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Original Research Paper

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EVALUATION OF OUTCOMES AND COMPLICATIONS OF SUPRACOSTAL PUNCTURES IN PERCUTANEOUS NEPHROLITHOTOMY

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ABSTRACT PCNL is accepted as the treatment of choice of large renal calculi including staghorn calculi. The calyces can be approached via a supracostal or subcostal or a combined approach. Often a supracostal approach is found to be the most appropriate approach for optimal stone clearance but is not often used for the fear of thoracic complications. This study is an observational study to evaluate the outcomes and complications of supracostal puncture in PCNL conducted at Department of Urology at Medical College Trivandrum during the period of 2016-2019. A total of 201 patients participated in this study and 52 punctures were supracostal. It was concluded that supracostal punctures above the level of 12th and 11th ribs can be considered as a safe option for PCNL as the incidence of bleeding, thoracic complications are visceral injuries are less if done using the proper technique and strict monitoring.

KEYWORDS : Urolithiasis, Percutaneous Lithotripsy, Supracostal Puncture

Introduction

Percutaneous nephrolithotomy (PCNL) is the treatment of choice for the treatment of large renal stones, staghorn calculi, upper calyceal stones and stones in calyceal diverticulum. The success of PCNL in clearing the calculi depends on the size of the stone, its location, calyceal anatomy and above all, the choice of the calyceal system to approach the stone. The lower calyceal approach is the most common method used in PCNL owing to the lesser incidence of bleeding and intrathoracic complications , associated with maximum stone clearance. Almost all lower calyceal punctures are done through the subcostal approach. But in some situations like complete staghorn calculi, upper or middle calyceal stones, stones in the calyceal diverticulum and stones with unfavourable lower calyceal anatomy we will require a middle or upper calyceal puncture as the primary tract or combined with a lower calyceal puncture for complete clearance of calculi. In such cases we may have to make the access to the collecting system through a supracostal puncture, which is a puncture above the level of 12th or 11th rib. But a supracostal puncture is associated with complications like bleeding, pneumothorax, hydrothorax or hemothorax and lung injury. This study is done to assess the outcomes and evaluation of complications that can occur after a supracostal puncture.

Aim of the study

Primary

To assess the intraoperative and post-operative complications after supracostal puncture in PCNL.

Secondary:

To assess the stone clearance rate and the need for ancillary procedures after supracostal approach in PCNL.

Methodology

Study Design: Observational study.

Study population:

All patients who underwent percutaneous nephrolithotomy in the Department of Urology Medical College, Thiruvananthapuram, during the period of 3 years from September 2016 - August 2019.

Inclusion criteria:

All patients who underwent PCNL, in whom supracostal approach was used to fragment the calculus. This includes cases in which multiple punctures were used in which supracostal approach was combined with subcostal approach.

Exclusion criteria

1. Patients with active pleural or lung pathology at the time of surgery were excluded from the study.
2. Patients with history of previous renal surgeries also were excluded from the study.

Sample size

Sample size was calculated using n Master software and was found to be 198.

Statistical analyses

Statistical analyses were done using the SPSS software (SPSS version 16.0). Chi square test was used to assess the differences in qualitative variables and to compare their distribution. Comparison of quantitative variables between two group were analysed by Independent sample T test. Differences were considered significant when $p < 0.05$.

Results

During the 3-year period, a total of 201 patients with renal stones were treated with PCNL in our hospital. Out of these 52 patients needed supracostal punctures for PCNL, either alone or along with subcostal punctures. They were grouped into 2 groups, depending on the site of puncture, as group I - above 12th rib (intercostal space between 11 and 12) and group II - above 11th rib and results were compared. 20(38%) punctures were done above the 11th rib and 32 (62%) were above 12th rib. Mean age was 48.3±10.7 in group I and 49.5±13.8 in group II, 42(82.4%) patients were males and 17(53.1%) supracostal punctures were right sided in group I and 12(60%) in group II. 7(21.9%) in group I and 3(15%) in group II were Diabetics, 3(9.4%) in group I and 1(5%) in group II had incidence of Urinary tract infection pre-operatively.

On radiological evaluation 17(53.1%) of group I and 9(45%) in

group II were had staghorn calculi , 5(15.6%) in group I and 6(30%) in group II had involvement of the upper calyx, 5(15.6%)had upper ureteric calculi in group I and 1(5%) had upper ureteric calculi in group II while 19(59.4%) in group I and 10(50%) in group II had evidence of hydronephrosis. The surgical procedure took more than 90 minutes in 11(34.4%) in group I and 8(40%) in group II and more than one puncture was needed in 20(62.5%) in group I and 9(45%) in group II.

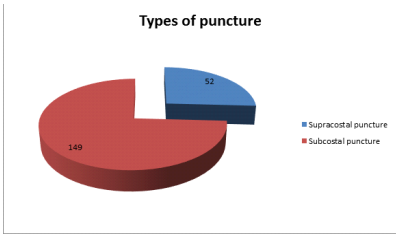

Figure 2- Types of puncture

The final outcomes evaluated were infective complications like episodes of fever, documented UTI, pyelonephritis and sepsis, drop in haemoglobin, blood transfusions, rise in serum creatinine, thoracic complications like hydrothorax and pneumothorax, and presence of residual calculi. Out of 32 patients in group I, 7(21.9%) developed fever, 3(9.4%) developed UTI, 2(6.3%) developed pyelonephritis and sepsis each, while none in group II developed any of the above mentioned infective complications post-operatively. There was a mean hemoglobin drop of 1.77±1.77 in group I and 1.38±1.48 in group II, which showed no significant difference (p= 0.421). 3 patients in group I and 1 patient in group II were given transfusions. Regarding the thoracic complications, 1(5%) had hydrothorax and 1(5%) had pneumothorax , both in group II , were punctures were above the 11th rib, while none in group I had these complications. Patients were managed with intercostal drainage for 2 days which was removed after confirming the clearance with a chest X-ray. Residual calculi was present in 4(12.5%) in group I and 4(20%) in group II. Those with residual calculi were submitted to Extra-corporeal Shock Wave Lithotripsy (ESWL) in 6 and Re-look PCNL in 2 cases. Comparative data of both groups are given in Figure 2.

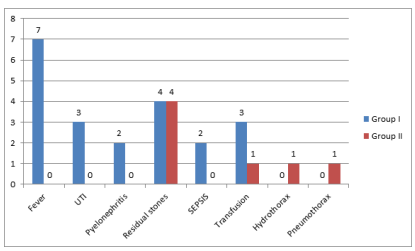

Figure 2- Comparison of complications between two groups

Discussion

The AUA Nephrolithiasis Clinical Guidelines panel recommended percutaneous stone removal as the first treatment option for managing staghorn calculi.[1] The management strategy for treating staghorn calculi depends on the overall stone burden, location and distribution of the stones, and the anatomy of the collecting system.[2] An ideal percutaneous nephrolithotomy (PCNL) puncture has been described as one that provides the shortest and straightest access to all calculi, avoids major vessels, bowel and lung, lies along the axis of the calyx and causes minimal parenchymal damage.[3] Sampaio, in his elegant description of the calyceal anatomy, has emphasized the need for a puncture to go through the fornix rather than the infundibulum to avoid haemorrhage.[4] The superior calyceal approach is considered ideal for approaching the renal system when managing staghorn stones, complex upper and lower calyceal calculi, proximal ureteric calculi, and calculi associated with primary pelvi–ureteric junction obstruction. Current clinical practice continues to reflect a reluctance to use the supracostal approach[5-7]. Supracostal access in general and supra 11th access in particular, continues to be underutilized due to an unfounded fear of thoracic complications like hydrothorax and pneumothorax.[3] The higher the level of puncture the higher will be the incidence of thoracic complications was the previous concept. In Clinical Research Office of the Endourological Society (CROES) PCNL Study report, access above the 11th rib was used only in 1.5–2.2% patients and 68–83% punctures were infracostal.[8] According to results of Hopper & Yakes' study, intercostal percutaneous approach between the 11th and 12th rib into the collecting system would result in lung injury in 14% on the left and 29% in right side[9]. This study is done to assess the outcomes and evaluation of complications that can occur after a supracostal puncture. The pleural complication following PCNL consisted of hydrothorax, hemothorax, pneumothorax or combination of these. Only few studies reported the factors of this complication following upper pole access.

Maheshwari et al. reported that in 150 patients with supra 12th approach there was not even one thoracic violation[12]. In a study by Hopper & Yakes, percutaneous nephrostomy puncture in the intercostal space between the 11th–12th rib results in a lung injury in 14 to 29% of the patients while a 10th–11th rib intercostal space puncture result in lung injury in 86 to 93% of patients[10]. In our study the incidence of thoracic complications were less (1.9%). There was a 3% thoracic complication rate with upper pole punctures, and an overall complication rate of 30% for both thoracic and non-thoracic complications in a study conducted by Stening SG etal[13]. A study by Kuldeep Sharma etal including more than 332 patients the incidence of pleural complications were 4.2 % in supracostal punctures and there was no significant difference between supracostal or infracostal punctures[15]. In our study there was no significant difference in the incidence of bleeding between 2 groups. One patient in group II and 3 in group I (total 7.7%) required transfusions, but none of them required angioembolisation. In the Egyptian study by Tarek El-Karamany,including 40 patients, 4(10 %) patients required blood transfusions and 1 patient required angioembolisation[2]. Other series reported transfusion rates of 0- 20%[16,17].

The incidence of fever was 21.9% in the group I which was significant compared to group II (P- 0.025). Sepsis and pyelonephritis were in the range of 6.3%. Wong and Leveillee[18] had 11.54% of incidence of fever, whereas Raza etal[19] had 19.12% incidence of septicaemia /pyrexia in their respective studies. In our study we did urine culture pre-operatively and antibiotics were given according to the culture report. Mariappan et al found that 1 week prophylactic course of ciprofloxacin in spite of negative urine culture prior to PCNL significantly reduce upper UTI and urosepsis in the postoperative period[20].

In our study 26(50%) of these cases were staghorn calculi, and the clearance rates(84.%) in both groups were comparable with other studies. Residual fragments which required ancillary procedures were found in 8(15.4%) patients. Tarek El- Karamany et al.[2], in his study on 40 renal units observed a 78% stone free status after PCNL monotherapy. In a study by Hariharasudhan etal[21] the stone clearance rates was 93%.

Injuries to adjacent visceral organs are rare during supracostal upper calyceal punctures. A retro-renal left colon occurring in 10% of patients when prone, or a large spleen, can preclude access via the 10th or 11th intercostal space[22].

Conclusion

Supracostal punctures above the level of 12th and 11th ribs can

be considered as a safe option for PCNL as the incidence of bleeding, thoracic complications are visceral injuries are less if done using the proper technique and strict monitoring. This method gives a better access in managing upper ureteral, upper calyceal stones and staghorn calculi, and the stone clearance rate is better.

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