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COMPARING THE SUCCESS RATE AND COMPLICATIONS OF TREATING KIDNEY STONE BY PERCOTANEUS STANDARD AND TUBELESS NEOPROLITHOTOMY

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ABSTRACT

Background: Percutaneous Nephrolithotomy is one of the methods used to treat urinary stones which may be performed by standard or tubeless method. The aim of this study was to compare the outcome of percutaneous standard neoprolithotomy and tubeless neoprolithotomy in the treatment of renal stones.

Methods: In this clinical trial, 107 kidney stone patients referred to Shahid Beheshti Hospital of Hamedan were randomly assigned to underwent percutaneous standard neoprolithotomy or tubeless neoprolithotomy. Success rates and postoperative complications were measured and compared in two groups.

Results: All 107 patients who entered into the study completed the study. The mean score of postoperative pain in patients undergoing percutaneous Nephrolithotomy and tubeless technique was 1.72 ± 5.72 and 4.12 ± 2.22 , respectively ($P < 0.001$). The severity of pain, the frequency of need for opioid, and the average amount of injected opioids in tubeless method were significantly lower than the standard method ($P < 0.05$). There was no significant difference between two surgical methods in terms of frequency of blood transfusion, the levels of hemoglobin, hematocrit and creatinine, as well as the rate of postoperative hematoma ($P > 0.05$).

Conclusion: The results of this study showed that two methods of percutaneous nephrolithotomy and tubeless techniques have similar success in

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treatment of urinary stones, but the severity of pain and the average amount of opioid consumed is more in standard percutaneous nephrolithotomy than in tubeless method.

INTRODUCTION

Urinary stones are the third most common type of urinary tract disorders and only urinary tract infections and various diseases of the prostate are more prevalent than urinary stones (1). The stones in each part of the urinary system are often required to be removed. Depending on the location of the stone, the size of the stone, the age of the patient, the number of stones, the presence or absence of infection and the severity of the symptoms, an especial therapeutic procedural approach is used for removing stones. Percutaneous nephrolithotomy (PCNL) procedure is now accepted as the gold standard procedure for treatment of the stones larger than 2cm (2-4). Today, PCNL is one of the methods of endourology that is widely used in the treatment of urinary tract stones. PCNL was introduced as a minimally invasive method for the removal of kidney stones in the 1970s and has progressed dramatically in recent years (3,4). Although in the early 1980s, with the appearance of Extracorporeal shock wave lithotripsy (ESWL), the use of PCNL dramatically decreased (5), in recent years and with the disclosure of clinical limitations of ESWL, the role of PCNL has been re-filled (6-8). At first, PCNL was used for simple and small stones, but with the development of crushing equipment and the acquisition of surgical skills, it was also employed for complex and large stones. Now with the advancement of ultrasonic, electrohydraulic, pneumatic and laser crusher, PCNL is also possible for large stones, and PCNL is preferred to open surgery for kidney stones (9).

Acute bleeding is the most common complication of percutaneous access to the upper urinary collection system. Percutaneous nephrostomy leads to bleeding and requires blood transfusion in 0.5% to 4% of surgical operations (10-12). The pelvic injury may occur during early access or dilatation. Extreme pressure on stones during crushing or inappropriate use of a lithotripter or resectoscope may also perforate the pelvic floor. The pelvic perforation is usually diagnosed during surgery (13). The results of several recent studies have shown that it can be eliminated both nephrostomy tubes, and ureter catheters in percutaneous surgery. This method has been performed on selected patients with small stones, access paths without injury and without any bleeding, obstruction or perforation (14-16).

According to the results of these studies and the new version of the tubeless method, this study aimed to compare the implications of the standard PCNL and tubeless method.

MATERIALS AND METHODS

This clinical trial was performed on patients with kidney stones referring to Shahid Beheshti hospital in Hamedan during 1994 to 1995. Sampling method was purposefully selected from eligible people. Prohibition of percutaneous surgeries such as coagulation disorders and the inability to follow the patient after surgery were reasons for excluding the subjects from the study. Patients entered the study after evaluation using IVP and ultrasound or CT scans without contrast and then large kidney stones ≥ 1.5 cm were diagnosed. The patients were then randomly assigned (using a block randomization method) in one of two groups including the standard PCNL treatment group or tubeless treatment group. A total of 50 subjects were eligible for standard PCNL percutaneous nephrolithotomy and 55 subjects were eligible for tubeless method.

All patients underwent general examination and were counseled if any disease was present. CBC Diff, BUN, Cr, urine analysis and urine culture tests were requested. In the case of urinary tract infections, the patient was treated with antibiotics and on the morning of the operation, KUB was done in order to ensure the absence of stone displacement. The patient was then surgically operated under spinal or general anesthesia by the standard or tubeless method. Surgery was conducted by the professors to guide the design and collection of data by the urological resident. Patients' pain intensity was evaluated three hours after surgery based on the 10-point VAS score that zero score equivalent to no pain and 10 score to very severe pain. The morning after the operation, laboratory tests, KUB, and ultrasonography were performed again, and the volume of transfused blood was recorded. The duration of hospitalization was also recorded in two interventional groups.

For statistical analysis, results were presented as mean \pm standard deviation (SD) for quantitative variables and were summarized by absolute frequencies and percentages for categorical variables. Normality of the data was analyzed using the Kolmogorov-Smirnoff test. Categorical variables were compared using chi-square test or Fisher's exact test when more than 20% of cells with expected count of less than 5 were observed. Quantitative variables were also compared with t test or Mann U test. For the statistical analysis, the statistical software SPSS version 16.0 for windows (SPSS Inc.,

Chicago, IL) was used. P values of 0.05 or less were considered statistically significant.

RESULTS

All 107 patients who entered into the study completed the interventions protocol. In standard and tubeless surgery, the mean age of patients was 14.57 ± 48.98 years and 16.43 ± 48.35 years, stone size was 11.9 ± 8.89 mm and 7.01 ± 14.26 mm, the mean pain score was 3.72 ± 1.69 and 2.22 ± 3 hours after surgery, the average drug consumption was 2.39 ± 2.54 and 1.79 ± 2.39 , and the rate of stone free condition was 96% and 100% respectively indicating no significant difference in some variables such as demographics, size of stone, and range of stone free status across the two groups (Table 1). But, the mean pain score and opioid consumed was significantly higher in standard percutaneous nephrolithotomy than percutaneous tubeless nephrolithotomy ($p < 0.05$). Of the 50 patients undergoing percutaneous nephrolithotomy, tract location was as subcostal and in others was as intercostal. There was no significant association between mean pain score tract location ($P = 0.84$). The rate of requiring opioids in patients treated with percutaneous standard Nephrolithotomy and tubeless technique was 64% and 44%, respectively ($P = 0.002$). Patients receiving non-opioid analgesics were not included in the study (Table 2).

Table 1. Comparing size and diameter of stones, pain score, and stone free rate in patients with renal stone based on the treatment procedure.

Variable	Standard method	Tubeless method	P value
Stone size, mm	11.11 ± 8.90	14.26 ± 7.02	0.192
Age, year	48.98 ± 14.35	48.35 ± 16.44	0.871
Pain score, VAS	5.74 ± 4.11	1.71 ± 2.22	< 0.001
Opioid use	2.54 ± 1.39	2.39 ± 1.79	0.005
Stone free rate	96.0%	100%	0.224

Table 2. Requiring analgesics in patients with renal stone based on the treatment procedure.

Method	No need	Pethidine	Morphine	Total
Standard	18 (36.0)	1 (2.0)	31 (62.0)	50 (100)
Tubeless	30	8 (14.54)	17 (30.91)	55

Method	No need	Pethidine	Morphine	Total
	(54.55)			9100
Total	48 (45.71)	9 (8.57)	48 (45.71)	105 (100)

In percutaneous standard Nephrolithotomy and tubeless methods, the frequency of blood transfusion was 4.0% and 5.4%, the incidence of hematoma was 5.0% and 7.0%, the mean hemoglobin drop was 2.09 ± 1.99 mg/dL and 1.96 ± 1.31 mg/dL, the mean hematocrit drop was 3.33 ± 4.97 mg/dL and 6.42 ± 4.83 mg/dL and the mean creatinine loss was 0.12 and 0.20 mg/dL (Table 3). There was no statistically significant difference between two methods in terms of the prevalence of hematoma, requiring blood transfusion, and the amount of hemoglobin, hematocrit and creatinine loss ($P > 0.05$).

Table 3. Surgical outcome in patients with renal stone based on the treatment procedure.

Variable	Standard method	Tubeless method	P value
Needing transfusion	2 (4.0)	3 (5.45)	0.74
Hematoma	5 (10.0)	7 (12.3)	0.51
Hemoglobin decline	1.99 ± 2.09	1.31 ± 1.96	0.69
Hematocrit decline	4.97 ± 3.33	4.83 ± 6.42	0.89
Creatinine decline	0.12 ± 0.40	0.20 ± 0.71	0.51

According to the ultrasound estimation (based on length, width, and depth dimensions and also geometric shape of the hematoma), in the tubeless methods, 4 cases had a 10 to 20 cm hematoma, 2 cases had a 50cm hematoma and one case had a 100cm hematoma in size. In the standard procedure group, all 5 cases had bleeding in the size of 10to 20cm.

Need to embed DJ was revealed in 68% of patients undergoing percutaneous standard Nephrolithotomy and in 43.6% of those who underwent tubeless method ($p = 0.012$). In both groups and after four weeks, the DJ was removed through cystoscopy. The DJ embedded was done at the end of the operation and none of them has been implanted because of a postoperative urinary leakage.

DISCUSSION

In the present study, patients with renal stone

undergoing percutaneous tubeless nephrolithotomy had significantly less requiring opioid administration than standard percutaneous Nephrolithotomy method. There was no statistically significant difference between pain severity which reported by the patients according to the location of the trachea. Also, there was no significant difference in the removal of renal stones by percutaneous standard nephrolithotomy compared to the percutaneous tubeless nephrolithotomy in terms of the values of hemoglobin and hematocrit, blood transfusion, creatinine, and incidence of hematoma as well as the stone free rate. In a study by Mishra et al. (17) in India, 96 patients were surgically treated without nephrostomy or ureteral stent. None of the patients needed opioid analgesics, and requiring blood transfusion was pointed in one patient due to lowering hemoglobin level. The researchers concluded that performing PCNL without nephrostomy and ureteral stent in patients, if properly selected, could be beneficial to the patient in terms of cost reduction and morbidity. In a clinical trial by Aghamir et al. (18), the extraction of stones in patients with abnormal kidneys (ectopic kidneys with inappropriate rotation) was compared between the two procedures including without nephrostomy and ureteral stent methods and using both tubes. Based on the results of that study, there was no significant difference between the two groups in the rates of blood transfusion, surgical complications, need for re-treatment and the total stone free rate, but the admission time, the degree of pain relief and the time to return to normal activity was better in the non-tubular group than another group. In another study by Agamir et al. (19) in 2012, two standard surgical procedure and tubeless procedure among children younger than 14 years were compared, indicating lower hospitalization rate and also lower analgesic need. In the study by Falahatkar et al. (20), there was no statistically significant difference between the two groups scheduling standard surgical procedure and tubeless procedure regarding opioid requiring and stone-free rate.

In our study, two patients in standard nephrolithotomy group and one person in tubeless method needed to blood transfusion due to hemoglobin decline that was higher than reported in the study by Mishra et al. In terms of the stone removal, our findings were consistent with the results of the studies by Falahtakkar et al. and Aghamir et al. In terms of analgesic need, our findings were consistent with the results of Agamir et al, but were contrary to the results of the studies by Mishra et al. and Falahat et al. The reason for the difference is that the administration of an analgesic drug in different places is not the same as the

standard one so that it is easy to administer in some hospitals and other hospitals have more strict rules for financial or other reasons.

In a study by Rana et al. (21) in Pakistan, performing PCNL without nephrostomy in the suppository posture did not show significant adverse effects and acknowledged that conducting a tubeless PCNL in the prone position is feasible and low. In the present study, all surgeries were performed in the prone position and the complications in our study were not observable. In a study by Andrew et al (22) that patients undergoing tubeless PCNL procedures, at the end of operation, a ureteral stent were inserted and the thread attached to it was removed through percutaneous nephrolithotomy pathway and fixed to the skin. About three to twelve days later, the stent was removed from the body with the thread in outpatient visit. After stent exiting, no major complication such as urinary leakage or bleeding was observed. The researchers suggested that this is very convenient for patients who should have a postoperative urethral stent, and it could be eliminate the need for postoperative cystoscopy to remove the stent. In the present study, less than half of the cases of the ureteral stent were embedded in the antegrade position and were removed by cystoscopy after four weeks. In a clinical trial study by Giusti et al (23) in India in 2009, the results of the two procedure including surgery with nephrostomy, ureteral and Foley catheter (group I) and using ureteral catheter and Foley (group II) were compared. One day after surgery, all tubes were removed in both groups, and patients were followed for one month.

According to their reports, the placement of nephrostomy in standard percutaneous nephrolithotomy for one day has side effects and benefits equal to the type without nephrostomy. Nephrostomy can be inserted if necessary and removed one day later. In our study, the nephrostomy was removed after 48 hours.

Of the study's limitations, there are a few examples to enter the study, nonetheless, attempts have been made to select the maximum number of samples according to the available population.

CONCLUSION

In the treatment of renal pancreas, applying percutaneous tubeless nephrolithotomy and standard percutaneous Nephrolithotomy leads to similar outcome in terms of serious complications and stone free rate, however the severity of pain and need for opioid use were less in tubeless method than in standard nephrolithotomy method. For the treatment of renal

stones and if there is a qualified urologist and experienced in the field of PCNL and the availability of conditions and therapeutic facilities, percutaneous tubeless nephrolithotomy is more preferred.

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