

ORIGINAL ARTICLE

Safety and Efficacy of Supracostal Access for Percutaneous Nephrolithotomy (PCNL) for Renal Stones

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ABSTRACT

Objective: To evaluate the Safety and Efficacy of supra-costal access of percutaneous nephrolithotomy (PCNL) for renal stones.

Methods: This cross-sectional study constituting 160 patients who underwent PCNL via the supra-costal approach was conducted from January 2018 to March 2021 in Recep Tayyip Erdoğan Hospital, Muzaffargarh. The supra-costal access was achieved through the 11th intercostal space. The success rate and complications were noted. Bleeding, pneumothorax and hydrothorax were noted as major complications.

Results: Mean age of patients was 36.06±14.57 years. There were 86 (53.7%) male and 74 (46.3%) female patients. In majority patients the stone size was 2.0 to 2.5 cm in 76 (47.5%) patients. Stone clearance was achieved successfully in 114 (71.3%) patients. The overall procedural complications rate was 54 (33.7%). The commonest complication was bleeding that occurred in 44 (27.5%) patients, hydrothorax in 7 (4.4%) patients, and bleeding plus hydrothorax in 3 (1.9%) patients.

Conclusion: PCNL performed using supra-costal access is effective and safe with minimal complications rate. Supra-costal access can be adopted as a safe and effective access for PCNL especially in patients with complex renal stones.

Keywords: Renal stones, Percutaneous nephrolithotomy, Supra-costal access.

INTRODUCTION

Worldwide, renal stone disease is a common problem. The prevalence of stone disease is increasing and causing significant economic problems for developing countries.¹ The renal stones are very common in routine urologic practice and constitute about 40 to 50% of the total burden of urology units. The reported prevalence of renal stones in Pakistan is 16%.²

Endoscopic treatment is now the established management option for renal stones. Since its first use by Goodwin et al. in 1955, Percutaneous nephrolithotomy (PCNL) has gained popularity gradually and is now the most widely used option for renal stones especially those >2 cm in size. PCNL is a safe procedure with success rate >80%.^{3, 4}

The PCNL success depends on gaining appropriate percutaneous access and accessing the correct calyx. The success of the surgery and subsequent stone clearing success are closely related to access. Because of the structure of the kidney, a route via the superior calyx is often preferred.⁵ The most common way to PCNL access is below the 12th rib, however in rare situations, a supracostal approach is more successful. A subcostal technique may result in less than ideal access and stone removal.⁶

The supra-costal access is more useful for upper calyx stones because of the more posterior and medial position of the upper pole in comparison to lower pole. Moreover, supra-costal approach is helpful for lower calyx stones, in obese patients, and high lying kidneys.^{7, 8}

However, there are some complications of supra-costal approach, it may cause lung injury leading to

pneumothorax or hydro-thorax.⁹ Therefore, because of these safety concerns the supra-costal approach is not used routinely. In this study we determined the safety and efficacy of PCNL via the supra-costal approach for the management of renal stones.

METHODS

This cross-sectional study constituting 160 patients who underwent PCNL via the supra-costal approach were included in this analysis. The study was conducted from January 2018 to March 2021 in Recep Tayyip Erdoğan Hospital, Muzaffargarh. Patients of age 15 to 70 years, having stone size 2 to 5 cm in any location of kidney were included. Patients having urinary tract infections and those with INR >1.5 were excluded. This study had approval from hospital IRB board. We also took written consent from each studied patient.

Pre-procedure computed tomography (CT) KUB was done to determine the size, location and number of stones. The procedures were under general anesthesia. The supra-costal access was achieved through the 11th intercostal space. Single access was used in all patients.

The success rate and complications were noted. Bleeding, pneumothorax and hydrothorax was observed in post-operative period in each patient. Bleeding as defined as the presence of blood in foley's catheter or nephrostomy tube with drop of Haemoglobin of ≥ 2 g/dL on first post-operative day from the pre-operative value. Hydrothorax was defined as obliteration of Costophrenic angle determined on first post-operative day on chest X-rays. Pneumothorax was defined as absence of lung

markings on Ipsilateral operative site on immediate first post-operative on chest X-rays. Stone clearance was defined as complete clearance of renal stones with no residual fragments or presence of insignificant residual fragments ≤ 4 mm on ultrasonography performed after 2-4 weeks.

Data analysis was carried out using SPSS v23.0. Categorical variables like gender, co morbidities, location of calculi, presence of hydronephrosis, stone site, nephrostomy tube placed, bleeding, hydrothorax, pneumothorax, and stone clearance rate was presented as frequency and percentage. Quantitative variables like age, size of renal stones, sheath size, and number of stones were presented as mean and standard deviations.

RESULTS

Mean age of patients was 36.06 ± 14.57 years. There were 86 (53.7%) male and 74 (46.3%) female patients. Out of 160, 99 (61.9%) patients of renal stones presented with hydronephrosis. In majority patients the stone size was 2.0 to 2.5 cm in 76 (47.5%) patients, followed by 2.5-3.0 cm in 38 (23.8%) patients. Majority of the patients had multiple stones; 109 (68.1%). In 50 (31.3%) patients the location of stones was lower calyx+ renal pelvis, in 35 (21.9%) patients the location was renal pelvis, in 24 (15.0%) the location was lower calyx (Table 1).

Table 1. Demographic Variables.

Age (Years)	36.06 \pm 14.57
Gender	
Male	86 (53.7%)
Female	74 (46.3%)
Comorbidities	
Diabetes	6 (3.8%)
Hypertension	3 (1.9%)
Hydronephrosis	99 (61.9%)
Size of Stones	
2.0-2.5 cm	76 (47.5%)
2.5-3.0 cm	38 (23.8%)
3.0-4.0 cm	34 (21.3%)
>4.0 cm	12 (7.5%)
Number of Stones	
Single	51 (31.9%)
Multiple	109 (68.1%)
Location of Stones	
Upper Calyx	4 (2.5%)
Middle Calyx	2 (1.3%)
Lower Calyx	24 (15.0%)
Renal Pelvis	35 (21.9%)
Uretero-pelvic Junction	2 (1.3%)
Staghorn	19 (11.9%)
Lower Calyx + Renal Pelvis	50 (31.3%)
Upper Calyx + Renal Pelvis	1 (0.6%)

Table 2. Study Outcomes.

Stone Clearance	114 (71.3%)
Complications	
Bleeding	44 (27.5%)
Hydrothorax	07 (4.4%)
Pneumothorax	0 (0.0%)
Hematuria + Hydrothorax	3 (1.9%)

Stone clearance was achieved successfully in 114 (71.3%) patients. The overall procedural complications rate

was 54 (33.7%). The commonest complication was bleeding that occurred in 44 (27.5%) patients, hydrothorax in 7 (4.4%) patients, and bleeding plus hydrothorax in 3 (1.9%) patients (Table 2).

DISCUSSION

Percutaneous stone surgery, followed by flexible or rigid ureteroscopy, has largely replaced open surgery as a consequence of technology advancements and innovations in novel procedures in the surgical treatment of kidney stones.⁹ All of these efforts are aimed at using less invasive methods on patients, providing more effective treatment options, and allowing patients to return to normal life as soon as possible. PCNL is the first option in the treatment for renal stones bigger than 2 cm, according to the stone recommendations of the American Urological and European Urological societies.¹⁰

The choice of a suitable percutaneous access, on the other hand, is critical for a smooth and successful operation. It has been demonstrated that the supracostal PCNL can effectively clear stones with a low rate of complications.¹¹

In this study we determined the complications and outcomes of supra-costal PCNL for managing renal stones of size >2 cm. The complete clearance in this study was achieved in 114 (71.3%) patients. Ahmed et al. in their study of 60 patients undergoing supra-costal PCNL reported success rate of 93.3%.¹² Rafi et al. in another study of 26 patients reported a success rate of 88.5%.¹³ Biswas et al. in a study of 56 patients reported a stone clearance rate of 82%.¹⁴ The lower success rate in this study may be due to our initial experience of using supra-costal approach.

The overall complications number in this study was 54 (33.7%). The commonest complication in this study was bleeding diagnosed in 44 (27.5%) patients, followed by hydrothorax in 7 (4.4%) patients, while there was no incidence of pneumothorax. El-Karamany T in a study of 40 patients of staghorn stones who underwent supra-costal PCNL reported overall complications in 38% patients. However, the authors did not specify the type of complications.¹⁵ While a study by Biswas et al. reported a total of 26% complications, with hydrothorax being the commonest complication diagnosed in 5 (8.9%) patients, hemothorax in 2 (3.5%) patients, pelvic perforation in 2 (3.5%), perinephric collection in 2 (3.5%) and infections/sepsis in 4 (7.0%) patients.¹⁴ Ahmed et al. reported total complications in 26.7% patients, out of which 6.7% patients had intrathoracic complications.¹²

Some endourologists have been put off by the increased risk of intrathoracic problems while gaining supracostal access. To prevent this danger, a full understanding of the anatomical connections of the diaphragm, pleura, and lung is required. Supracostal access was used in all of our instances above the 12th rib, while none were above the 11th. We chose this strategy since the latter approach causes a large rise in chest problems.¹⁶ The visceral pleura never lowers below the level of the mid-point of the 12th rib during the maximal expiratory phase of breathing. As a result, employing the 11th intercostal space greatly reduced the risk of pulmonary problems.

CONCLUSION

PCNL performed using supra-costal access is effective and safe with minimal complications rate. Supra-costal access can be adopted as a safe and effective access for PCNL especially in patients with complex renal stones.

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