Supine percutaneous nephrolitotripsy in septuagenarian and octogenarian patients: outcomes of a case-control study

Fábio C. M. Torricelli, MD, Guilherme K. M. Ogawa, MD, Fábio C. Vicentini, MD, Giovanni S. Marchini, MD, Alexandre Danilovic, MD, Miguel Srougi, MD, William C. Nahas, MD, Eduardo Mazzucchi, MD

Division of Urology, Department of Surgery, University of São Paulo Medical School, São Paulo, Brazil

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Introduction: *Currently, there is a paucity of data evaluating the outcomes of supine percutaneous nephrolithotomy (PCNL) in septuagenarian and octogenarian patients. In this study we aim to compare the outcomes of supine PCNL in elderly patients with those of younger population.*

Material and methods: *A matched case-control study was performed from January 2009 through December 2015 using our prospectively collected kidney stone database. Case group was composed of patients with age greater than 70 years. Control group included patients with less than 70 years old. Patients were randomly matched based on Guy's Stone Score as a surrogate of case complexity.*

Results: *Fifty-four patients were enrolled in this study, 18 cases and 36 controls. There were no significant differences in gender and body mass index between groups. There were significantly more ASA 3 patients in septuagenarian and octogenarian patients (p = 0.012). Mean Charlson comorbidity index was significantly higher in septuagenarian and octogenarian patients (p = 0.041). Regarding PCNL technique, there were no differences in number of accesses, number of supra-costal accesses, and operative time. There was no significant difference in stone-free rate, nephrostomy tube time, complication rate, mean decrease in hemoglobin level, and need of blood transfusion. Hospital stay time (days) was longer in case group (4.0 ± 1.7 versus 2.4 ± 1.1 days; p = 0.002).*

Conclusion: *Septuagenarian and octogenarian patients have similar complication and stone-free rates compared to younger patients, although they demand a longer length of hospital stay.*

Key Words: aged, kidney calculi, supine position, urolithiasis

Introduction

Percutaneous nephrolithotomy (PCNL) has been proved to be the most efficient procedure to treat kidney stones bigger than 2.0 cm.[1,2] Although it is classically performed in prone position, in the last decades, supine PCNL has been shown to be equally effective in some group of patients, while it may be more desirable from the anesthesiologists' perspective.[3]

Data from the Clinical Research Office of the Endourological Society (CROES) Global PCNL Study have shown a higher rate of complications from PCNL in elderly patients (> 70 years old) when compared to younger subjects, such as bleeding and collecting system perforation.[4] A higher rate of infectious complications has also been reported in the elderly population submitted to PCNL.[5] Lastly, a longer length of hospital stay has been associated with an older age.[6] All these findings are based on studies where the majority of PCNL were performed in prone position.

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Address correspondence to Dr. Fábio César Miranda Torricelli, Av. Vereador José Diniz, 3300, conj. 208 , São Paulo (SP) — CEP 04604-006

Currently, there is a paucity of data evaluating the outcomes of supine PCNL in septuagenarian and octogenarian patients. We hypothesized that maybe the supine position may be more suitable for elderly people, as patients remain in a single position during whole procedure and are less prone to anesthesiologic undesirable events.

The purpose of this study was to evaluate and compare supine PCNL stone-free and complication rates in this particular group of patients with outcomes of supine PCNL in younger subjects with same stone complexity.

Materials and methods

Study design

After Institutional Review Board approval, a retrospective case-control study was conducted from January 2009 through December 2015, using our institutional prospectively collected kidney stone database. All septuagenarian and octogenarian patients who underwent supine PCNL were included in the case group. Two controls with age with < 70 years old submitted to supine PCNL in the same frame of time were randomly selected for each elderly patient. The matching process was blinded for postoperative outcomes. Patients were matched based on Guy's stone score, as a surrogate of case complexity, based on preoperative computed tomography (CT) scan. Guy´s score classifies stone disease according to its complexity and works as an independent predictive factor for complications and stone-free rate.[7,8] Patients younger < 18 years, patients with pelvic kidneys, horseshoe kidney, duplex collecting system or urinary diversion were not included in this study.

Groups were compared for their demographic data, American Society of Anesthesiologists (ASA) score, Charlson comorbidity index, PCNL laterality, number of accesses, necessity of supra-costal punctures, mean operative time, drop in hemoglobin level, need for transfusion, mean time with nephrostomy tube, length of hospital stay, stone-free rate, and complication rates according to the Clavien Score. Success rate was defined as absence of fragments bigger than 4 mm in the CT scan performed on the first postoperative day.

Surgical procedure

Following our Institutional protocol, all patients with negative urine culture received Ceftriaxone 2 g at anesthetic induction before PCNL, whereas patients with positive urine culture were treated during one week before surgery based on pathogen susceptibility.

PCNL was performed under general anesthesia. Patients were placed in lithotomy position or complete dorsal decubitus according surgeon´s preference. A 6Fr ureteral catheter was placed under direct view using cystoscopy and retrograde pyelography was performed. The selected calix was punctured under fluoroscopy guidance. A hydrophilic guidewire was inserted and passed into the ureter. If this guidewire did not reach the ureter, a PTFE guidewire was used to replace it. The tract was dilated with fascial dilators and then a 30F Amplatz sheath was placed. Ultrasonic/ballistic lithotripter was used for stone fragmentation and suction (Swiss LithoClast Master; EMD, Dallas, TX, USA). An 18F nephrostomy tube was placed at the end of the procedure in most of cases. The ureteral catheter was maintained for 12 hours or a double-J stent was left in place at surgeon discretion. Operative time was considered from the beginning of cystoscopy for ureteral catheter placement until the end of nephrostomy tube placement. A CT scan and laboratory examinations were done on the first postoperative day in all cases according to our institutional protocol.

Statistical analysis

Categorical variables were compared using chi-square and Fisher exact tests, whereas continuous variables were compared using Student's t test for independent groups. All statistical analyses were performed using SPSS version 20.0 (SPSS, Inc., Chicago, IL, USA). Significance level was set at $p < 0.05$.

Results

Fifty-four patients were included in this study, 18 cases and 36 controls. Mean age was 73.9 ± 3.6 years and 44.5 ± 11.8 years in case and control group, respectively ($p < 0.001$). There was no significant difference in gender, body mass index, or stone laterality between groups. There were significantly more ASA 3 patients in septuagenarian and octogenarian patients ($p = 0.012$), although overall ASA score revealed only a tendency of more comorbidities in case groups ($p = 0.07$). Mean Charlson comorbidity index was significantly higher in septuagenarian and octogenarian patients ($p = 0.041$). Table 1 summarizes the demographic data.

With regards to perioperative data, there were no significantly differences in mean operative time, number of accesses, and number of supracostal accesses between groups. There were no significantly differences in pre and postoperative hemoglobin levels, hemoglobin level drop, blood transfusion rate, or nephrostomy tube time between groups. Length of hospital stay was longer in case group (4.0 ± 1.7 versus 2.4 ± 1.1 days; $p = 0.002$). Stone-free rate was also not significantly different between groups (83.3% case

TABLE 1. **Demographic data**

	Cases (n = 18)	Controls (n = 36)	p value
Age (years)	73.9 ± 3.6	44.5 ± 11.8	< 0.001
Gender (male)	50.00%	27.80%	0.096
Body mass index (kg/m^2)	27.6 ± 4.3	28.1 ± 8.2	0.760
Mean Charlson index (range)	1.05 (0-6)	0.13 (0-1)	0.041
ASA score			0.070
ASA 1	22.2%	55.6%	
ASA 2	50.0%	41.7%	
ASA 3	27.8%	2.8%	
Side (right)	64.70%	68.60%	0.888
Guy's Stone score			1.000
Guys 1	33.3%	33.3%	
Guys 2	27.8%	27.8%	
Guys 3	25.0%	25.0%	
Guys 4	13.9%	13.9%	

ASA = American Society of Anesthesiologists

group versus 75.0% control group; p = 0.487). Table 2 shows perioperative parameters.

Overall complication rate was similar in both groups, 16.7%. In case group, there was one Clavien 1 complication, one Clavien 2, and one Clavien 3 b. Only one complication in the elderly group required invasive intervention after a collecting system perforation and consequent urinary fistula. A double-J stent was successfully placed under general anesthesia to treat the urinary extravasation. In the control group, there were two Clavien 1 complications, three Clavien 2, and one Clavien 3a. Also, one complication required an invasive procedure. One patient presented with dyspnea and thoracic pain few hours after PCNL. Chest radiography revealed a pleural effusion and a thoracic drainage was placed to successfully treat a hemothorax. Table 3 shows all complications and how they were managed.

TABLE 2. **Perioperative data**

	Cases (n = 18)	Controls (n = 36)	p value
Number of accesses (%)			0.095
One	94.4	69.4	
Two	5.6	13.9	
Three	0	16.7	
Supracostal accesses (%)	11.1	27.8	0.165
Mean operative time (min)	136.5 ± 48.9	127.4 ± 52.6	0.541
Complications	16.70%	16.70%	1.000
Mean preop hemoglobin (mg/dL)	13.6 ± 1.3	13.4 ± 1.5	0.749
Mean postop hemoglobin (mg/dL)	11.2 ± 1.7	11.2 ± 2.1	0.902
Mean drop of hemoglobin (mg/dL)	2.4 ± 1.4	2.2 ± 1.6	0.686
Blood transfusion (%)	5.6	8.3	0.713
Mean time w/nephrostomy tube (days)	2.2 ± 2.6	1.7 ± 3.4	0.518
Mean length of hospital stay (days)	4.0 ± 1.7	2.4 ± 1.1	0.002
Stone-free rate (%)	83.3	75	0.487

TABLE 3. **Postoperative complications**

	Cases (n = 18)		**Controls (n = 36)**	
Clavien 1	1 (transitory acute renal insufficiency)	Crystalloids	2 (transitory arterial hypotension)	Crystalloids
Clavien 2	1 bleeding	Transfusion	3 bleeding	Transfusion
Clavien 3	1 collecting system perforation	Double J placement	1 hemothorax	Thoracic drainage
Clavien 4	0	-	0	-
Clavien 5	0	-	0	-
Overall	3 (16.7%)	-	6 (16.7%)	-

Discussion

Our study shows that supine PCNL in septuagenarian and octogenarian patients may have similar complication rate when compared to supine PCNL in younger patients. Although elderly people have more comorbidities, it has only impacted on length of hospital stay. There was no difference in the stone-free rate between the groups. Careful preoperative evaluation, experienced endourologists and multi-professional postoperative care team, including specialized nurses, clinicians and urologists may be the key for reaching such outcomes. Preoperative evaluation in our institution includes a systematic routine in elderly, including urine and blood exams, electrocardiogram, Doppler echocardiography, thoracic radiography, regular visit to clinicians, and an anesthesiologist preoperative evaluation prior any surgery.

Kamphuis et al reviewing the data of 25 studies from the CROES Global PCNL Study reported that special populations such as obese and elderly are at higher risk of postoperative complications and longer hospital stay. Authors concluded that age over than 70 years is an independent risk factor for complications.[9] Okeke et al have reported a significantly higher rate of all degrees of postoperative complications in elderly people, including Clavien 1 (10% versus 4.1%), Clavien 2 (4.8% versus 2.5%), Clavien 3 (3.1% versus 0) and Clavien 4 (1.8% versus 0). Collecting system perforation (4.6%) and bleeding (8.0%) were the most common significant complications in patients older than 70.[4] Our study is not in agreement with these findings, as postoperative complication rate was similar between elderly and young patients. In contrast to previous studies that analyzed data from PCNL in prone position, our results came exclusively from PCNL in supine position.

Septuagenarian and octogenarian patients, as expected, have more comorbidities than younger subjects. In our study, ASA score and Charlson comorbidity index were significantly higher in elderly patient, which is accordance with previous reports.[4-6,9] Probably that is the main reason for a longer length of hospital stay of elderly patients compared to younger people, as those patients many times require special attention for blood pressure control, glycemic regulation, and others comorbidities compensations. Furthermore, in a few number of cases, immediate postoperative care in intensive care unit is mandatory, resulting in one or two more days of hospitalization.

Few studies have reported the outcomes of supine PCNL in elderly patients. Currently, most of data is from sub-analysis of studies designed for other purposes. Okeke et al when comparing the outcomes of PCNL in elderly with those from young patients reported approximately 20% of supine PCNL in each group. However no further analysis was made based on patient's position.[4] To the best of our knowledge, we present the first study comparing data from patients who underwent exclusively supine PCNL evaluating the impact of age on surgical outcomes. Although, prone PCNL is still performed in almost 80% of patients,[9] supine position has been associated with potential benefits, such as less operative time, the possibility of performing a simultaneous retrograde approach, and more comfort to the surgeon during the procedure.[10-12] From the anesthesiologists point-of-view, the supine position is associated with an easier management of the airways. Furthermore, it has a lower risk of injuries in pressure dependent areas, as well as a reduced chance of ocular damage.[3,13] We speculate that supine positioning may have contributed to the similar postoperative complication rate between elderly and young patients.

With regards to stone-free rate, there was no difference between groups. Supine PCNL provided

similar success rate in elderly and young patients. Regardless patient's age or patient's position, PCNL has proved to able of providing high stone-free rates.[6,9,14]

Our study has some limitations such as its retrospective design and the relative small number of patients. However, a standardized method of data collection and a matched case-control population were performed to minimize such limitations. There was a tendency of multiple accesses and more supracostal accesses in control group when compared to case group. As these variables can be related to a higher complication rate, they could act as confounding factors. However looking at our data there were no complications or blood transfusion in patients with more than one access. All three blood transfusions in control group were in patients with single access. In addition, only two of 10 patients with supracostal access had an undesirable event (one bleeding with blood transfusion and one transitory arterial hypotension). Randomization process including Guys stone score, number of access and supracostal access probably would not affect our results. Furthermore, our data is collected from a large-volume service in PCNL (more than 150 PCNL per year), which minimize bias due to inexperienced surgeons.

Conclusion

Supine PCNL in septuagenarian and octogenarian patients presents similar stone-free and complication rates when compared to supine PCNL in younger patients. A longer hospital stay is expected in elderly patients who underwent to supine PNL probably due to their higher prevalence of comorbidities. □

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