BANGLADESH JOURNAL OF
UROLOGY
Bangladesh J. Urol. 2024; 27(2): 95-100
www.banglajol.info/index.php/BJU
DOI: https://doi.org/10.3329/bju.v27i2.71218

Original Article

ISSN : 2304 - 8514 (Print)
ISSN : 2304 - 8522 (Online)

Comparison of outcome in between single tract and multiple tract percutaneous nephrolithotomy in the management of staghorn calculus

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Received: 01-01-2024
Accepted: 02-02-2024
Conflicts of interest: None

Abstract

Background: *Staghorn calculi are branched and generally infected stones that occupy a large portion of the collecting system. Failure to eliminate complex staghorn stones presumably destroys the kidney and causes sepsis as well as complete loss of function. Percutaneous nephrolithotomy (PCNL) is currently the accepted first line treatment option for staghorn calculi with various auxiliary procedures.*

Objective: *To assess the efficacy and the safety of single versus multiple tract PCNL in the management of staghorn stones.*

Materials and Methods: *This study was carried out in the department of Urology, National Institute of Kidney Diseases and Urology, Dhaka from November 2020 to November 2021. Sixty patients were selected by purposive sampling technique and allocated into two groups as single tract PNCL (Group-A) and multiple tract PCNL (Group-B). Both groups were compared in terms of efficacy and safety outcomes: Stone free rate, Duration of operation, Postoperative hemoglobin drop, blood transfusion, complications, Hospital stay and renal function.*

Results: *Mean age was 41±13.81 years in Group-A and 39.63±11.16 years in Group-B. Mean stone size was 6.21±2.68 cm in Group-A and 6.62±2.65 cm in Group-B respectively with no statistically significant difference (P=0.555). Mean operation time of Group-A was 74.53±5.16 minutes and of Group-B was 82.03±3.86 minutes with no significant difference. Mean hemoglobin drop in Group-A was 1.99±0.49 g/dl and 2.60±0.13 g/dl in Group-B with statistically significant difference (P=0.001). Percentage of blood transfusion was 13.3% in Group-A and 30% in Group-B (P=0.117). An overall stone clearance rate was 73.3% in Group-A and 83.3% in Group-B (P=0.559). In both group, there was no statistical difference in post operative hospital stay (P= 0.325), post operative serum creatinine (P=0.72), post operative complications (P=0.317) and post operative follow up after one month (P=0.488).*

Conclusion: *This study showed that STPCNL is an effective method for treating complex caliceal calculi or staghorn stones. Compared with MTPCNL, STPCNL not only yields similarly high SFRs but also is associated with many advantages, less blood loss, fewer blood transfusions, and less complications.*

Keywords: Single tract percutaneous nephrolithotomy, multiple tract percutaneous nephrolithotomy.

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Introduction:

Urolithiasis is one of the important causes of morbidity affecting urinary system like kidney with lifetime prevalence is 13% and 7%, in male & female respectively. Although kidney stone disease is not often fatal disorder, it has a repetitive nature, so it disrupts the quality of life and causes high cost to the health system. Despite appropriate surgical approach and medical prophylactic program, half of patients who have previously been treated for renal stones will face stone recurrence within 5 – 7 years. Thus, number of patients who needed second surgical intervention increases.

The principle of management of urinary stone includes the management of acute symptoms and removal of stone by non-invasive methods or minimally invasive or endoscopic and rarely by open method and prevention of recurrence. Minimal invasive procedures such as retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotomy (PCNL) have been reported as feasible and safe options for various kidney stones. Recently, PCNL have almost completely replaced open surgical procedures. However, in Bangladesh, still many surgeons are practicing open stone surgery in different centers where facilities and expertise for PCNL are not available.

Staghorn or complex caliceal calculi constitute one of the most challenging problems in urology and are likely to destroy the kidney and cause life threatening sepsis. Staghorn calculi are branched, usually infected stones that occupy a large portion of the collecting system, typically filling the renal pelvis and branching into several or all of the calices. Failure to eliminate complex staghorn stones presumably destroy the Kidney parenchyma and causes sepsis as well as complete loss of function. Therefore, complete removal of the stones to eradicate causative organisms, reduce obstruction, and prevent further stone growth is the main target in the management of these cases.

Currently, complex staghorn calculi have been mostly managed with percutaneous nephrolithotomy (PCNL). The morbidity of PCNL is seen less than open surgery with better stone-free rates. For patients with staghorn or complex caliceal calculi, the goal of treatment is to achieve maximal clearance of stones and assure maximal renal function preservation with minimal complications. In the recently updated guidelines of the American Urological Association Nephrolithiasis Guideline Panel on staghorn calculi, percutaneous nephrolithotomy (PCNL) is an integral component of the management of most staghorn and large volume renal calculi (Preminger et al., 2005). However, complex Caliceal and staghorn stones are difficult to remove with a single tract PCNL approach.

A trend toward the use of percutaneous monotherapy using multiple tracts as the preferred treatment option for most staghorn or complex calculi has emerged. However a concern with creating multiple percutaneous tract is potential risk of greater bleeding and higher complication rates compared with single-tract approach. In recent years, an increasing number of studies have been conducted to asses the clinical efficacy, operative results and complications of single tract PCNL& multiple tract PCNL, but outcome of these studies have varied.

Therefore, the purpose of the present study was to compare the outcomes in between single-tract PCNL and multiple-tract PCNL in the management of staghorn stones or complex caliceal calculi.

Methods:

Prospective interventional study, at Department of Urology, National Institute of Kidney Diseases and Urology (NIKDU), Dhaka from November 2020 to November 2021.It is purposive sampling. Population were the patients who required PCNL for the management of staghorn renal stones in the department of Urology, NIKDU. The data were collected in a predesigned data collection sheet after taking written informed consent of the participants. A detailed history was taken from the participants about accreditation systems and standards. Data were processed manually and were analyzed on SPSS (Statistical package for social sciences). Mean, standard deviations was used for description of quantitative data and frequencies and proportions for categorical or dichotomous data. Tests of significance was independent sample t-test for quantitative outcome and Chi-square (X^2) test or Fisher's exact test for categorical outcome 95% confidence interval was used. p-value of less than 0.05 was considered significant. The summarized findings were then presented in form of tables and graphs.

Results:

Mean age was 41±13.81 years in Group-A and 39.63±11.16 years in Group-B. Mean stone size was 6.21±2.68 cm in Group-A and 6.62±2.65 cm in Group-B respectively with no statistically significant

difference (P=0.555). Mean operation time of Group-A was 74.53±5.16 minutes and of Group-B was 82.03±3.86 minutes with no significant difference. Mean hemoglobin drop in Group-A was 1.99±0.49 g/dl and 2.60±0.13 g/dl in Group-B with statistically significant difference (P=0.001). Percentage of blood transfusion was 13.3% in Group-A and 30% in Group-B (P=0.117). An overall stone clearance rate was 73.3% in Group-A and 83.3% in Group-B (P=0.559). In both group, there was no statistical difference in post operative hospital stay (P= 0.325), post operative serum creatinine (P=0.72), post operative complications (P=0.317) and post operative follow up after one month (P=0.488).

Discussion:

Incidence and prevalence of renal stone is increasing worldwide facilitating the upgrading of related diagnostic and therapeutic procedure with more advancement in the last 10 years. In recent decades endoscopic technology and operative techniques including endoscopic technology have consistently advanced which have increased success rate (> 90%) of PCNL and decreased the associated complications and morbidity. So, PCNL gained popularity to manage renal stone. Percutaneous nephrolithotomy is an integral component of the management of complex renal stones. PCNL is recommended by AUA as the most appropriate treatment option for most patients with large volume renal staghorn calculi. With this procedure in various publications, stone-free rates, incidence of acute complications and the requirement for an auxiliary procedure has been reported to be 74% to 83%, 0% to 15% and 14% to 24% respectively.

The age of the patients in both groups of the present study ranged between 18 and 65 years and the majority between 31-50 years of which 11 & 18 belongs to group-A and group-B respectively. Mean age ± SD of group-A was 41% ± 13.81 and that of group-B was 39.63 ±11.16 years. The age range of present study is comparable with study done by Akman et al. (2010) in 413 patients who underwent STPCNL & MTPCNL. Mean age of their study was 43.5 ± 14.4 and 40.8 ± 14.0 years in STPCNL & MTPCNL respectively.

Sex distribution was over all male 40 (66.65%) and female 20 (33.35%) with male female ratio 2: 1. Akman et al. (2010) showed is patients over all male female ratio1.45:1.

The mean stone size is group-A was 6.4 ± 2.68 cm and that was is group-B 6.62 ± 2.65 cm, statistically not significant (p value > 0.05)

In this study, mean operation time was 74.53 ± 5.16 min is Group-A and that was 82.03 ± 3.86 min in group-B. Both the differences are not statistically significant (p >0.05). Akman et al. (2010) found the mean operation time 70.04 ± 27 in STPCNL and that was 82.14 ± 32.14 in MTPCNL. Jiao et al. (2020) in a metanalysis showed no significant difference between STPCL and MTPCNL with respect to operative time.

In present study mean hemoglobin drop of group A was 1.99 ± 0.49 g/dl and that of Group-B was 2.60 ± 0.13 g/dl respectively Akman et al. (2010) in their study found mean hemoglobin drop was 2.1 ± 1.7 g/dl in STPCNL & 2.5 ± 16 g/dl in MTPCNL, Jiao et al. (2020) a meta analysis showed a significantly lower operative hemoglobin decrease was observed for STPCNL than MTPCNL.

In this study number of blood transfusion in 13 (43.3%) and 21 (70.0%) in group A and group-B respectively which was not statistically significant. Akman et al. (2010) formed number of blood transfusion 34 (13.9%) and 48 (28.4%) in STPCNL and MTPCNL respectively. Jiao et al. (2020) in a metanalysis by fixed effect model demonstrated a statistical difference between single and multiple tract PCNL with respect to blood transfusion.

It has been observed that mean length of postoperative hospital stay was 4.07 ± 0.98 days in STPCNL and that was 4.63 ± 0.93 days in MTPCNL respectively. The Length of hospital stay in both the group was nearly same which was statistically not significant. Akman et al. (2010) found that mean length of hospital stay was 3.02 ± 1.91 days in STPCNL and 3.53 ± 2.55 days MTPCNL. Jiao et al. (2020) in their metanalysis shows that overall results were similar with regards to this outcome in between STPCNL & MTPCNL.

In the present study, stone free rate was 73.3% in group-A and 83.3% in group-B respectively. The success rate of stone clearance in a study conducted by Akman T. et al. (2010) was 70.1% for group-A (STPCNL) and 81.1% for group-B (MTPCNL) after one session of PCNL. Akman et al. (2010) performed auxiliary treatment PCNL 13 in group-A & 5 in group-B, SWL 41 in group-A & 12 in group-B, URS is 6 in group-B. They found no statistical difference between two groups Jiao et al. (2020) in their metanalysis

showed no significant difference between two groups for the immediate SFR.

In this study mean serum creatinine increased in early post operative period was 0.039 ± 0.014 mg /dl in group A and 0.040 ± 0.015 mg/dl in group-B which is not statistically significant. Akman et al. (2010) in their retrospective comparison revealed that early renal function is not significantly and clinically affected by multiple tracts. Zhou et al. (2017) & Jiao et al. (2020) slowed no significant differences between STPCNL & MTPCNL on renal function. Hearty NJ, Desai MM (2006) also showed no difference between two group in terms of renal function.

Post operative complications occurred in 4 (13.3%) & 7 (23.3%) in group-A and group-B respectively which is not statistically significant. Among the complications post operative fever, Urine leakage and Urinary tract infection was common. Akman et al. (2010) found that post operative complications rate was 7% and (16%) in STPCNL & MTPCNL respectively. Jiao et al. (2020) in their metanalysis revealed no significant difference in the incidence of post operative fever and other complications between STPCNL & MTPCNL.

In this study residual stone was found 6 (20%) in group-A and 4 (13.3%) in group-B after 1 month follow up Which is not statistically significant. Residual stones were treated with 2nd stage PCNL.

Conclusion:

This present study compared the outcome of single tract and multiple tract PCNL for patients with staghorn calculus. Mean age, gender distribution, stone parameter was similar with no statistically significant difference. Mean duration of operation was found with no significant difference in between two procedures. A statistically significant less post operative hemoglobin drop was found in STPCNL. Percentage of blood transfusion was less in STPCNL. Mean duration of post operative hospital stay and overall stone clearance were similar with no statistically significant difference. Post operative complications, serum creatinine and post operative follow up after 1 month were also similar with no statistically significant difference.

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