

Outcomes and Complications of Percutaneous Nephrolithotomy (PCNL) at Al-ribat Urology Center (Omer Sawi Hospital)

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Submitted: 2023, Sep 16; Accepted: 2023, Oct 05; Published: 2023, Oct 18

Citation: Amin, M. H. J., Mohammed, H. E. H., Ahmed, H. M., Hassn, H. I., Magbol, M. A. I., et al. (2023). *Int Internal Med J*, 1(4), 193-196.

Abstract

Objective: Percutaneous nephrolithotomy generally is safe, effective, and associated with a few but specific complications. However, the definition of complications of PCNL and their management still lacks consensus. We aimed to evaluate the Technique, Outcome, and Complication of percutaneous Nephrolithotomy at Al-ribat Urology Center (Omer Sawi Hospital).

Methods : A prospective, institutional-based cross-sectional study, the study investigated all patients presented to the study area with renal stones. The data was collected by a pre-designed questionnaire filled out inside the theater during the surgery and 1-month follow-up by phone calls.

Result: The study assessed the outcome of PCNL among 28 patients. The study found that the mean size of stones recorded was 1.25 cm, and the stones were on the left and right kidneys in 53.6%, and 46.4% respectively. Stones present by a percentage of 10.7%, 28.6%, and 53.6% in the upper and lower calyx and pelvis respectively. The stones were rounded in 78.6% and staghorn in 21.4%. The stone was single in 53.6% and multiple in 46.4%. All operations were done under fluoroscopy guidance. Patients were supine in 25% and prone in 75% of the operations. Injury to the surrounding organs did not occur. Mild bleeding occurs in 10.7% of the patients, in which blood transfusion was necessary. Extravasation of fluid occurs in 10.7%. Fever occurs in 42.9%. Most of the patients stay for 1 day postoperatively 57.1%.

Conclusion: This study demonstrated that PCNL is a safe elective, minimally invasive surgical modality with good outcomes and lower incidences of major complications.

Keywords: Percutaneous Nephrolithotomy, Urinary Calculous, Surgical Outcomes, Complications.

1. Introduction

The surgical gold standard for treating large or complex kidney stones is percutaneous nephrolithotomy (PCNL). Treatment of nephroliths (urinary calculosis) accounts for more than 30% of the surgical load in an average active urologic division [1]. Prior to the adoption of less invasive therapies, many patients with painful calculi of the urinary tract underwent open laparoscopic lithotomy [2, 3].

In addition to surgical intervention, the following interventions are currently available for the treatment of renal stones: ureteroscopy, percutaneous nephrolithotomy (PCNL), and shockwave lithotripsy (SWL).

PCNL has made open surgery for complex renal stones obsolete in most countries. After its first description in 1976, the use of PCNL grew widely [4]. Recent studies have revealed a rise in PCNL usage over the past ten years [2, 5, 6]. PCNL procedures have resulted in stone-free rates of >90% in treated patients and minimized morbidity [7, 8].

Over many decades, improvements in techniques for percutaneous stone removal have contributed to increased efficacy of percutaneous stone disintegration and decreases in the overall morbidity rates for PCNL. These improvements have also led to substantial decreases in transfusion rates [9]. PCNL has proven to be safe and effective in treating many kinds of

kidney stones [10].

Inherent in the developmental progress of PCNL is an increase in variations of the technique. While obtaining renal access for percutaneous renal surgery has typically required the aid of an interventional radiologist, urologists are increasingly performing this technique on their own with comparable success [11, 12]. The study aims to assess the outcome of percutaneous Nephrolithotomy at Al-ribat hospital.

2. Materials and Methods

This is a prospective, institutional-based cross-sectional study, during the period from November 2019 – April 2020. At Al-rebat Urology Center (Omer Sawi Hospital) in Sudan, Khartoum. The target population was all patients presented to Al-rebat Urology Center (Omer Sawi Hospital) who were subjected to PCNL. which included 28 patients who met the Inclusion criteria (stone more than 2 cm in diameter, residual post-open surgery, multiple kidney stones, and high-density stones) and exclusion criteria (patients having coagulopathy, pregnancy, and patients who refuse to participate).

A multistage stratified random sampling method was used. The sample size for this study was calculated via The following equation $n = z^2 P(1-P)/d^2$. With a 95 % Confidence Interval (CI), 50 % response distribution and 0.05 margin of error, a sample of 28 participants can be considered as a minimal sample to represent the population. The data was collected by a pre-designed questionnaire filled out inside the theater during the surgery and 1-month follow-up by phone calls. The data collected was analyzed using The SPSS Statistics version 23 (IBM Corporation, Armonk, NY, USA). Descriptive statistics were done. Categorical variables were described as numbers and percentages. The Pearson Chi-square was used, and P was less than 0.05. Verbal consent was obtained from participants before data collection, confidentially concern considering data as it was only used for research Issues. Hospital permissions were obtained before data collection.

3. Results

Different age groups are present in our study, the youngest patient was 6 years old while the eldest was 75 years old with a mean age of 23.9 years. There were 17 males (60.7%) and 11 females (39.3%) Patients in our study came from different parts of Sudan. Various stone sizes are recorded most of them are between 2-4 the rest of them are above 4cm and the mean stone size of 2.25cm. The calculi were on the right side in 13 patients (46.4%) and on the left side in 15 patients (53.6%). The calculi were in the upper pole in 10.7 percent, the pelvis in 53.6 percent, the lower pole in 28.6 percent, and both the upper and middle pole in 7.1 percent of the cases. Out of 28 stones recorded in our study, 22 of them were rounded (78.6%) and 6 of them were Staghorn in shape (21.4%). Hard Stones were recorded in 25 patients (89.3%) and Matrix (muddy or like clay) Stones in 3 patients (10.7%). Stones can present according to visibility under X-ray as Radiopaque (visible under X-ray) or radiolucent (Not visible under X-ray nor CT) Both are presented in our study as follows. They were solitary in 53.6 percent and

multiple in 46.4 percent of the cases. All 28 patients underwent the surgery under fluoroscopy guidance. The majority of patients were treated in the prone position (75.0%), and others were treated supine position (25.0%). Access was gained through the lower pole in 15 cases (53.6%). Puncture of the middle pole was performed in 7 cases (25%) and of the upper pole in 6 cases (21.4%). The time of the overall procedure ranges from less than 20 minutes to 120 minutes with an average time of 27.9 minutes calculated from the time of puncture not including retrograde and positioning. For PCNL a rigid nephroscope with a caliber of 12 F was used in 12 patients (42.9%) and a caliber of 26 F was used in 16 patients (57.1%). Placement of a nephrostomy after the completion of PCNL was done on 16 out of 28 patients (57.1%). Placement of a nephrostomy after the completion of PCNL was done on 16 out of 28 patients (57.1%). Placement of a double J after the completion of PCNL was done on 16 out of 28 patients (57.1%). In 12 out of 28 patients (42.9%), there was no need for the placement of a nephrostomy tube or double J. Out of 28 patients who underwent the surgery 19 of them were stone-free (67.9%) from the first look, 7 of them required a second session (25.0%) and 2 patients required more than 2 sessions (7.1%). Stone-free rate was achieved in 26 patients (85.7%) and the rest of the cases required more than 2 sessions that we did not record it. Serious complications such as injury to neighboring organs (lung, intestine, liver, spleen, jejunum, pleura) or loss of the kidney did not occur. Mild bleeding occurred in 3 patients 10.7% for which blood transfusion was necessary and no surgical intervention for bleeding since any hemorrhage ceased spontaneously. Extravasation is a common incident during PCNL, which can potentially lead to untoward consequences and it occurred in 3 patients 10.7%. Fever is the most common postoperative complication and only one spike of fever postoperatively is considered positive for pyrexia. Another post-operative complication in our study is postoperative leak from the wound which includes either urine leakage or blood leakage occurs in 4 patients 14.3%. Arterio-venous fistula is a rare complication which does not occur. Most of the patients stayed in the hospital for 1 day 57.1%, 25% stayed for 3- 4 days and the rest stayed for more than 4 days 17.9% with a mean time of 2.03 days for patients' age groups.

4. Discussion

This study included 28 patients, 17 of them were males 60.7% and 11 were females 39.3%. WJ Lee, report 312 men 53.6%, and 270 women 46.4% in contrast to J.E. A. WICKHAM where he demonstrated that 66% of the patients included in his study were males and 34% were females. In our study the age range is between 6-75 years with a mean age of 23.9 years Shahzad Ali reported that in his study the mean age was 35 ±9.56 years and WJ Lee reported that the average age in his study was 57 years [13,14, 15]. Stones size was ranging from 2cm to 12cm with a mean stone size of 2.25 in comparison to Sven Lahme who report a mean stone size of 2.4cm which is very similar to our stones recorded in our study [15]. The calculi recorded in our study were on the right side in thirteen patients (46.4%) and on the left side in 15 patients (53.6%), in contrast to Mohanad Moawia Mustafa's study who reported that the stones were on the right kidney on 53.6% and left kidney on 46.4%. J.E. A. WICKHAM

reported that out of 50 patients, the calculi were on the right side in 21 patients 42%, and on the left side in 29 patients 58% which is quite similar to our study [14,16]. Access was gained through the lower pole (53.6%), the middle pole (25%), and the upper pole (21.4%) of cases. J.E. A. WICKHAM reports that the upper pole was punctured in 2%, the middle pole in 24% and the lower pole in 74% of the cases [14]. All 28 patients underwent the surgery under fluoroscopy guidance because the ultrasound machine was not working. The mean operative time was 27.9 minutes and this is by far less than the time recorded in other studies. Tolga Akman reported that the mean operative time was 64.9±27.6 minutes [17]. Eduardo Mazzucchi reported that the Mean operative time was 164.6 minutes in the prone and 120.3 minutes in the supine position [18]. Sven Lahme reported that the mean operative time was 99.2 minutes [19]. Nephrostomy was used in (57.1%) of the patients which is less than Mohanad Moawia Mustafa who reported 92.8% of the patients had both DJ (double j) nephrostomy drainage tubes [16]. In our study, the post-operative stone clearance rate was 92.9% which is considered an excellent result when compared to other studies. Similar to our findings, Jean de la Rosette reported an 89.8% stone-free rate [20]. Whereas Mohanad Moawia Mustafa reports a stone-free rate of 60.8% [16]. Moreover, Mayank Agarwal showed better results all patients were rendered stone free.-Intra-operative complications that related to the administration of nephroscope such as pleura, liver, Spleen, Colon, Duodenum and Jejunum injury did not occur and were considered an excellent result in contrast to Maurice Stephan Michel who reported colonic injury in (0.2–0.8%) and pleural injury in (0.0–3.1%) [21]. Also, Shahzad Ali reported colonic injury in 0.57% [15]. Mild bleeding occurred in 10.7% for which he received a blood transfusion. This rate is quite acceptable. Mohanad Moawia Mustafa reported that 16.5% of his patients had bleeding and needed blood transfusion [16]. WJ Lee experienced bleeding necessitating transfusion in (12%) of their patient Abdominal extravasation of fluid occurred in 10.7% of the patients which is quite acceptable in contrast to WJ Lee who reported that extravasation occurred in 7% of their patients [13]. Maurice Stephan Michel reported that 7% of their patient had extravasation in this study, and fever was seen in 42.9% of the patients [21]. Other literature reported a lower incidence of fever post-operatively Mohanad Moawia Mustafa had less fever as one of PCNL complications than this study, he found that fever occurred in 16.5% of his patients [16]. WJ Lee Reported fever in (23%) of his patients [13]. Maurice Stephan Michel found that fever occurred in 32.1% of the patients [21]. One of the drawbacks of our study was that we did not document the etiology of fever as TWBCs count and our criteria were very strict that only one spike of fever is considered positive for pyrexia. Fever after surgery is the most common complication in our study. This complication is probably related to the poor sterilization technique and it is not a serious complication unless it is associated with other complaints or abnormal investigations. Fever accompanied by several other complications such as infections requiring additional antibiotics as well as a side effect of blood transfusion.-Postoperative Leak from wound occurred in 14.3% of our patients which is quite high; Shahzad Ali demonstrates that urinary leakage in 8.57% of their patients.-Arterio-venous fistula did not occur in our study, in contrast

to Gremmo E (16) who reported that arteriovenous fistulas occurred in 0.39% of their patients [15]. Most of the patients in this study stayed at the hospital postoperatively for 1 day, the mean postoperative hospital stay was 1.47 days. Mohanad Moawia Mustafa reported that most of the patients (57.7%) stayed for 1-3 days in the hospital, Whereas J.E. A. WICKHAM (17) reported that the mean hospital stay was 8.3 days [16].

5. Conclusion

This study highlights the safety, good outcomes, and lower incidences of major complications of PCNL. Small size of stones were found to have better outcome clearance than large size or stag horn stones ($p=.030$). 92.9% of assessed patients had complete stone clearance. Fever was the most common post-operative complications complication and we recommend that better sterilization of equipment and safety hygienic measures should be applied.

Recommendations

We recommend that better sterilization of equipment should be applied and safety hygienic measures should be applied more strictly. PCNL as a surgical procedure has good outcomes and fewer complications and it's better to expand it to all tertiary hospitals with urology departments in Sudan by availing all needed resources in the form of availability of all investigations and treatment even for suggested post-operative complications, skilled and trained health workers and equipped theaters.

Declarations

Funding

This study received no funding.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval of the study was obtained from the IRB committee in the faculty of medicine, University of alzaiem alazhari, Khartoum, Sudan. The study was carried out following the relevant ethical guidelines and regulations. The participants were asked to give consent that they agree to participate in the study by filling the questionnaire for research purposes, and all the participants provided informed consent.

Consent for Publication

No personal data was collected from the participants.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

MH, Jaber, HE, HM, HI,MA and SE: idea conception, study design. HE, HM: Questionnaire design. MH, Jaber, HE, HM, HI,MA and SE: Data collection and data creation. HE: Analysis planning, data analysis, and interpretation. MH, Jaber, HE, HM, HI,MA: Manuscript drafting. HE: Study design and

Supervision. All authors revised the manuscript and approved it for publication.

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