

# Outcomes of percutaneous nephrolithotomy in elderly versus young patients under regional anesthesia: A comparative study

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## Abstract

**Introduction:** Surgical management of elderly patients with renal calculi is inherently challenging. We compared the efficacy and safety of percutaneous nephrolithotomy (PCNL) performed under regional anesthesia between elderly patients (age >65 years) and patients aged <65 years.

**Materials and Methods:** Between July 2015 and June 2016, fifty patients aged >65 years with renal stones (size >1.5 cm) were treated with PCNL under regional anesthesia (elderly group). We retrospectively compared the outcomes with those obtained in an equal number of patients aged <65 years (younger group) who underwent PCNL under regional anesthesia. Patients with staghorn stones and pyonephrosis and falling under the American Society of Anesthesiologists (ASA) Grade IV were excluded. Data pertaining to demographic characteristics, body mass index, stone bulk, operative time, tract size, number of tracts required, blood loss, clearance rates, complications, and length of hospital stay were analyzed.

**Results:** The mean age at presentation in the elderly and younger groups was  $66.8 \pm 2.1$  years and  $38.7 \pm 11$  years, respectively; 56% of the patients in the elderly age group had ASA Grade II, whereas 58% in the younger age group had ASA Grade I. The mean stone size and the number of tracts were comparable in both the groups, whereas operative time was slightly longer in the elderly group ( $58.54 \pm 18$  vs.  $51.98 \pm 18$  min;  $P < 0.05$ ). Postoperative complications and stone-free rates (94% vs. 92%, respectively) were comparable in the two groups.

**Conclusions:** Age itself should not deter the treatment of elderly patients with renal stones as PCNL under regional anesthesia is safe and effective in elderly patients; outcomes in elderly and younger patients were comparable in this study.

**Keywords:** Elderly patients, percutaneous nephrolithotomy, regional anesthesia

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## INTRODUCTION

Open surgery for kidney stones has been virtually replaced by percutaneous nephrolithotomy (PCNL) owing to the progressive improvement in the technique ever since

the first PCNL was performed in 1976.<sup>[1]</sup> Despite the technological advances and the advantages of PCNL over open surgery, the complication rates for this procedure still remain high.<sup>[2]</sup>

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With the longer life expectancy, the number of elderly patients with urinary stone disease is increasing. According to the statistics released by the Union Ministry of Health and Family Welfare, India, the life expectancy for males and females in the period of 2011–2015 was 67.3 years and 69.6 years, respectively.

PCNL in elderly patients is challenging owing to the age-related decline in function of all organ systems and an overall decrease in the physiological reserve.<sup>[3]</sup> Moreover, age plays an important role in perioperative and postoperative morbidity and renders the procedure complex in these patients. Elderly patients are less tolerant toward bleeding and septic complications owing to their overall poor organ reserve and the associated comorbidities.<sup>[4,5]</sup>

In the contemporary literature pertaining to PCNL in elderly patients, the majority of the procedures were performed under general anesthesia. In this study, we compared the efficacy and safety of PCNL performed under regional anesthesia between elderly patients (age  $\geq 65$  years) and patients aged  $< 65$  years.

## MATERIALS AND METHODS

### Patients

This was a retrospective comparative study of outcomes of PCNL performed under regional anesthesia between July 2015 and June 2016 at a single center. We compared the outcomes between patients aged  $> 65$  years ( $n = 50$ ) and those aged  $< 65$  years ( $n = 50$ ). The inclusion criterion was patients with renal stones sized  $> 1.5$  cm who were treated with PCNL under regional anesthesia. All data were anonymized before the analysis to protect patient privacy.

Exclusion criteria included patients with staghorn stones and pyonephrosis requiring preoperative diversion (percutaneous diversion).

### Procedure

After complete preoperative evaluation and clearance, the patients were subjected to PCNL under regional anesthesia. Negative urine culture was documented in all the patients before the procedure. All procedures were performed by a single surgeon. The PCNL technique and postoperative protocol are described below.

The procedure started with the patient in the lithotomy position, and rigid cystoscopy was performed to place a ureteral catheter. Percutaneous access was achieved under fluoroscopic guidance using an 18-gauge needle in prone position and guidewire (0.035 inch) placed. Tract dilation was accomplished using serial metal dilators (Karl Storz), and a

24 or 26 Fr Amplatz (Cook) was placed depending on the dilatation of the pelvicalyceal system and the stone bulk. We use a 22 Fr wolf nephroscope for all patients. Fragmentation was accomplished in all patients using pneumatic energy. After retrieval of all the fragments, stone clearance was ascertained under fluoroscopy. Double J stent was retained if required; however, a nephrostomy tube of appropriate size (2 Fr smaller than the Amplatz size) was placed in all patients and fixed. The nephrostomy tube was removed after 48 h.

Postoperatively, Kidney Ureter Bladder (KUB) and hemoglobin were performed 48 h post procedure to confirm clearance and to estimate the blood loss. The nephrostomy was removed after 48 h, followed by the catheter. Patients with a stent were asked to come back after 4 weeks for stent removal.

Follow-up was performed up to 1 year after the procedure. The first follow-up was at 1 month and then at 3 monthly intervals up to 1 year. At each visit, urine routine examination and ultrasound of the KUB region were performed. Serum creatinine level was measured in patients with compromised renal function only.

Data pertaining to the following variables were collected and analyzed: demographic profile, body mass index (BMI), American Society of Anesthesiologists (ASA) grade, stone bulk, operative time (in minutes), tract size, number of tracts required, intraoperative blood loss, transfusion, clearance rates, surgical complications (intraoperative, perioperative, and postoperative periods were recorded as per the Clavien-Dindo grading system), and length of hospital stay.

Statistical analysis was performed using SPSS version 15 for windows. Data are presented as frequency (%) or mean  $\pm$  standard deviation. Between-group differences were assessed using the Chi-squared test or Student's *t*-test as appropriate.  $P < 0.05$  was considered indicative of a statistically significant between-group difference.

## RESULTS

A total of 144 PCNL procedures were performed during the study reference period. Of these, 41 patients underwent PCNL under general anesthesia. General anesthesia was used in patients in whom regional anesthesia was contraindicated (increased intracranial pressure or neurological disorders), patients with ASA Grade 4, and those who opted for general anesthesia for personal reasons. Of the 103 patients who underwent PCNL under regional anesthesia, one patient with staghorn calculus and two patients with pyonephrosis requiring preoperative

diversion were excluded from this study owing to the complexity of the procedures. All three excluded patients were in the young age group.

The demographic parameters are summarized in Table 1. Patients in both the groups had comparable BMI. The mean age of patients in the elderly and younger groups was  $66.8 \pm 2.1$  years and  $38.7 \pm 11$  years, respectively. Hypertension was the most common comorbid condition in both the groups (42% and 30%, respectively), followed by diabetes and chronic obstructive pulmonary disease (COPD).

ASA grade in the elderly group was higher than that in the younger group. A majority of the patients in the elderly group (56%) had ASA Grade II, whereas a majority of the patients in the younger group (58%) had ASA Grade I. The comorbid conditions and ASA grade in the two groups are summarized in Table 2.

All procedures in this study were performed under regional anesthesia.

The average stone size, number of tracts, tract size, blood loss, and clearance rates were comparable in the two groups [Table 3]. The average length of hospital stay in the elderly group was longer than that in the younger group. The postprocedure drop in hemoglobin level in the older group was 1.6 gm% as against 2 gm% in the younger group. The transfusion rate in the elderly group was 8% as against 12% in the younger group.

**Table 1: Baseline characteristics of the study population**

Parameter	Elderly (n=50)	Young (n=50)
Age (years)	66.8±2.1	38.7±11
Sex (male/female)	29/21	40/10
Side (right/left)	24/26	32/18
BMI (kg/m <sup>2</sup> )	24.1±3	23.6±2.5

Data presented as mean±SD or frequencies. BMI: Body mass index, SD: Standard deviation

**Table 2: Comparison of comorbidities in the two study groups**

	Elderly (n=50)	Young (n=50)	P
Comorbidities			
Diabetes mellitus	11	3	$\chi^2=5.316$ , df=1, $P=0.0211$
Hypertension	21	15	$\chi^2=1.563$ , df=1, $P=0.2113$
Coronary artery disease	1		NS
COPD	10	4	$\chi^2=2.990$ , df=1, $P=0.0838$
CKD	2	2	$\chi^2=84.640$ , df=1, $P<0.0001$
ASA			
ASA I	10	29	$\chi^2=15.174$ , df=1, $P<0.0001$
ASA II	28	17	$\chi^2=4.889$ , df=1, $P=0.0270$
ASA III	12	4	$\chi^2=4.762$ , df=1, $P=0.0291$

All P values are two-tailed. df: Degrees of freedom, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, ASA: American society of anesthesiologist, NS: Not significant

In the postoperative period, more patients in the elderly group had a fever as compared to that in the younger group (12% vs. 6%, respectively). None of the patients in our study sustained injury to adjoining organs or required angioembolization.

## DISCUSSION

With advancing age, more patients with kidney stones present for treatment. Initially, owing to the risks associated with open surgery, there was always a dilemma whether to treat them or not. However, advances in endourology have changed the perspective. General anesthesia is considered safer than regional anesthesia for procedures such as PCNL. However, at our institution, anesthesiologists are not very comfortable in administering general anesthesia to elderly patients. This prompted us to perform this procedure under regional anesthesia. To our surprise, we observed that regional anesthesia works equally well with the added advantage of ease of positioning. In addition, the prolonged effect of regional anesthesia ensures a good analgesic effect in the immediate postoperative period. Therefore, we currently perform all PCNL procedures under regional anesthesia in the absence of any contraindications. The outcomes were comparable with those achieved with the use of general anesthesia. For patients in whom prolonged procedure is anticipated, we use clonidine with bupivacaine.

The United Nations recommends 60 years as the cutoff age for “elderly” population; however, most developed countries consider 65 years as the criteria for elderly population.<sup>[6]</sup> We believe that it is the physiological age rather than the chronological age that impacts the outcomes in this category of patients.

The estimated prevalence of renal stone disease in elderly males and females (age >65 years) is 47.3 and 34.2 per 1000 population, respectively.<sup>[7,8]</sup>

In a study by Gentle *et al.*,<sup>[9]</sup> the geriatric stone formers showed a male predominance of 71% versus 65% in younger patients. However, in a study by Stoller *et al.*,<sup>[10]</sup> 57.5% of patients aged  $\geq 65$  years who were treated with PCNL were male. The proportion of male patients in our cohort was comparable (58%).

Elderly patients tend to have more comorbid conditions; therefore, owing to the poor cardiopulmonary reserve, these patients are less tolerant to bleeding and septic complications.<sup>[3,11]</sup> In general, the main complications of PCNL are bleeding that requires intervention (0.6%–1.4%),

**Table 3: Operative parameters in the two study groups**

Parameters	Elderly (n=50)	Young (n=50)	P
Stone size (mm)	22±5.8	21±6.7	NS
Number of tracts	1.05±0.2	1.04±0.9	NS
Amplatz (Fr)	24.5±7.7	26.2±6.5	NS
Operative time (min)	58.54±18	51.98±18	P<0.05
Blood transfusion	4	6	$\chi^2=0.444$ , df=1, P=0.5050
Fever (postoperative)	6	3	$\chi^2=1.099$ , df=1, P=0.2945
Residual stones	3	4	NS
Length of hospital stay (days)	3.14±0.4	2.7±0.6	$\chi^2=0.154$ , df=1, P=0.6951
			NS
			P<0.5

Data presented as mean±SD or frequencies. All P values are two-tailed. df: Degrees of freedom, NS: Not significant, SD: Standard deviation

infection (0.9%–4.7%), pulmonary complications (3.1%–23%), and injury to adjacent organs (0.2%).<sup>[12]</sup>

In our study, elderly patients had more comorbid conditions, with the most common being hypertension (42%), followed by diabetes (22%) and COPD (20%); these findings are comparable to those in the study by Sahin *et al.*<sup>[13]</sup>

The incidence of postoperative complications, especially the hemoglobin drop (1.6 gm% vs. 2 gm%) and the transfusion rates (8% vs. 12%), was comparable in the two groups. This is consistent with a previous study.<sup>[14]</sup>

None of our patients sustained pleural injury or injury to adjoining organs. This may be attributed to the fact that we avoid puncture above the 11<sup>th</sup> rib, which is associated with a higher risk of chest complications. Furthermore, the surgeon's experience and skillset goes a long way in reducing the complications. All patients in the present study were operated by a single surgeon. This likely contributed to the comparable operative time in the two groups (58.54 ± 18 vs. 51.98 ± 18 min). However, the puncture time was longer than usual in some patients. Since the puncture time was included in the total operative time, this may have increased the operative time in the elderly group.

As expected, the length of hospital stay in the elderly group (3.14 ± 0.4 days) was longer than that in the younger group (2.7 ± 0.6 days). This is likely attributable to the associated comorbidities in the elderly group and is consistent with that reported from a previous study.<sup>[15]</sup> The length of hospital stay did not include the time needed for preoperative optimization of patients.

Stone-free rates were comparable between the two groups (94% vs. 92%, respectively), which is consistent with the literature.<sup>[13,14]</sup>

Akman *et al.* reported the use of retrograde intrarenal surgery for moderate size stones to avoid the inherent complications in elderly patients.<sup>[5]</sup> However, the clearance

rates with one sitting of PCNL were 82.1% vs. 92.8%; in addition, the operative time was also significantly longer in the elderly group (64.5 vs. 40 min in the younger group). We feel that PCNL affords better one-time clearance rates (>90%) compared to any other procedure. Furthermore, subjecting elderly patients to multiple anesthesia has its own problems.

Majority of the studies have reported PCNL in the elderly under general anesthesia.<sup>[5,10,13]</sup> Although PCNL under regional anesthesia was first described in 1988,<sup>[16]</sup> it is still not used widely. Mehrabi *et al.* evaluated the intraoperative and postoperative anesthetic and surgical outcome of PCNL under spinal anesthesia in prone position; they found that spinal anesthesia is a safe and effective alternative to general anesthesia for performing PCNL in adult patients. They made a critical observation that turning the patient to prone position during general anesthesia can cause complications such as endotracheal tube dislodgement and brachial plexus nerve injury; the use of spinal anesthesia precludes these complications.<sup>[17]</sup> The largest study pertaining to the use of spinal anesthesia for PCNL was performed by Borzouei and Bahar-Mousavi; they concluded that spinal anesthesia is well tolerated, especially by elderly patients who have significant comorbidities such as pulmonary disease.<sup>[18]</sup>

This was our observation too; even the older group patients who had a higher ASA score tolerated PCNL under spinal anesthesia well.

## CONCLUSIONS

Age itself should not deter the treatment of elderly patients with renal stones. PCNL under regional anesthesia is safe and effective in elderly patients and provides comparable results to the younger counterparts.

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## Conflicts of interest

There are no conflicts of interest.

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