCNL in morbidly obese patients. **Study Design:** Observational study. **Setting:** Armed Forces Institute of Urology, Rawalpindi. **Period:** February 2018 to February 2020. **Material & Methods:** After applying inclusion and exclusion criteria, a total of 47 morbidly obese patients undergoing PCNL in prone position were observed prospectively. The demographic data, intraoperative and postoperative outcomes were evaluated. The data were analyzed by SPSS ver. 24. **Results:** Average age was (46.43±10.41) years with (70.2%) males and (29.8%) females. The mean basal metabolic index (BMI) is (40.47±3.37) kg/m2 and mean stone size was (2.93±0.49 mm). A single stone is seen in twelve patients (25.5%), multiple in sixteen (34.0 %), partial staghorn in nine (19.1 %) and complete staghorn calculus in ten (21.3%) patients. The mean operative time was (83.38±13.20 min), duration of hospital stay (55.94±16.52 hours), stone-free rate (72.3%) and only (27.7%) patients had re-intervention. Calcium oxalate is the most common stone encountered followed by calcium phosphate and uric acid. Intraoperatively, transfusion secondary to bleeding and postoperatively grade 3 clavien-dindo classification is most commonly seen. **Conclusion:** Prone PCNL is an effective and safe procedure for morbidly obese patients.

Key words: Morbidly Obese PCNL, Prone PCNL Obesity, Renal Calculus Prevalence, Renal Calculus Composition.

INTRODUCTION

Obesity is the leading cause of morbidity and mortality with a prevalence of (53.1%) in European countries.[1] The risk factors for urolithiasis is related to the comorbidities associated with obesity such as hypertension, diabetes mellitus and hyperlipidemia.[2,3]

The prevalence of urolithiasis in Asia is 1%–19.1% while it is 16% in Pakistan.[4,5] Percutaneous nephrolithotomy (PCNL) is the first‐line treatment for renal calculi ≥2 cm.[6,7] Since obesity is already expected to become a global epidemic, an increased number of obese patients with complex nephrolithiasis in need of treatment are expected.[8]

In 2012, the CROES PCNL global study showed that PCNL may be done safely in obese patients but with a longer operation time, lower stone free rates and higher re-intervention rates.[9] In seventeen super obese patients, prone PCNL were performed by Keheila M. et al[10] and concluded that PCNL is safe and feasible in super obese.

Being a high volume referral tertiary care center, we have collected data of morbidly obese patients (BMI >35kg/m^2) in order to provide the first documented prone PCNL outcome study for patients stratified by basal metabolic index (BMI) in the region. The aim is to determine the safety and efficacy of prone PCNL in morbidly obese patients.

MATERIAL & METHODS

After getting approval from institutional review board (Uro-adm-Trg-1/IRB/2020/109) an observational study was conducted at Armed Forces Institute of Urology (AFIU), Rawalpindi

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where 47 morbidly obese patients undergoing PCNL in the prone position from February 2018 to February 2020 were reviewed prospectively.

Patients with BMI more than >35kg/m^2, all the adult (20-80 years) patients of either gender with renal calculi of >20 mm in size, American society of anesthesiologists [ASA] score 2–3, Any systemic co-morbid disease and no active urinary tract infection (assessed on urinalysis).

Exclusion criteria for this study included: congenital kidney anomalies, previous urological surgery (assessed on history), patients with recurrent stone, pregnancy (assessed on ultrasonography (USG)), pelvic kidney (assessed on USG), pelvi-ureteric junction obstruction (assessed on USG and Intravenous urography (IVU)), sepsis and bleeding disorders (INR >1.2).

Preoperative evaluation of the patients included age, gender, BMI, type and size of stone. Intraoperative and postoperative data contain no of tract dilated, operative time, duration of hospital stay, the need for the second procedure (either PCNL or ESWL), stone composition, stone-free status and intraoperative /postoperative complications (Clavien-Dindo classification). Operative time elapsed from the induction of anesthesia until extubation. Stone free rate was defined as no stone or clinically insignificant residual fragment of less than 4mm.

General anesthesia is preferred. Antibiotics with (cefaparazone and sulbactam) were given at the time of induction of anesthesia. During the procedure, the patient is initially placed in lithotomy position, draped and ureterorenoscope introduced in the patient's urethra. Ureteral orifice was identified and a 4fr open ended ureteral catheter is then advanced up the kidney. A 16Fr Foley catheter is secured alongside the 4Fr open ended catheter to keep the bladder compressed. A 60m/l leur lock syringe is filled with the contrast and connected to the open ended catheter.

A retrograde pyelogram is obtained and under C-arm fluoroscopy, the preferred calyx is selected and chiba needle (20cm) advanced into the tissues. Successful penetration is confirmed by return of urine. A sensor guide wire is advanced into the pelvi-calyceal system. A small nick is made in the skin and tract is dilated through 10F fascial dilator. An amplatz sheath (30 Fr) is pushed forward over the fascial dilator and guide wire into the determined calyx.

A rigid nephroscope (12 Fr) is introduced into the collecting system, calculus is identified and fragmented using a pneumatically driven EMS Swiss lithoclast. The fragments are removed using suction and irrigation. Stone free status is ensured through visual and fluoroscopic inspection. If a residual calculus is seen in the line of ureter, a 4.8 Fr 26 cm double J ureteral stent is placed.

All patients had postoperative X-Ray kidney, ureter and bladder (KUB) after 24 hours and computed tomography of kidney, ureter and bladder (CT KUB) scans at 3 months to determine stone-free rates. The data was analyzed by SPSS ver. 24. Age, BMI, stone size, intraoperative time and duration of hospital time have been expressed as mean±S.D while stone free status, re-intervention, stone composition, tract dilated and complications are expressed as frequencies. Results: After applying inclusion and exclusion criteria, data of all the 47 morbidly obese patients who underwent prone PCNL were analyzed. There were thirty-three males (70.2%) and fourteen females (29.8%) with a mean age of (46.43±10.41) years. The mean basal metabolic index (BMI) is (40.47±3.37 kg/m^2). The mean stone size was (2.93±0.49 cm). Single stone is seen in twelve patients (25.5%), multiple in sixteen (34.0%), partial staghorn in nine (19.1%) and complete staghorn calculus in ten (21.3%) patients.

The systemic diseases associated with morbid obesity are type 2 diabetes mellitus 5 (10.6%), hypertension 9 (19.1%), ischemic heart disease 7 (14.9%), osteoarthritis 5 (10.6%) and sleep apnea 5 (10.6%), gastroesophageal reflux disease 7 (14.9%), infertility 7 (14.9%) and depression 2 (4.3%). Intra-operative and post-operative characteristics and complications were given in

Table-I to III.

Characteristics	Mean ± SD	N, Percentage (%)
Operation Time (min)	83.38±13.20	
Duration of Hospital Stay (hours)	55.94±16.52	
Stone Free Status		34/47,(72.3%)
Re-intervention		13/47, (27.7%)
1. PCNL		4/47 (8.5%)
2. ESWL		9/47 (19.1%)
Stone Composition		47 PCNL
1. Calcium oxalate		20, (42.6%)
2. Calcium phosphate		12, (25.5%)
3. Uric Acid		10, (21.3%)
4. Struvite		5, (10.6%)
Dilated Tract		47 PCNL
Single tract		33, (70.2%)
More than one tract		14, (29.8%)

Table-I. Intra-operative and post-operative characteristics.

Complication	N (% total intraoperative complications)
Renal collecting system injury	3 (30%)
Violation of the pleural space	2 (20%)
Transfusion	5 (50%)
Colonic injury	0
Mortality	0

Table-II. Intra-operative complications.

Grade	N (% total postoperative complications)
1	2 (11.1%)
2	3 (16.7%)
3	13 (72.2%)
4	0
5	0

Table-III. Postoperative complications based on clavien-dindo classification.

DISCUSSION

One of the cause of global increase in the prevalence of urolithiasis is high BMI.[11] Urolithiasis is associated with obesity, diabetes, hyperuricemia, hyperlipidemia and hypertension.[12] Therefore, diet and lifestyle changes are advised for the prevention.[13] Shavit, et al.[14] reported the incidence of urolithiasis is higher in overweight and obese patients.

Matta I, et al.[15] and Falahatkar S, et al.[16] reported the increased incidence of urolithiasis in morbidly obese females as compared to males (57.14% vs 42.86%) and (52% vs 48%) respectively. While prevalence of urolithiasis is more in morbidly obese men (70.2% vs 29.8%) in our study and a study by Chen TF, et al.[17] The mean BMI was lower (34.47 kg/m^2) in a study by Falahatkar S, et al.[16] and higher (57.2kg/m^2) by Keheila M, et al.[10] as compared to our study (40.47kg/m^2).

The outcome of PCNL not only depends on the stone size but also on the stone complexity. A study by Alyami FA, et al.[18] estimated the mean stone size (2.4 ±0.39 cm) while we had encountered significantly large calculi with a mean stone size of (2.93±0.49 cm). Keheila M, et al.[10] managed the full staghorn in six patients and partial in four patients. A study by Matta I, et al.[15] operated the (35.7%) of the staghorn calculi, Chen TF, et al.[17] demonstrated (42%) of partial and (13%) of complete staghorn calculi while our study had partial staghorn in nine (19.1%) and complete staghorn calculus in ten (21.3%) patients. It shows the most pressing need for early diagnosis and immediate intervention in morbidly obese patients with renal calculi.

The most common systemic condition associated with morbid obesity and urolithiasis is hypertension in our study (19.1%) and Keheila M, et al.[10] reported it to be (70%). The mean operative time in our study is less (83.38±13.20 min). It was much higher (106 min) in a study by Keheila M, et al.[14] and (96.80±29.66 min) by Falahatkar S, et al.[16] Our mean operative time was consistent with supine PCNL (79.38±38.38 min) by Falahatkar S, et al.[16] It is potentially an advantage for morbidly obese patients due to lesser anesthesia time even in prone position.

The mean hospital stay in our study was (55.94±16.52 hours) and the study by Falahatkar S, et al.[16] (54.06 ± 14.34) hours in the prone versus (58.33 ± 13.80) hours in the supine position. Chen TF, et al.[17] reported it to be six

days. This is partially due to the fact that most of the patients in our hospital have the right to obtain free health care services. Therefore, special attention is given to quick postoperative recovery. This will guarantee the best possible treatment at a reasonably lower cost.

The stone clearance rate in our study was 72.3%. Chen TF, et al.[17] shows the 70% clearance while Falahatkar S, et al.[16] had 78% and 73.3% in the prone and the supine positions, respectively. Alyami FA, et al.[18] showed the stone clearance rate of 80% while Manohar T, et al.[19] showed it to be 95% due to simultaneous ureteroscopy and flexible nephroscopes to access inaccessible calices. Re-intervention in the form of PCNL in obese (BMI 30-39kg/m^2) is seen in 12.1% of the patients by Alyami FA, et al.[18] while none of the morbid obese had 2nd intervention in the form of PCNL. ESWL is performed in 34% of patients and 40% of the patients in obese and morbid obese respectively by Alyami FA, et al.[18] Our study showed a statistically better results in terms of ESWL (19.1%) but the rate of PCNL re-intervention is much higher (8.5%).

The stone composition in our study were calcium oxalate (42.6%), calcium phosphate (25.5%), uric acid (21.3%) and struvite (10.6%). A study by Almannie RM, et al.[20] estimated that most of the stones were calcium oxalate (61.3%), carbonate apatite (27.7%), and uric acid (7.3%) stones in 137 overweight patients. The results of tract dilatation in our study (single vs multiple) were consistent with a study by Keheila M, et al.[10]

The most common intraoperative complication was bleeding which was managed by transfusion. Renal collecting system injury was managed successfully by nephrostomy drainage for 5 days and DJ-stent placement for 4 weeks. The violation of the pleural space was managed by placing a chest drainage tube immediately at the end of operation. Postoperatively, two patients had Grade 1 Clavien-Dindo complication in our study. Three (6.4%) out of forty-seven patients had sepsis/ systemic inflammatory response syndrome which is managed conservatively with intravenous broad spectrum antibiotics. Re-intervention in the form of PCNL or ESWL is required in thirteen patients (27.7%). All the patients had complete stone clearance after re-intervention. Keheila M, et all.[10] Reported the re-intervention rate (26.6%). This study is retrospective and contains a small number of cases. While we had observed the safety and efficacy of prone PCNL prospectively with a significantly large cohort size.

A study by Chen TF, et al.[17] reported the fever (17%) while Manohar T, et al.[19] showed infection (18%) as the most prevalent complication. The former study is retrospective with lack of morbidly obese patients. The low intraoperative and postoperative complication rates in our study showed the prone PCNL in morbidly obese patients is safe and effective.

It was a single center study observed in prone position only. The comparison of the outcomes between different positions and centers has been limited. Despite these limitations, it is the largest single center study in region providing data for morbidly obese patients with renal calculus.

CONCLUSION

The present study showed that prone PCNL in morbidly obese patients is effective and safe. It will allow urologists to perform prone PCNL in morbidly obese patients.

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2	Muhammad Nawaz	Acquisition and analysis.	
3	Muhammad Usman Javed	Drafting the work.	
4	Khubaib Shahzad	Revising it critically for important intellectual content.	
5	Hussain Ahmad	Final approval of the version to be published.	
6	Zahoor Iqbal Mirza	Accountable for all aspects of the work related to the accuracy.	