ORIGINAL ARTICLE

EFFICACY AND SAFETY OF SUPINE PERCUTANEOUS NEPHROLITHOTOMY IN OBESE PATIENTS

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Background: Obesity is an increasing health concern, affecting 39% of the population. In Qatar, in recent years, the obese population contributed 35.9% of men and 46.1% of women. Qatar's obesity prevalence is higher in the region. The diet, rich in animal protein, high in oxalate, low in calcium, and the dry subtropical desert climate are risk factors for urolithiasis in Qatar. Objectives were the efficacy of percutaneous nephrolithotomy in obese patients. Patients and **Methods:** We retrospectively reviewed the patients who underwent PCNL between January 2015 and December 2019. A total of 150 patients were enrolled. The patients were categorized into two groups according to BMI: <30 kg/m2 (group 1, non-obese) and >30 kg/m2 (group 2, obese). The stone clearance rate, operation time, duration of hospital stays, Postoperative analgesic use, and postoperative complications were compared among groups. The chi-square test was used to analyze variables and Complications were graded according to the Clavien–Dindo classification system. **Results:** The BMI values of 110 patients were lower than 30 kg/m2, while 40 patients' BMI values were higher than 30 kg/m2. There was no significant difference between operation time, fluoroscopy time, number of access points, or access sites when the two groups were compared. No significant difference was found in the total length of hospital stay, haemoglobin drop, or complication rates. Immediate stone-free rates were 81.8% in the non-obese group and 75% in the obese group (p=0.21). **Conclusion:** In a retrospective study of 150 patients undergoing supine PCNL, the efficacy was not different between non-obese and obese patients. This is the first study evaluating these outcomes for PCNL performed under the ERAS protocol in the supine position. Further multicenter and prospective studies are required to verify these findings.

Keywords: Obesity; Percutaneous nephrolithotomy; Qatar

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INTRODUCTION

Obesity is an increasing health concern, affecting 39% of the population. In Qatar, in recent years, the obese population contributed 35.9% of men and 46.1% of women. Qatar's obesity prevalence is higher in the region. The diet, rich in animal protein, high in oxalate, low in calcium, and the dry subtropical desert climate are risk factors for urolithiasis in Qatar.[1] Obesity and weight gain also pose a high risk of urolithiasis.[2] Multiple modalities are available for kidney stones, including extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), and percutaneous nephrolithotomy (PCNL). However, obesity is a factor in the failure to fragment renal stones by extracorporeal shock wave lithotripsy. Percutaneous nephrolithotomy (PCNL) is the gold standard treatment for renal stones if the stone size is above 2 cm and has been universally endorsed by American, European, and other national guidelines.[3–5] The impact of body mass index (BMI) on the outcome of PCNL is still controversial. Recently, a study by the Endourological Society (CROES) reported that the PCNL had a lower stone-free rate and prolonged operative time in obese patients.[6]

Obesity has generally been considered a factor that affects the outcomes of PCNL procedures due to anaesthesia-related issues, imaging issues, and technical aspects of endoscopic surgery. Several studies have evaluated the impact of body mass index (BMI) on PCNL outcomes, but in most of these studies, PCNL has been performed in the prone position.[7] Enhanced recovery after surgery (ERAS) has been introduced in endourology to improve postoperative outcomes by reducing the length of stay (LOS). ERAS is also helpful in

reducing stress, morbidity, and recovery time.[8] A few studies have been published about the effect of BMI on the outcomes or complications of PCNL in the supine position. The purpose of the current study was to evaluate the impact of obesity on the outcomes of complete supine PCNL under the umbrella of the ERAS protocol in a single center. To the best of our knowledge, this is the first study on a specific topic.

MATERIAL AND METHODS

We retrospectively collected a database of all patients who underwent PCNL from January 2015 to December 2019 at our center. For this study, we selected only adult patients who underwent PCNL in the complete supine position. The patients were stratified into two groups. according to their BMI at the time of surgery: <30 kg/m2 (group 1, non-obese) and >30 kg/m2 (group 2, obese). Preoperative evaluation of the patients included age, sex, size of the stone, preoperative renal parameters, and stone history. The Intraoperative and postoperative data contained operation time, fluoroscopy time, transfusion rate (intra and until discharge), stone-free status, the need for the second procedure (either PCNL or ESWL), complications, analgesic use, and duration of hospital stay. The immediate success rate was defined as "no residual stone. "Complications were classified. according to the Clavien-modified system. Enhanced recovery after surgery (ERAS) protocol for a smooth recovery for the different surgical procedures includes (Cho module, Gabapentin 600 mg, Celecoxib 200 mg, Paracetamol 1gm, Dexamethasone 8mg, VTE prophylaxis, single-dose antibiotic) as preoperative. The surgical technique was similar in all cases. Patients were positioned in a supine position completely. Initially, cystoscopy was performed with a 6F open-ended ureteral catheter placed in the upper ureter or kidney. Subsequently, retrograde pyelography and puncture were performed under fluoroscopic or ultrasonic guidance. The 18-gauge needle was used for puncture. A hydrophilic guidewire was passed into the ureter. In the case of puncturing multiple tracts, first gird wires are placed, and then dilation is done. Tract dilation was accomplished with sequential fascial dilators, and a 30F Amplantz sheath was used to proceed. The stones were broken using an ultrasonic lithotripter. An 18F nephrostomy tube was placed at the end of the procedure in cases of moderate bleeding, residual stones, renal pelvis perforation, or multiple Otherwise, a Double-J stent was placed and left indwelling for 5–14 days with or without string, according to procedure. Operation time was recorded from the beginning of flexible cystoscopy to the end of nephrostomy tube placement or stent placement. Some PCNL procedures are tubeless based on the urologist's decision. A postoperative plain abdomen X-ray would be done to confirm stone clearance and the position of the nephrostomy. If the patient had no fever within 24 hours after the operation, the Foley catheter would be removed and the nephrostomy would be clamped. The time of nephrostomy removal depended on the clinical condition and the judgment of the doctor. Statistical analysis was carried out in the form of mean and standard deviation. Student t-tests were performed to see significant mean levels between the two groups and Chi-square tests were applied to see the association between the two groups. A *p*-value of 0.05 was considered a significant level. SPSS 20.0 statistical package was used. for the analysis.

RESULTS

The study included 109 male patients (72%) and 41 females. Patients (28%) with a mean age of 49±12.9 years (Range: 22–72 years) As for the distribution of stone characters. The proportions were 32%, 48%, and 18% in the ureteropelvic junction or stone in one calyx, partial staghorn stone, and complete staghorn stone, respectively. Right-side renal stones accounted for 40%, and the left side for 60%. The mean stone size was 22.6±8.3 mm. The mean BMI was 26.41±3.53 kg/m2. in the non-obese group and 35.4±3.8 in the obese group. Among the two groups, in terms of age, there were no significant differences observed, in gender, stone character, laterality, stone size, history of diabetes mellitus or chronic kidney disease, and preoperative pyuria. Among Group 1 patients, 65 (59.1%) had simple stones. while 45 (40.8%) had complex stones. In group 2, 28 (70%) had simple stones, and 12 (30%) had complex stones. There was no statistically significant difference observed between the two groups in terms of the complexity of the stones. The mean duration time of operation was 105±36.4 minutes in the non-obese group and 109±42.4 minutes in the obese group. The mean duration of operation was not statistically significantly different between the two groups. The mean duration of fluoroscopy was 5.4±3.6 minutes in Group 1 patients and 5.8.4±4.9 minutes in Group 2. patients, displaying no statistically significant difference between the two groups (p=0.54). In the non-obese group, 96 patients had one, 13 had two, and one had three accesses. In the obese group, however, 32 patients had one, 7 had two, and 01 had three accesses. There were no significant differences observed in terms of the number of accesses (p=0.510). Due to intraoperative haemorrhage resulting in hypotension, a blood transfusion was

given to two patients (1.81%) in group 1 and one patient (2.5%) in group 2. There were no significant differences observed in intraoperative blood transfusion (p=0.79). Except for haemorrhage, no other intraoperative complication was observed in the patients. Fever (>38 °C) was determined before discharge in 13 patients in the non-obese group and 5 patients in the obese group, and they were appropriately treated before being discharged from the hospital. No significant difference was observed in terms of postoperative fever between the groups (p=0.91). None of the Patients developed sepsis or died from operation-related complications. When the groups were evaluated in terms of operation success, postoperative residual stone fragments were observed in 18 patients (16.36%) in group 1 and 5 patients (12.5%) in group 2. There was no significant difference. in operative performance between the groups (p=0.21). The Groups were also evaluated for additional interventions. Eleven Patients in the non-obese group required additional interventions post-discharge. Double Stents (DJS) were inserted in three patients due to wound sites: discharge or severe colic pain. Ureteroscopy (URS) was performed on three patients for treatment of the ureteral stones and five patients with ESWL. In Group 2, however, a total of 4 Patients required additional interventions—three patients with ESWL. One patient underwent URS due to a ureteral stone. The requirement for additional intervention was considered a Clavien grade 3 complication, and there was no significant difference between the two groups (p=0.922).

Table-1: Demographic and Stone Characteristics

	Non-obese	**Obese**	***p*-values**
No. of Patients	110	40	
Gender:			
Male	85 (77.2%)	24 (60%)	0.06
Female	25 (2.72%)	16 (40%)	
Age			
Stone Side:			
Right	66 (60%)	24 (60%)	1
Left	44 (40%)	16 (40%)	
Stone nature:			
De novo	90 (81.81%)	30 (75%)	0.49
Recurrent	20 (18.18%)	10 (25%)	
Stone site:			
Upper calyx only	07 (6.36%)	03 (7.5%)	0.8
Middle calyx only	07 (6.36%)	11 (27.5%)	0.001
Lower calyx only	18 (16.3%)	06 (15%)	0.84
Pelvis only	40 (36.36%)	08 (20%)	0.09
Multiple renal	38 (34.54%)	12 (30%)	0.79
Hydronephrosis:			
Mild	20 (18.18%)	10 (25%)	0.49
Moderate, Severe	30 (27.27%)	08 (20%)	0.48
Essence:			
Non-opaque	08 (72.72%)	04 (10%)	0.83
Opaque	102 (92.72%)	36 (90%)	0.74
Comorbidities:			
HTN	09 (8.18%)	05 (12.5%)	0.63
DM	07 (6.36%)	02 (5%)	0.76
CKD	02 (1.81%)	01 (2.5%)	0.79
Coronary artery disease	03 (2.72%)	02 (05%)	0.86
Bronchial asthma	04 (3.63%)	01 (2.5%)	1
Hepatic impairment	02 (1.81%)	01 (2.5%)	1
Neurologic disease	01 (0.90%)	01 (2.5%)	0.46
Peptic ulcer	02 (1.81%0	01 (2.5%)	1
Medication:			
Anticoagulants	12 (10.90%)	03 (7.5%)	
Prednisone	02 (1.81%)	01 (2.5%)	
ASA Score:			
1	20 (18.18%)	10 (25%)	0.024
2	60 (54.54%)	10 (25%)	
3	30 (27.27%)	20 (50%)	
Previous ESWL history	20 (18.18%)	05 (12.5%)	0.56
Previous PCNL history	13 (11.81%)	02 (55%)	0.36
Previous open surgery history	03 (2.72%)	01 (2.5%)	1

Table-2: Intraoperative data and results of supine PCNL

	Non-obese	Obese	*p*-values
No. of Patients	110	40	
Operative time	105±36.4	109±42.6	0.57
The number of accesses:			
1	96 (87.27%)	32 (80%0	0.51
2	13 (11.81%)	07 (6.36%)	
3	01 (.90%)	01 (.90%)	0.48
Achieved access:			
Urologist	110	40	
Radiologist	00	00	
Postoperative:			
Stent	110	40	0.91
Nephrostomy	06 (5.45%)	02 (1.81%)	0.91
Complications:			
Failed access	02 (1.81%)	01 (.90%)	0.79
Perforation renal pelvis	06 (5.45%)	02 (1.81%)	0.91
Hydrothorax	00	00	
Blood Loss:			
Reported Bleeding	10 (9.09%)	03 (2.72%)	0.75
Transfusion	02 (1.81%)	01 (.90%)	0.79
Fate of residual stones:			
ESWL	09 (8.81%)	03 (2.72%)	0.89
2^{ND} Look	02 (1.81%)	01 (.90%)	0.79
Fluoroscopy time (minute)	14.5±8.7	13.5±9.2	01
Nephrostomy time (hour)	44.8±53.6	48.7±52.6	01
Tubeless	56 (50.90%)	18 (45%)	0.64
Immediate success	94 (85.45%0	30 (75%)	0.21
Hospital stay (hours)	60.2±98.5	53.6±37.2	0.68

Table-3: Complications of supine PCNL

	Non-obese	Obese	*p*-values
No. of Patients	110	40	
Postoperative transfusion	02 (1.81%)	01 (2.5%)	0.79
Postoperative fever	07 (6.36%%)	02 (5%)	0.91
Anaemia	13 (11.81%)	03 (7.5%)	0.64
Leakage < 24 h	05 (5.45%)	01 (2.5%)	0.94
persistent leakage > 24 h	02 (1.81%)	01 (2.5%)	0.77
Colonic injury	00	00	
Postoperative DJ insertion	110	40	
Re-treatment:			
Ureteroscopy	10 (9.09%)	03 (7.5%)	0.76
PCNL	02 (1.81%)	01 (2.5%)	0.79
SWL	10 (9.09%)	03 (7.5%)	0.76
Other	01 (.90%)	01 (2.5%)	0.77
Complications within 30 days			
Clavien category:			
Minor (I + II)	20 (18.81%)	04 (10%)	0.34
Major (III + V)	05 (4.54%)	01 (2.5%)	0.92

DISCUSSION

Obesity has affected the population of both developed and developing countries through reduced physical activity and increased calorie intake. Particularly high-income countries have displayed higher rates of increase in obesity in the last two decades.[9] The incidence of health problems such as metabolic syndrome, cardiovascular disease, malignancy, and renal calculus also increased in the community with the increased prevalence of obesity.[10] PCNL remains the gold standard for patients with large renal stones. A few studies reported the impact of obesity on PCNL in the prone position. Studies have shown that prone PCNL in normal-weight, obese, and super-obese individuals have similar outcomes.[11,12] The CROES Percutaneous Nephrolithotomy Global Study reported a longer operation time, an inferior stone-free rate, and a higher reintervention rate in obese patients than in nonobese patients. Standard-prone positioning affects the airway in overweight patients and may also impair venous blood flow.[13] Over the last two decades, the supine position for PCNL has gained acceptance and popularity as an alternative to the standard historical prone position.[14] The main benefit of the supine PCNL is that it can be carried to protect the airway. Supine PCNL offers a safe way for patients with compromised cardiorespiratory function

and morbidly obese patients to breathe.[15] Different studies have shown the supine PCNL safety and effectiveness.[14]

There are a few studies comparing supine and prone PCNL in obese patients. In another study, outcomes of prone and total supine position PCNL in 42 obese patients showed results of stone-free (83.3% vs. 78.1%; *p*=0.74) and complication rates (33.3% vs. 31.3%; *p*=0.77), but significantly shorter operative time, lower transfusion rates, and a shorter hospital stay (*p*=0.014) in the supine position group than in the prone position group.[16] However, anaesthesia-related problems can be seen in obese patients. Respiratory complications like a decrease in total lung capacity may occur in the prone position, and extubation difficulties may also occur in obese patients.[17] In some centres, to minimize the complications of PCNL, it is carried out in a supine position.[16] ERAS Enhanced recovery after surgery is a protocol for a smooth recovery for the different surgical procedures it includes (Cho module, Gabapentin 600 mg, Celecoxib 200 mg, Paracetamol 1gm, Dexamethasone 8mg, VTE prophylaxis, single-dose antibiotic).

Our study had some limitations. It was retrospective and might be biased by management strategies and patient allocation in the absence of stone analysis results. Furthermore, the surgeons who performed supine PCNL were not the same ones and might be biased by the surgeon's experience. However, to the best of our knowledge, this is the first study in Qatar. We also extended the outcome with the ERAS protocol, which has not been reported in previous studies.

CONCLUSION

Our study has demonstrated that the efficacy and safety of the supine PCNL procedure were similar in obese and nonobese groups. Supine PCNL under the cover of the ERAS Protocol seems to be a safe and efficacious option for obese patients with renal stones.

Conflicts of interest: This study has no conflict of interest to be declared by any author.

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AUTHORS' CONTRIBUTION

KHB: Acquisition, drafting work, and agreement to be accountable for all aspects of work. AAC, AAS, HMA, AHS, WSB, and FSG: Conception and design of the work. SA, AMS, NS, KMA, Analysis, and data interpretation. SA, AMS, NS, and KMA, were critically revised for important intellectual content. SA, AMS, NS, KMA, Final approval of the version to be published.

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