

Original research article

Safety of Puncture in Deep Inspiration During Supracostal Access for PCNL

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Abstract

Introduction: PCNL is most common procedure for renal calculi. Safety of PCNL puncture is very important to avoid complications. Also it should be the best target calyx punctured in best possible direction through the kidney parenchyma. Usually supracostal puncture is done at full expiration for fear of chest complications.

Method: Retrospective analysis of 300 cases of supracostal puncture done at deep inspiration is done in this study.

Results: It has shown similar complication rates like any other approach, Chest tube insertion in 1%, blood transfusion rates of 6.3%, similar length of hospital stay of average 2.02 days. Early chest tube insertion when chest complication is suspected is found to give early recovery. **Conclusion:** Precautions to be taken are: Remain in lateral part of intercostal space, remain just at superior border of lower rib and initial direction of needle to be kept vertically downwards till it passes well beyond the rib.

Key words: Supracostal, PCNL, Inspiration, complication, chest tube

Introduction

PCNL is one of the most common procedure for renal calculi. Puncture of Upper/ middle calyx requiring supracostal approach is best for some situations like upper calyceal calculus, upper ureter calculus, large stone load etc.. There are many studies showing deep inspiration leading to descent of kidney making subcostal approach possible in majority cases. Standard is to use full expiration¹ for supracostal tracks for fear of injury to pleura or lung on inspiration. Present study has analysed only supracostal punctures made in deep inspiration or Normal breathing and its complications.

Material and Methods:

Patients undergoing PCNL from September 2015 to Aug 2022 at various centres are included in study requiring supracostal puncture done at full inspiration. Exclusion criteria – punctures

below 12th rib, multiple tracks, previous nephrostomy insertion. Subcostal access is preferred, taking help of deep inspiration to move the kidney down. Supracostal puncture is done between 11th and 12th rib, in lateral part of intercostal space, just above the lower rib. Initially the needle is passed vertically down till passed below the rib, then it is moved towards the desired calyx. Deep inspiration is used during puncture or normal breathing is allowed in uncooperative patients in Spinal anesthesia. Air pyelogram and occasionally radioopaque dye is used. DJ stent was put in almost all cases, Nephrostomy was put in majority of supracostal tracks. Nephrostomy was removed after 24 hours. Foley's catheter was removed at 36 hours and patient discharged at 48 hours. Some variation in this routine based on patient characters and intraoperative findings.

Results:

300 cases with supracostal puncture in deep inspiration or normal breathing are included in the study. Average age of the patients is 44.19 years with youngest patient of 3 years age and eldest being 79 years. Male to female ratio of 1.2. Maximum stone size is of 35mm, smallest stone operated is 7mm size and average stone size of 17.8mm. Location of stone is upper calyx in 25 cases, upper ureter in 78 cases, middle calyx in 17 cases and renal pelvis in 180 cases. Average BMI of the patients is 22.8. 76 cases were done under general anaesthesia and 224 cases were done under spinal anaesthesia, where patient was instructed intraoperative to hold breath in deep inspiration during puncture and dilatation momentarily. Puncture is done in upper calyx in 248 cases and middle calyx in 52 cases. 259 punctures are done in deep inspiration. 41 are done in normal breathing. Size of track is 30 Fr in 169 cases, 24 Fr in 130 cases and 18 Fr in 1 case. Nephrostomy was inserted in 264 cases at the end of procedure.

Chest tube(CT) was needed to be inserted in 3 cases. CT was put at the end of procedure in 2 cases and on post operative day (POD) 7 in 1 cases. Details of each case are as follows:

First case requiring chest tube had chest pain, breathing difficulty persisting even after 7 days of conservative management. USG chest showed more than 100 ml collection in right pleural space. 24 Fr chest tube was put in 5th intercostal space in anterior axillary line on 7th POD draining 100 ml hemorrhagic fluid. 24 hour output in chest tube decreased progressively over 7 days. CT was removed after 7 days of insertion. Hospital stay of patient was 15 days. Patient was relieved of chest symptoms at discharge. This patient was 27 year male, BMI 21, with 11mm stone in upper calyx. Puncture was done above 12th rib in deep inspiration under GA creating 24 Fr track and keeping nephrostomy at end of procedure. One unit blood transfusion was needed.

Second case requiring CT was 32 yr male, BMI 22, with 27mm renal pelvis calculus, operated through 30 Fr upper calyx track with normal breathing under spinal anaesthesia (SA). Nephrostomy was kept at end of procedure. Patient complained of severe pain in chest on right side operated and difficulty in breathing. Fluoroscopy was suspicious of pneumothorax, air entry was decreased on affected side. 20 Fr Chest tube was inserted on OT table instantly. Few air bubbles were released in under water seal drain, and patient breathing

improved. There was no persistent air leak. CT was kept for 2 days. Hospital stay was 3 days. No chest complains at discharge.

Third patient requiring chest tube was 37 year male , bmi 24, with 23mm renal pelvis calculus, operated with 30 Fr track through upper calyx in deep inspiration under spinal anaesthesia. Patient complained of chest pain on left side operated and breathing difficulty intraoperative. Air entry was decreased on the same side in basal part. 20 Fr chest tube was inserted in 5th intercostals space and Nephrostomy and DJ stent kept. CT drained about 10ml hemmhragic fluid instantly with nil output over next 2 days. Ct was removed after 3 days with complete relief of chest symptoms and discharged.

Mild symptoms of pain on deep breathing , basal lung collapse was seen in another 8 cases not requiring chest tube insertion.

281 cases did not require any blood transfusion. 19 cases required blood transfusion (max 8 units in a case , average 2.2 units). 4 patients required angioembolization for recurrent/persistent bleeding. 4 patients developed clot retention requiring cystoscopic evacuation. Average hospital stay is 2.02 days. 69 cases discharged within 24 hours, 194 cases in 2 days. Hospital stay of more than 2 days was seen in 37 cases (Causeof prolonged hospital stay: Fever-9, respiratory-6, soakage-5, pain-7, hematuria-10). Unplanned readmission was observed in 23 cases on average 10.4th POD (Cause of readmission: Fever-16, Hematuria- 7). Hospital stay on readmission was average 3.5 days. No incidence of Nephrectomy, Death or surrounding organ damage was seen in the studied population.

Discussion:

PCNL puncture at deep inspiration helps by bringing the target calyx so low as to make subcostal puncture possible. Even if need to do Supracostal puncture , deep inspiration help to make direction of puncture more in line with renal axis. If supracostal puncture is done with full expiration, where deep inspiration not sufficient to make subcostal puncture possible, it will cause the target to move very high, requiring punctures above 11th or 10th rib or make the direction of puncture at very acute angle with the renal axis. Complication for supra 11th rib -34.6%, supra 12th -9.7% including intrathoracic complications (hemo/hydrothorax- 4%, Nephropleural fistula-2%, Pneumothorax in 1%)².

Pankaj maheshwari et al ³ has used full expiration for supracostal punctures leading to 25% of their patients requiring supra 11th rib and 4% requiring supra 10th rib puncture. Here in this study all punctures were possible from supra 12th rib when deep inspiration was used. Higher punctures irrespective of stage of respiration give rise to higher complication rates⁴. Similar study for PCNL with full inspiration done by Sher singh yadav at al ⁵ has mainly shown that on deep inspiration the puncture can be made subcostal. 12% patients required supracostal puncture inspite of deep inspiration, two patients developed Hydro/ pneumothorax requiring chest tube insertion. All patients in Our study have supracostal puncture at deep inspiration. Govind Sharma et al⁶ have studied safety of supracostal approach. They have used full

expiration for supracostal puncture and concluded supracostal approach to be a safe refinement of technique of PCNL.

In this study chest complications requiring intervention was seen in 1% cases. Early recovery was seen when chest complication is detected early and chest tube is inserted early. Once blood/urine is collected, it acts as irritant and cause persistent breathing difficulty, which in long run may give rise to pleural fibrosis. Need of blood transfusion is 6.3% requiring secondary procedure for bleeding in 1.6% of cases. Average hospital stay of 2.02 days show that pain is comparable to standard access. Readmission rate of 7.6% is due to causes unrelated to the access.

Conclusion:

Though supracostal puncture is done at full expiration for fear of increased complications, this study clearly show that supracostal puncture in deep inspiration has similar complication rates like any other approach. Rather inspiration leads to better puncture direction. Thus supracostal puncture is safe when done at deep inspiration. Precautions to be followed: Remain in lateral part of intercostal space, remain just at superior border of lower rib and initial direction of needle to be kept vertically downwards till it passes well beyond the rib.

Acknowledgement: Dr Rajeev Mathur, senior Professor, Department of urology, NIMS medical college for his guidance on the puncture technique at deep inspiration.

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