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Original Research Article

Comparison of the results of percutaneous nephrolithotomy in different age groups

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ABSTRACT

Background: Evaluation of feasibility, safety and effectiveness of percutaneous nephrolithotomy (PCNL) in different age groups.
Methods: Between July 1997-October 2012, 233 patients who were 65 years old and older were included in this study. These patients were divided into two age subgroups used in gerontology research. Group 1 was defined as patients 65-74 years old, Group 2 was older than 74 years old. Data from patient records, including demographic characteristics, preoperative evaluation, operative details, and complications were retrospectively analyzed and compared with control group data.
Results: The mean age of 233 patients was 69.7±4.6 years. The mean operative times for Group 1, group 2 and the control group were 76.2±47.3mins, 92.9±47.6mins, 77±44mins, respectively and there was no statistically significant difference between groups 1 and 2 and the control group ($p>0.05$). Twenty-eight of the 233 patients (12%) needed blood transfusion due to perioperative bleeding. The transfusion rates of groups 1 and 2 were 11.3% and 16.7%, respectively. There was no statistically significant difference between the study groups and control group for blood transfusion rates ($p>0.05$). There was no statistically significant difference in complications between the study and control groups ($p>0.05$).
Conclusions: In geriatric patients, stone-free rates, transfusion rates and other operation parameters are similar to younger populations when experienced surgeons perform PCNL. Despite comorbidities and decreased body reserve, PCNL can be performed without a significant increase in complications in different ages.

Keywords: Geriatric, Kidney stone, PCNL, Complication

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the gold standard surgical treatment of kidney stones, with proven reliability and effectiveness. This technique has been miniaturized with advances in tools and other technologies in recent years. With the use of endoscopic techniques, PCNL has become more minimally invasive and has been performed with success on cases of urinary stone disease of all ages.[1]

Today, PCNL is used as the preferred method for removal of large urinary stones, even in cases where surgery or stone localization is difficult due to patient anatomical structure. When combined with increased surgical experience, this method has proven to be effective and reliable in anatomically difficult cases, such as pediatric patients and patients with skeletal deformities or morbid obesity, that can complicate surgery.[2-4] However, the number of studies in the literature describing PCNL in the different age patients is limited.[5,6]

In the present century, average life expectancy has lengthened considerably with rapidly evolving technology and innovations in the field of medicine. The average life expectancy of the population aged 65 years and over, defined as the geriatric population by the World Health Organization, has increased in recent times, and this increase in the elderly population creates a novel and growing group of patients with distinct comorbidities. However, advanced age and comorbidities may pose risks during surgery.[7] In this retrospective study, we analyzed data from patients aged 65 years and over who underwent PCNL.

METHODS

Data from 1046 patients who underwent PCNL between July 1997- October 2012 were included in this study and retrospectively analyzed. Of these patients, 233 who were chronologically old (65 years and older) as defined by the World Health Organization (WHO) were identified as the study group. Data from patient records, including demographic characteristics, preoperative evaluation, operative details, complications and additional operations, were retrospectively analyzed. Patients were informed that their clinical and laboratory data may be used for scientific purposes, and written consent was obtained prior to operation. Complete blood count and liver function tests were performed and serum creatinine, sodium and potassium levels were obtained preoperatively. All patients underwent preoperative urinalysis, and urine culture and antibiotic sensitivity were performed in patients with leucosituria. Patients with urinary tract infections were operated on after receiving the appropriate antibiotic therapy.

In all patients, PCNL was performed using the same surgical steps. After retrograde ureteral catheterization, an access needle was inserted into the appropriate calyx of the kidney in the prone position. After Amplatz dilatation using a guide wire, a 28 F nephroscope was inserted into the kidney. The stones were fragmented using pneumatic lithotripsy and fragments were removed using forceps. A reentry malecot catheter was inserted into the kidney at the end of the operation.

These patients were divided into three age subgroups used in gerontology research. Group 1 was defined as patients 65-74 years old. Group 2 was defined as patients 75-84 years old, and Group 3 defined as patients older than 84 years of age. There were 3 patients in Group 3, and these patients were added to Group 2. Among these patients, operation times, fluoroscopy times, peri-operative blood transfusion rates, nephrostomy removal times, length of hospital stays, and peri-operative and postoperative complications were evaluated for associations with the age. Furthermore, data obtained from these patients were compared with data from 813 PCNL patients operated on between same dates in our clinic and designated as a control group because they were close in age (50-64 years) to the study group.

Statistical analysis

For the statistical analysis, quantitative measurements are summarized as the mean and standard deviation (the median and the minimum-maximum where necessary).For the comparison of quantitative measurements between the operation groups, Student's T Tests were used when appropriate; Mann-Whitney U test were used if the assumptions for Student's T Tests were violated. The statistical significance level for all tests was 0.05.

RESULTS

The mean age of the 233 patients who were included in the study was 69.7±4.6 (67-100) years. Patients were divided in to 2 groups: old (aged 65-74 years) and very old (aged 75 years or more). The 203 patients in Group 1 (age range65-74 years) had a mean age of 68.4±2.8 years, and the 30 patients in Group 2 (age range 75-100 years) had a mean age of 78.2±5.3 years (Table 1). Urinary stone sizes were availablefor233 patients in the study group, and the mean stone size was 611.1±607.4 (range 75-7000) mm^2. The mean stone size was 607±635.6 (range 75-7000) $mm^2$for Group 1 and 638±372.3 (range 150-1759) mm^2 for Group 2. The mean stone size was not significantly different between the two groups ($p>0.05$). In the control group, stone sizes for 802 patients were obtained from the operative data. In this group, the median stone size was 400 mm^2, and stone size did not differ significantly between study and control groups ($p>0.05$).

The operation times for 224 patients were available in the database, and mean operative time was 78.4±47.5 mins (range 12-260). The mean operative times for Groups 1, Group 2and the control group were 76.2±47.3 (range 12-260) mins, 92.9±47.6 (range 25-210) mins, and 77±44 (range 50-210) mins, respectively, and there was no statistically significant difference between the study and control group for operation time ($p>0.05$).

Operative fluoroscopy times were reviewed, and mean fluoroscopy times for the study group overall, Group 1 and Group 2 were 10.4±6.9 (range 1-49) mins, 1.4±7.1 (range 1-49) mins, and 10.4±5.5 (range 1-20) mins, respectively. There was no statistically significant difference between Groups 1 and 2; however, when the study group was compared with the control group, the fluoroscopy time was significantly shorter in the study group ($p<0.05$).

Twenty-eight of the 233 patients (12%) needed blood transfusion due to peri-operative bleeding. The transfusion rates for Groups 1 and 2 were 11.3% (n:23), and 16.7% (n:5), respectively. In the control group, 96 (11.8%) patients needed blood transfusion peri-operatively. There was no statistically significant difference between the study and control groups in blood transfusion rates ($p>0.05$).

Table 1: Patients' demographics.

	Group 1	Group 2	Control Group	P value
Number of patients	203	30	813	
Male/female	110/123	14/13	477/336	
Meanage of patients (years) (mean±std) (range)	68.4±2.8 (65-74)	78.2±5.3 (75-100)	55.7±4.1 (50-64)	>0.05
Stone burden (mm^2) (mean±std) (range)	607±635.6 (75-7000)	638.7±372.3 (150-1759)	611.4±561.7 (75-1750)	>0.05

Table 2: Operative parameters and results of PNL in different age groups.

	Group 1	Group 2	Control Group	P value
Mean operative time (min) (Mean±STD) (range)	76.2±47.3 (15-260)	92.9±47.6 (25-210)	76.6±45.3 (5-360)	>0.05
Fluoroscopy time (min) (Mean±STD) (range)	10.4±7.1 (1-49)	10.4±5.5 (2-19)	11.5±7.2 (0-61)	<0.05
Transfusion requiring haemorrhage	23 (11.3%)	5 (16.7%)	28 (12%)	>0.05
Stone free (%)	94%	76,6%	75,8 %	>0.05
Mean nephrostomy removal time (days) (Mean±STD) (range)	2.3±1.9 (1-14)	2.2±1.5 (1-9)	2,5±0,5 (1-23)	>0.05
Mean hospital stay (days) (Mean±STD) (range)	3.8±2.4 (1-17)	4±2.5 (2-13)	4.2±3.7 (1-60)	>0.05

Table 3: Intraoperative and postoperative complications of the study group.

Studygroup	Number (n)
	Intraoperative complications
Haemorhage	19
Collecting system perforation	1
Dyspnea	1
	Postoperative complications
Prolonged urine leakage	6
Extrarenal stone migration	2
Fever	1
Hematuria	1
Urosepsis	1
Cerebrovascular attack	1
Brain edema	1
Metabolic asidosis	1
Exitus	1

The mean nephrostomy removal time was 2.3±1.8 (range 1-14) days for the study group, 2.3±1.9 (range 1-14) days for Group 1and 2.2±1.5 (range 1-9) days for Group 2. The mean urine leakage duration was 3.5±2.2 (range 1-17) days for the study group, 3.5±2.2 (range 1-17) days for Group 1 and 3.5±2.2 (range 1-12) days for group 2. For the study group, the mean hospital stay was 3.8±2.4 (range 1-17) days, and the mean hospital stay was 3.8±2.4 (range 1-17) days and 4±2.5 (range 2-13) days, respectively. Mean nephrostomy removal time, mean urine leakage duration, and mean hospital stay did not differ significantly between Group 1, Group 2 and the control group (p>0.05) (Table 2).

When we examined the peri-operative complications in the study group, hemorrhage accounted for 19 of the 21 complications. Respiratory distress and collecting system perforation each developed in one patient. Postoperative complications occurred in 15 patients in the study group, and one patient died (Table 3). In the control group, peri-operative complications were observed in 32 patients, and postoperative complications were observed in 36 patients. There was not statistically significant difference in the rate of complications between the study and control groups (p>0.05).

DISCUSSION

In recent times, the elderly population has been increasing, and this increase has resulted in the emergence of a novel group of patients with distinct comorbidities. The health problems of the elderly population are different from those of young people and unique in their own right.[8] According to epidemiological studies in the United States, the annual incidence of urinary stone disease in the geriatric patients is 2%.[9] Extracorporeal shock wave lithotripsy (SWL) and other conservative methods are the preferred treatment of urinary stone disease in the majority of elderly patients.[10] Although there is a higher risk associated for PCNL compared to SWL in elderly patients, some reports have stated that SWL is less effective, and despite the concerns associated with the complications of PCNL in elderly patients with various comorbidities, this method can be necessary for very large and complex stones.[11-14] Anagnostou et al, noted that if the surgeon performing PCNL is experienced, there may not be cause for significant concern in elderly patients.[15]

Many studies have reported that the majority of patients with stone disease were males in the elderly population.[11,13] Sahin et al, reported that there were more female patients than male patients in their study, and male patients were more likely to be in the control group.[16] In our study, we found the similar results to Sahin et al. With advancing age, particularly in Turkish women, increasing immobility, decreasing fluid intake and urinary tract infections are thought to be responsible for the observed gender difference.

Long operation times can result in increased risk in elderly patients due to their comorbidities. In early studies, it was reported that the mean duration of PCNL is 60-130 mins.[16,17] In our study, the elderly patients' PCNL times were similar to those found in the literature, and despite their comorbidities, there was no statistically significant difference between the study and the control groups ($p>0.05$). However, the fluoroscopy times in elderly patients were significantly shorter than those in the study group ($p<0.05$). This result may be associated with the preference for quick intervention and to complete the operation expediently because of the surgeon's concerns regarding comorbidities and surgical risk. Kandel et al reported that in geriatric patients with urolithiasis, stone size was the most important factor in choosing treatment modality, and PCNL is the gold standard method for a kidney stone bigger than 2.5cm.[18] There was no statistically significant difference in stone size between the study and control groups in our study ($p>0.05$).

The incidence of significant arterial bleeding after PCNL has been reported to be between 0.5% and 1% in large studies.[19] In our study, with or without a history of any open surgery or SWL, there was no statistically significant difference between the study group and control group or the subgroups in blood transfusion rates ($p>0.05$). The reason of this lack of significance may be associated with the similar stone sizes between the groups. In a recent study, Okeke et al reported that the length of hospital stay was longer in elderly patients than young patients.[20] However, we found that there was no significant difference between the study and control groups for Malecot catheter removal time, urine leakage time or hospital stay, regardless of whether patients had any history of open surgery or SWL ($p>0.05$). Factors that may affect this result include the experience of the surgical center and the surgical team performing the operation.

Treatment of urolithiasis in a solitary kidney presents a challenging situation, and in geriatric patients, the concerns regarding complications are maximized. Previous studies have found that PCNL is safe and effective method for solitary kidney stones in the elderly population, but Stoller et al reported that the need for transfusion may be greater in geriatric patients with solitary kidney than the normal population.[11,20,21] In our study, 9% of geriatric patients had a solitary kidney, and the stone-free rate of these patients was 85%. There were no complications, except a cerebrovascular attack in one patient who died in intensive care unit nine days postoperatively. In the recently published CROES study, the stone-free rates in the geriatric population were similar to the rates in young patients, and despite their advancing age, the increase in the complication rates for the elderly population were minimal.[20] In our study, the stone-free rates appeared to be better in the geriatric patients than the control group, but they did not differ significantly ($p>0.05$).

Limitations of this study include its retrospective and non-randomized design, differences in the experience levels of the surgeons performing and recording the operations, and low patient volume in the study group, especially when compared with the control group.

CONCLUSION

In geriatric patients, stone-free rates, transfusion rates and other operation parameters were similar to those observed in a young population when experienced surgeons perform the PCNL. Despite the presence of comorbidities and decreased body reserve, PCNL can be performed without a significant increase in complications. PCNL is a safe and effective treatment method for geriatric kidney stone disease, even in cases with complex stones or a solitary kidney.

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