Original Article

Treatment of renal stones by standard percutaneous nephrolithotomy versus modified mini percutaneous nephrolithotomy in Yala Hospital: A comparative study

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Keywords:
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Abstract

Objective: The aim of this study was to compare the postoperative outcomes of patients receiving standard percutaneous nephrolithotomy (S-PCNL) and modified mini percutaneous nephrolithotomy (MM-PCNL) in Yala Hospital.

Material and Method: We collected data from 117 patients who underwent S-PCNL or MM-PCNL from 2013-2018. We compared the data of patient characteristics, laboratory results, and postoperative outcomes, such as operative times, duration of catheter, blood transfusion rate, duration of hospitalization, stone free rate and complication rate between the S-PCNL and MM-PCNL groups.

Results: There were no significant differences in operative time, blood transfusion rate, stone free rate and complication rate between the 2 groups. However, the duration of catheter and hospitalization in the MM-PCNL group was significantly shorter than in the S-PCNL group.

Conclusion: Hence, we confirmed that MM-PCNL could be used as an alternative procedure to Mini-PCNL for the management of renal stones in other tertiary hospitals which already have the equipment for S-PCNL by modifying that equipment, as we have shown.

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Introduction

Renal stones are one of the most common urinary diseases found worldwide. In 2019, there were 55,957 Thai patients with renal stones[1]. Thus, it is a major condition and healthcare systems should be concerned. There are several ways to treat renal stones, such as open surgery, endoscopy, and percutaneous nephrolithotomy (PCNL)[2].

Since 1977, PCNL has gained popularity as a renal stone surgery by virtue of it being less invasive. Various PCNL techniques have been invented and the most important difference between them is the size of renal access, which leads to a variety of outcomes and complications. PCNL can be categorized into 4 main groups: Standard PCNL, Mini-PCNL, Ultra-Mini-PCNL and Micro-PCNL using the Amplatz sheath in the sizes of 24-30 Fr, 18-22 Fr, 11-13 Fr and 4.8 Fr, respectively[3] Despite numerous renal access sizes, it has been determined that the smaller sizes are safer during surgery[4].

Yala Hospital has been using Standard PCNL to treat renal stones since 1999, but when the Mini-PCNL was introduced, our team tried to put it into action. However, changing from Standard PCNL to Mini-PCNL leads to changes in all the equipment required for the surgery. Instead of buying new equipment, we attempted to modify what we already had by using the 22 Fr Amplatz sheath with the other equipment of Standard PCNL (S-PCNL), including nephroscope, to perform Mini-PCNL, which we call "Modified Mini-PCNL (MM-PCNL)".

The aim of this study was to evaluate and compare the effectiveness and advantages between S-PCNL and Modified MM-PCNL in terms of operative times, duration of catheter, blood transfusion needed, duration of hospitalization, and stone free rate.

Material and Method

The medical records of 127 patients, diagnosed with renal stones, who underwent standard S-PCN and MM-PCNL from 2013 to 2018 were reviewed retrospectively. Patients were excluded when their medical records, such as radiographic data or operative finding, were incomplete. Thus, this study was conducted on a total of 117 patients. The study was approved by the Institutional Ethics Committee of Yala Hospital.

Before the procedures were carried out, renal function, hemostasis, and radiographic finding of the kidney were evaluated. The surgeries were conducted under general anesthesia. In the supine position, a 6 Fr ureteral catheter was placed and contrast media was ejected. The patient was then turned prone; punctures were performed at the desired calyx under fluoroscopic guidance. All upper calyx accesses were performed below the 12th rib through the retroperitoneum during full expiration. A guide wire was inserted into the collecting system. For the Standard PCNL group, tract dilatation was performed using a telescopic metal dilator size 10 Fr to 30 Fr followed by the 30 Fr Amplatz sheath and the operation was performed with a standard 26 Fr nephroscope. The stone was disintegrated and removed via ultrasonic or pneumatic lithotripsy. At the end of the surgery, the collecting system was examined. A 20 Fr nephrostomy catheter was inserted and kept postoperatively till hematuria recovered. Postoperative chest x-ray was obtained in case of upper calyx access for the assessment of any pulmonary complications[5].

For the MM-PCNL group, the same procedure as S-PCNL was performed with some changes in tract dilatation and nephroscope. Tract dilatation was performed using a telescopic metal dilator size 10 Fr to 22 Fr followed by the 22 Fr Amplatz sheath and the operation was done with a standard 26 Fr nephroscope with outer sheath removal (Figure 1).

Statistical Analysis

Statistical analyses were conducted using program R. We used the independent sample t-test and the Mann-Whitney U test for comparison of

quantitative variables. Chi-square test and Fisher's exact test were used for qualitative variables. A P-value of less than 0.05 was considered statistically significant.

Results

A total of 127 patients were considered for inclusion in the study. Ten were excluded due to inadequate clinical data, leaving 117 patients.The patients were divided into 2 groups following their treatments: 63 patients in S-PCNL and 54 patients in MM-PCNL. Mean age of the patients was 56.87 ± 12.7 years; half (55.60%) were women. Mean stone size was 3.41 ± 1.61 cm. Stone size ranged from 1-8 cm.

The details of clinical and demographic characteristics of the patients are shown in Table 1. The 2 treatment groups were similar with regard to baseline characteristics, with the exception of stone position. The S-PCNL group had more staghorn stones (p=0.01) and puncture sites, in which upper pole punctures were obviously more frequent in the S-PCNL group (p<0.05).

There was no significant difference in operative time between the 2 groups (p=0.15). The blood transfusion rates were 12.70% and 5.56% in the S-PCNL and MM-PCNL groups, respectively. The stone free rate in the MM-PCNL was higher than in the S-PCNL with no significant statistical difference (p=0.35). The complication rate in the MM-PCNL group was lower than in the S-PCNL group with no significant statistical difference (p=0.19). However, the durations of catheter and hospitalization in the MM-PCNL group were significantly shorter than in the S-PCNL group (Table 2).

Discussion

Several studies have been conducted in order to compare S-PCNL and Mini-PCNL. Most have reported that Mini-PCNL was safer than S-PCNL, yet had equal efficacy rates in renal stone management[6-8]. Many studies have shown that M-PCNL had a significant advantage over standard PCNL, such as reduced hospital stay[10].

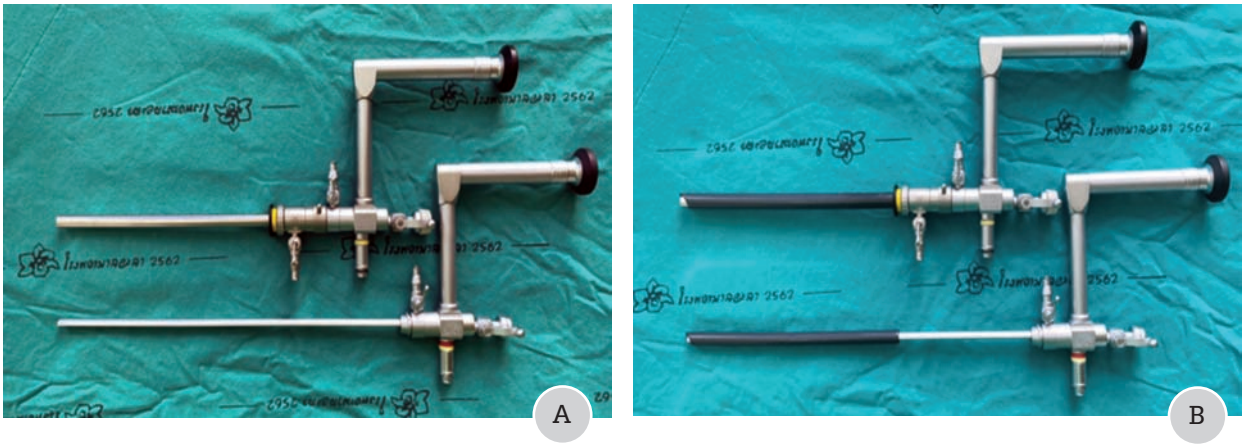

Figure 1. A. Standard 26 Fr nephroscope for S-PCNL technique (above) and standard 26 Fr nephroscope with an outer sheath removal for MM-PCNL (below).
B. S-PCNL nephroscope with 30 Fr Amplatz sheath (above) and MM-PCNL nephroscope with 22 Fr Amplatz sheath (below).

Table 1. Baseline characteristics of the standard percutaneous nephrolithotomy (S-PCNL) and modified mini percutaneous nephrolithotomy (MM-PCNL) groups.

	S-PCNL (N=63)	MM-PCNL (N=54)	P-value
Sex			0.35
Male	31 (49.21)	21 (38.89)	
Female	32 (50.79)	33 (61.11)	
Age (years)	56.67 ± 11.60	57.11 ± 13.98	0.85
Hematocrit level (%)	39.10 ± 4.93	38.68 ± 4.88	0.65
Creatinine level (mg/dl)	1 (0.80,1.20)	1 (0.80,1.21)	0.87
Hydronephrosis			0.33
Nil	3 (4.76)	0 (0.00)	
Mild	22 (34.92)	24 (44.44)	
Moderate	29 (46.03)	25 (46.30)	
Severe	9 (14.29)	5 (9.26)	
Stone size (cm)	3 (2.20,4.68)	2.75 (2.00,4.85)	0.48
Stone side			1.00
Left	28 (44.44)	24 (44.44)	
Right	35 (55.56)	30 (55.56)	
Stone number			0.43
Single	44 (69.84)	33 (61.11)	
Multiple	19 (30.16)	21 (38.89)	
Stone position			0.01
Upper	0 (0.00)	1 (1.85)	
Middle	1 (1.59)	1 (1.85)	
Pelvic	26 (41.27)	23 (42.59)	
Lower	9 (14.28)	9 (16.67)	
Staghorn	27 (42.86)	19 (35.19)	
Multiple	0 (0.00)	1 (1.85)	
Puncture site			<0.05
Upper pole	18 (28.57)	4 (7.41)	
Middle pole	12 (19.05)	6 (11.11)	
Lower pole	32 (50.79)	43 (79.63)	
>1 site	1 (1.59)	1 (1.85)	

Table 2. Treatment outcomes compared between standard percutaneous nephrolithotomy (S-PCNL) and modified mini percutaneous nephrolithotomy (MM-PCNL).

Variables	S-PCNL	MM-PCNL	P-value
Operative times (minutes)	120 (97.50,147.50)	120 (81.25,140.25)	0.15
Duration of catheter (days)	4 (3,4)	4 (4,4)	0.03
Blood transfusion rate (%)	8 (12.70)	3 (5.56)	0.32
Duration of hospitalization (days)	8 (6.5,9)	7 (6,8)	<0.05
Stone free rate (%)	47 (74.60)	45 (83.33)	0.35
Complication rate (%)	18 (28.57)	9 (16.67)	0.19

In this study, we evaluated the postoperative outcomes of patients receiving S-PCNL and MM-PCNL. There were no statistical significant differences in total operative time, blood transfusion rate, stone free rate and complication rate between S-PCNL and MM-PCNL, which is similar to a result from the study by Thapa et al[6], whose meta-analysis compared S-PCNL and mini-PCNL. However, the duration of catheter and duration of hospitalization in the MM-PCNL group were significantly shorter than in the S-PCNL group. These results are supported by Kader et al and Yun et al, which reported that duration of hospitalization could be reduced by applying a small diameter catheter[10,11].

The overall stone free rate of renal stone patients in Yala Hospital was 78.60%. In our study, 74.60% of patients in the S-PCNL group were stone free. Compared with other studies, a 54.80% stone free rate in Thailand (S-PCNL) was reported in a study by Ketsuwan et al (2019)[12]. In Korea, the stone free rate was 73.33% (S-PCNL)[10]. On the other hand, we reported an 83.33% stone free rate in patients in the MM-PCNL group. Comparing our results with Mini-PCNL by other authors, our result showed the same trend as the study by Güler et al (SFR=76.5%)[13].

Overall complications did not differ between mini-PCNL and S-PCNL[6]. The same result was found in this study. We reported bleeding and ureteric obstruction from stone migration as major intraoperative and postoperative complications in our study, respectively. However, we found that the complication rate in MM-PCNL was less than in S-PCNL (16.67% vs 28.57%). Furthermore, we did not find embolization, which is considered a severe complication in any MM-PCNL case.

Conclusion

The results of the present study showed that MM-PCNL procedures did not differ greatly from S-PCNL in effectiveness and safety. However, MM-PCNL might be superior in terms of reducing hospital stay and complications, while it did not lengthen operative times. Hence, we confirmed that MM-PCNL could be used as an alternative procedure to Mini-PCNL for the management of renal stones in other tertiary hospitals which already have the equipment for S-PCNL by modifying that equipment, as we have shown.

Conflict of interest

The author declares no conflict of interest.

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