

Original Article

Comparison of Mini-perc and Retrograde Intrarenal Surgery in Residual Stone Fragments with Hounsfield Unit after Percutaneous Nephrolithotomy

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HIGHLIGHTS

- The percentage of success and release from stone was higher in the mini-perc group, it was not significantly different from RIRS.
- Complications in the mini-perc group were significantly higher than the RIRS group.
- RIRS have lower operation time, hospital stay and complications.

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ABSTRACT

Introduction

Retrograde Intrarenal Surgery (RIRS) and Minimally invasive PCNL (also termed mini-PCNL or mini-Perc or mPCNL) mini-perch surgery are two methods of residual stone treatment. We aim to compare the results of mini-perch and RIRS to treat residual stones after PCNL with Hounsfield unit over 1000. In this retrospective cohort study patients with residual stones after PCNL with Hounsfield unit above 1000 or a stone-to-skin distance greater than 10 cm divided into two groups of mini perch or RIRS.

Methods

Total number of 32 patients in the RIRS group (mean age 38.68±8.00) and 35 patients in the mini-perc group (mean age 42.05±13.22) were studied. The hemoglobin loss (p-value=0.01), need for blood transfusion (p-value=0.04), hospital stay (p-value=0.006) and surgery time (p-value=0.001) were significantly lower in RIRS group.

Results

Although the percentage of success (p-value=0.17) and Stone Free Rate (SFR) (p-value=0.401) were higher in the mini-perc group, it was not significantly different from RIRS. Complications in the mini-perc group were significantly higher than in the RIRS group (p-value=0.05).

Conclusions

The RIRS method has no significant difference in comparison with mini-perc. RIRS have lower operation time, shorter hospitalization, and less complication.

Keywords: Retrograde Intrarenal Surgery; Mini-perc; Effectiveness; Percutaneous Nephrolithotomy

Introduction

Urolithiasis is the second most common disease of the genitourinary tract. Today, several surgical procedures are used to treat these, each with its advantages and disadvantages. The success of surgery depends on several factors, including the size of the stone, the duration of the operation, and the length of stay in the hospital (1). Recent studies have shown the role of Hounsfield unit CT

scans in the treatment of kidney stones (2). Retrograde Intrarenal Surgery (RIRS), performed by flexible ureterorenoscopy, is one of the new methods used to treat urinary stones, which can be used especially in stones smaller than 15 to 20 mm (3). This method is less invasive than other treatments which have fewer side effects and shorter hospital stay, so the indications for using this method have become widespread (4, 5). The success rate

of this method has been reported in previous studies of 60 to 90% (6). Minimally invasive PCNL (also termed mini-PCNL or mini-Perc or mPCNL) is less invasive than percutaneous nephrolithotomy (PCNL) which is now used as an alternative to PCNL, especially in cases of stones larger than 2 cm, diverticular caliceal stones, and large lower-pole stones (7).

In the treatment of residual stones, several methods have been proposed, including sandwich therapy, in which two surgical procedures are performed at a distance from each other, but few studies have been conducted on their success rate and complications (8). This study aimed to compare the results of mini perch and RIRS to treat residual stones after PCNL with above 1000 Hounsfield units.

Methods

The study was conducted as a retrospective cohort with the permission of the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1398.835) and the Iranian Registry of Clinical Trials (IRCT20190624043991N5). Patients entered after signing the consent form and after PCNL had a residual stone with above 1000 Hounsfield unit or stone distance to skin more than 10 cm. Kidney abnormalities, including horseshoe, pelvic and mal-rotated kidneys, and patients under 18 years of age were excluded.

Patients were randomly candidates to mini-perch or RIRS. RIRS was performed according to the method reported in the study of Kazem Aghamir et al., in 2018 (9) In this study, patient's demographic information, body mass index (BMI), stone-to-skin distance (cm), location, size (cm), decreased hemoglobin (g/dl), need for blood transfusion, hospital stay (day), surgical time (minute), successful rate, stone-free rate and complication based on Calvin classification (10) were recorded from patients' electronic profiles. The number of patients with residual stone below 3mm was considered a successful rate and the absence of residual stone was considered stone-free rate.

Statistical analysis

Data were analyzed with SPSS software. Qualitative analysis was reported in prevalence and percentage. Quantitative analysis was reported based on mean \pm standard deviation (SD). Comparisons between different groups in terms of classification variables were performed using the Chi-square test. In case of correction, Fisher Exact test was used. For data with normal distribution, a comparison between groups with different factors was performed using an independent t-test. For non-parametric distribution variables, comparisons between groups were performed using the Mann-Whitney test. A significant level was considered less than 0.05.

Results

We observed 67 patients who had 32 RIRS and 35 mini-perc surgeries. The mean age of patients was 40.44 ± 11.09 . 44 patients (65.7%) were male and 23 patients (34.3%) were female. The mean age in the RIRS and mini-perc groups was 8.00 ± 38.68 and 13.22 ± 42.05 , respectively. Comparing age (p-value=0.208), gender (p-value=0.601), BMI (p-value=0.248), stone-to-skin distance (p-value=0.403), stone size (p-value=0.284) and stone location (p-value=0.752) in the two groups of RIRS and mini-perc was no significant difference (Table 1).

The length of hospitalization (day), surgical time (minutes), drop of Hb, and the need for blood transfusion in the mini-perc group were significantly higher. The success rate in the RIRS and mini-perc groups was 84.37% (27.32) and 91.42% (32.35), respectively. The stone-free rate in the RIRS and mini-perc groups was 81.3% (26.32) and 88.6% (31.35), respectively. There was no significant difference between the two groups in terms of success rate and stone-free rate (Table 2).

In the study of complications based on Clavien criteria, 1 case of fever, 1 case of hematuria, and 1 case of renal colic were observed in the RIRS group and 1 case of fever, 2 cases of Urinary tract infection (UTI), and 1 case of hemorrhage and 1 case of urosepsis were observed in the mini-perc group (Table 3). Complications in the mini-perc group were significantly higher than RIRS (p-value=0.01).

Discussion

In this study, we compared mini-perc and RIRS methods in the treatment of stones residual over from PCNL with above 1000 Hounsfield unit. As far as we know, there is no specific study to compare these two method's surgery in materials that have been contraindicated or impossible to perform Extracorporeal shock wave lithotripsy (ESWL) in the remaining stones after the previous PCNL. We showed for the first time that although the percentage of success and the stone-free rate was higher in the mini-perc group, it did not differ significantly from RIRS. PCNL is a surgical procedure used for large or complex kidney stones (11). In a study by Ramman et al., 8% of patients with PCNL had residual stones and 61% of them needed reoperation. In this study, similar to our study, the highest location of the remaining stones was in the lower lobe (12).

In Resorlu et al., study, the success rate of mini-perc and RIRS was 85.7% and 84.2%, respectively. In this study, researchers examined stones with 1 to 3 cm diameter. In our study, the range of stones studied was 1 to 3 cm, except that these stones were remnants of the previous PCNL surgery. Our success rate in mini-perc and RIRS was 91.42% and 84.37%, respectively. Our higher success rate in this study was probably due

Table 1. Demographic information in RIRS and mini-perc patient

| Variable | Surgery | | p-value |
|-----------------------|--------------|---------------|------------|
| | RIRS | Mini-perc | |
| Age | 38.68 ± 8.00 | 13.22 ± 42.05 | 0.208 |
| Gender | Male | 20 (62.5%) | 24 (68.6%) |
| | Female | 12 (37.5%) | 11(31.4%) |
| Body mass index | 1.93 ± 31.84 | 1.07 ± 29.66 | 0.248 |
| Distance to skin (cm) | 0.70 ± 10.12 | 0.45 ± 10.28 | 0.403 |
| Size (cm) | 0.40 ± 2.13 | 0.31 ± 2.20 | 0.284 |

Table 2. Surgery information in RIRS and mini-perc

| Variable | Surgery | | p-value |
|-----------------------|----------------|-----------------|---------|
| | RIRS | Mini-perc | |
| Surgery time (min) | 1.12 ± 48.70 | 1.31 ± 59.20 | 0.001 |
| Admission time | 0.68 ± 1.71 | 0.67 ± 2.20 | 0.006 |
| Decreased Hb | 1.9 ± 0.51 | 0.3 ± 1.39 | 0.01 |
| Blood transfusion (%) | 3.1% | 8.5 % | 0.04 |
| Success rate | 84.37% (27.32) | 91.42 % (32.35) | 0.17 |
| Sup. Calis | 100 % (2.2) | 100 % (3.3) | - |
| Mid. Calis | 75 % (3.4) | 83.34% (5.6) | 0.09 |
| Inf. Calis | 85 % (17.20) | 94.11 % (16.17) | 0.06 |
| Pelvic | 83.34% (5.6) | 88.89 % (8.9) | 0.319 |
| Stone free rate | 81.3 % (26.32) | 88.6 % (31.35) | 0.401 |
| Sup. Calis | 75 % (3.4) | 100 % (3.3) | 0.06 |
| Mid. Calis | 75 % (3.4) | 83.34 % (5.6) | 0.06 |
| Inf. Calis | 80 % (16.20) | 88.23 % (15.17) | 0.061 |
| Pelvic | 83.34% (5.6) | 88.89 % (8.9) | 0.319 |

to the effect of the previous surgery on the remaining stones and making them more vulnerable. Also, in this study, the complication was reported based on Clavien classification, as in our study. The complications that were observed in mini-perc and RIRS surgeries were 17% and 8.4%, respectively, which was similar to the results of our study (13). In review studies, comparing the interventional methods of treating kidney stones, Ramón de Fata et al., showed that the RIRS surgical procedure took longer, while in our study the RIRS time was shorter than the mini-perc. This difference could be due to the skill of the surgeons. However, the results of hospitalization were similar in the two studies (14). In another study in South Korea, that examined RIRS and mini-perc interventions in stones larger than 10 mm, the success rate in mini-perc and RIRS was 85.7% and 97%, respectively, that contrary to our results. In this study, hemoglobin reduction and

hospital stay time were similar, while in our study they were lower in the RIRS group (15). This difference may follow ethnicity, which shown to be effective in outcomes of urolithiasis surgery (16).

Conclusions

According to the results, in cases with residual stones in PCNL that have more than 1000 Hounsfield unit, the success and stone-free rate of RIRS did not differ significantly from mini-perc and also the time of operation and duration of hospitalization and the need for blood transfusion and reduction of hemoglobin and complication lower in a patient with RIRS. It is recommended to choose the treatment method in each center according to the surgeon's facilities and skills. There is attendant morbidity associated with ureteral stenting, which is a limitation of RIRS. Limitations of this study include its retrospective

Table 3. Complication in RIRS and mini-perc (*mw: mean weight)

| Variable | Surgery | | p-value |
|--|-----------------|--------------------|---------|
| | RIRS N(mw*) | Mini-perc N(mw) | |
| (Clavien grade I) Fever | (1) 1 | (1) 1 | |
| (Clavien grade I) hematuria | (1) 1 | - | |
| (Clavien grade II) urinary tract infection | - | (4) 2 | |
| (Clavien grade II) hemorrhage | - | (2) 1 | |
| (Clavien grade III) renal colic | (3) 1 | - | |
| (Clavien grade IV) urosepsis | - | (5) 1 | |
| Total (N(%)/mw) | 3(9.73%)/(0.35) | 5(14.28%)/(0.85) | 0.01 |

nature and that there was the risk of selection bias. The main disadvantage of RIRS is the need for general anesthesia and PCNL has the advantages of having a high rate of stone clearance and being cost-effective.

PCNL Percutaneous nephrolithotomy
RIRS Retrograde intrarenal surgery
SFR Stone free rate
UTI Urinary tract infection

Authors' contributions

SMKA had the main idea for this research and conceived the study. MRJS was involved in protocol development, gaining ethical approval, patient recruitment, and data analysis. BF, MGhM wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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Conflict of interest

All authors declare that there is not any kind of conflict of interest.

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Ethics statement

Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1398.835) and the Iranian Registry of Clinical Trials (IRCT20190624043991N5). Patients entered after signing the consent form.

Data availability

Data will be provided by the corresponding author on request.

Abbreviations

BMI Body mass index
ESWL Extracorporeal shock wave lithotripsy

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