

PCNL-EVALUATION OF SUPRA COSTAL PUNCTURESG. Ravichandar¹, T. Jagadeeshwar², A. Bhagavan³, K. V. Narendra⁴**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: AIMS AND OBJECTIVES: To study the effective stone clearance rate, to analyze and study the intra and post-operative complications and the morbidity in terms of hospital stay.

MATERIALS AND METHODS: The present study has been conducted in the Department of Urology, Gandhi Hospital, and Hyderabad from November 2012 to December 2014. **RESULTS:** Total 42 cases were included in supracostal group, in which mid calyceal puncture done in 5 (11.9%) cases, upper calyceal puncture done in 37(88.1%) cases. Post-operative x-ray chest on day one normal in 39(92.85%) cases and 3(7.15%) cases developed hydrothorax, post-operative pain assessment: visual analogue score on average - 6.5, post-operative x-ray KUB on day two showed insignificant calculi in 2(4.76%) cases and significant calculi in 3(7.1%) cases. Ancillary procedure: needed for 3(7.1%) cases with significant calculi, one case (2.4%) required relook PCNL and for two cases (4.7%) ESWL was done and blood transfusion required for 3 cases (7.1%). Finally stone clearance rate was 88.9%. **CONCLUSIONS:** Supracostal PCNL is a safe procedure with acceptable morbidity. When the puncture site is well planned, keeping it on or lateral to posterior axillary line and performed during expiration, would minimize thoracic complications. Supra costal PCNL has high rate of stone clearance (more than 90%) especially when the stone is complex, burden is in upper pole and stone is of stag horn type. The need for ancillary procedures for complete stone clearance is less. The requirement of multiple tracts and their attendant complications are less with supracostal PCNL. It can be done safely in pediatric as well as elderly population.

KEYWORDS: Pcnl, Retro Grade Pyelogram (Rgp), Shock Wave Lithotripsy, Usg, Intra Venous Urogram, Ncct, Visual Analogue Score.

INTRODUCTION: Percutaneous Nephrostomy is the cornerstone of every percutaneous procedure in the upper tract. As a minimally invasive conduit to the pelvicalyceal system, the percutaneous approach provides a convenient route for the diagnosis of upper urinary tract pathology. In the age of minimally invasive surgery, urologists who are able to master the technique of percutaneous renal access have distinct advantages in remaining at the forefront of the rapidly evolving field of endourology.

Advances in surgical technique and technology have allowed the urologist to remove calculi percutaneously with increasing efficiency. As the percutaneous approach to stone removal is superior to other approaches in terms of morbidity, convalescence and cost, PCNL has replaced open surgical removal of larger or complex calculi at most institutions.^(1,2,3,4) The intimate understanding of the anatomic relationships of the kidney and surrounding structures is crucial for successful and safe percutaneous entry into the renal collecting system.^(1,3) In 2005, the clinical practice guidelines report for the management of staghorn calculi and by the AUA guidelines panel confirmed that percutaneous nephrolithotomy should be the first line of management for most of the patients with staghorn calculi.⁽²⁾

ORIGINAL ARTICLE

AIMS AND OBJECTIVES: To study the effective stone clearance rate, to analyze and study the intra and post-operative complications and the morbidity in terms of hospital stay.

MATERIALS AND METHODS: The present study has been conducted in the Department of Urology, Gandhi Hospital, Hyderabad from November 2012 to December 2014.

Inclusion Criteria: This is a prospective study. Patients with large renal calculi, upper 1/3rd ureteric calculi, PUJ calculi, complete/partial staghorn calculi and calyceal calculi were included in the study.

Exclusion Criteria: Patients with urosepsis like pyonephrosis, bleeding diathesis, active pleural pathology, significant hepatomegaly and splenomegaly were excluded from the study.

Data Analysis: All continuous variables were exposed as mean + standard deviation. Continuous variables were compared and analyzed using students –t test. Categorical variables were compared using chi-square or Fischer’s test as necessary. Statistical analysis was performed using Medalc version 11.3.

Patients with history of loin pain, haematuria with or without fever, nausea and vomiting, suspected to have urolithiasis were evaluated thoroughly. Thorough general physical examination of the patient, spine and genitourinary examination was done. Routine protocol investigations were done as per the preoperative study guidelines.

Initially with ultrasound KUB and then IVU/CT KUB to know the exact location of calculi, pelvicalyceal anatomy and dilatation, lie of the kidney, relationship with ribs and surrounding organs. Complete blood count and urinary examination, S. creatinine, random blood sugars, viral markers, urine for culture and sensitivity, blood grouping and Rh typing was done in all patients. If S. creatinine more than 1.5mg/dl and for radio lucent calculi plain CT KUB was advised and if below 1.5mg/dl then IVU was done in all patients. In case urine culture was positive for micro-organisms growth, appropriate culture sensitive antibiotics were initiated and treated prior to intervention.

Informed written consent was taken in all patients. Antibiotics were given at the time of induction of anesthesia. Type of puncture either supracostal or subcostal was analyzed preoperatively and also intra-operatively after RGP in prone position under C-arm. All cases were done under general anesthesia. Initially with the patient in lithotomy position with adequate padding to pressure points, cystoscopy and retrograde ureteric catheterization with no: 4/5Fr ureteric catheter over a 0.035/0.032 guide wire was done in all cases under fluoroscopy.

Then the patients were turned to prone position with adequate padding, retrograde pyelography was done with UROGRAFFIN 1:2 dilution with normal saline (10ml of urograffin with 20ml normal saline). The grade of hydronephrosis, orientation of the calyces, relationship with the ribs, location of calculi, and infundibulo-pelvic angle in relation to the stone burden was noted. Appropriate calyx chosen for puncturing i. e infundibulo pelvic angle of more than 90° for entering the pelvi calyceal system under fluoroscopy.^(5,6,7,8) Skin entry point was lateral border of erector spinae muscle, at the level of posterior axillary line, puncture is done during expiration for supra coastal access.^(8,9,10) Needle position was assessed both in zero and 30° angles under fluoroscopy.^(11,12,13) After confirmation of needle position within the PCS, and stylet was removed to look for urine gush. After which tract was serially dilated with ALKENS metallic dilators/AMPLTAZ

ORIGINAL ARTICLE

serial Teflon dilator over the guide wire and guide rod and Amplatz sheath was placed into the pelvicalyceal system with guide wire in-situ till the end of the procedure.^(14,15,16,17)

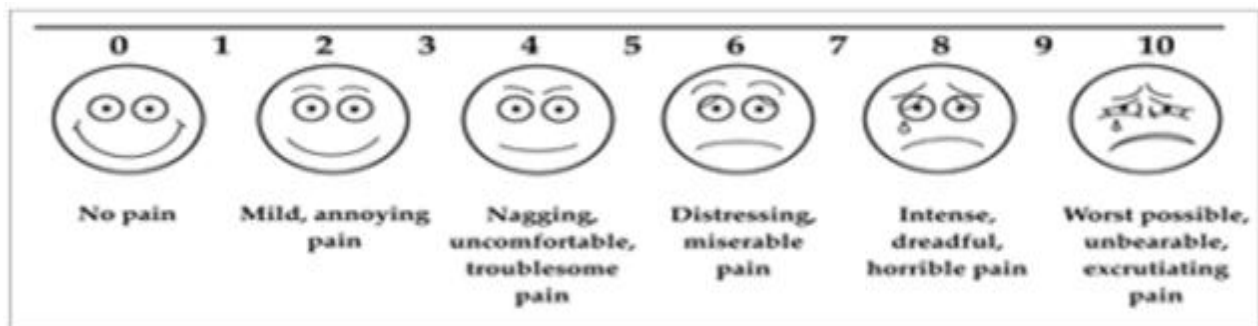
No: 24 Fr rigid nephroscope was used for the PCNL procedure. Normal saline was used for irrigation, for intra-corporeal lithotripsy - pneumatic lithotripter was used.^(18,19,20,21) Stone fragments were retrieved with stone holding forceps or basket. Entire pelvicalyceal system was visualized at the end of the procedure and confirmed with fluoroscopy for complete stone clearance. Fluoroscopy was helpful even to access significant pleural breach and pulmonary complications in immediate intra-operative period.^(22,23)

Ante grade DJ stent no: 4.5/5Fr was placed in all cases. Red rubber drain No. 16/18Fr was used as percutaneous nephrostomy in all cases and was secured to the skin.^(24,25) Ureteric catheter was removed at the end of the procedure.

Post-operatively patients were shifted to ward and oral fluids followed by soft diet was initiated in all cases after 6 hours. Post-operatively quinolones/culture positive antibiotics were continued for 5-10 days. Tramadol hydrochloride 50mg was used for analgesia twice daily. Patients had mild to moderate pain at the operated site for 1-2days which was treated by tramadol hydrochloride. Severity of pain was reduced by 50% by second post-operative day. We were able to remove PCN tube on the first post-operative day in all patients as urine was clear or mildly hemorrhagic. In case of gross hematuria on day one, PCN was clamped overnight and was removed once the urine is clear.

X-ray KUB/CT KUB was taken to assess the clearance of stone and ultrasound was done in cases of radiolucent calculi and ultrasound chest was done if there is any significant evidence of pleural breach clinically or on X-ray.

In case of significant residual stone i. e stone size more than 4mm and symptomatic in the form of pain, infection, obstruction, ESWL was used as an ancillary procedure. For insignificant residual stone i. e stone size of less than 4mm and asymptomatic without pain, infection/ obstruction were offered nothing and discharged to review after 3 months with repeat ultrasound KUB. For patients with post-operative urosepsis repeat urine for culture was sent and was treated accordingly. Visual analogue score for assessment of pain, at PCN site post operatively.



ORIGINAL ARTICLE

RESULTS:

AGE	SUPRA COSTAL	SUB COSTAL
11-20YRS	2.00%	18.00%
21-30YRS	12.00%	10.00%
31-40YRS	22.00%	18.00%
41-50YRS	38.00%	33.00%
51-60YRS	20.00%	15.00%
61-70YRS	4.00%	8.00%
71-80YRS	2.00%	0.00%
AVERAGE	39.6±15.3	43±9.7

TABLE 1: AGE DISTRIBUTION

STONE DISTRIBUTION	SUPRACOSTAL	SUB COSTAL
RENAL PELVIC CALCULI	35.00%	50.50%
PUJ CALCULI	21.50%	15.50%
PARTIAL STAG HORN CALCULI	12.50%	17.50%
UPPER1/3 URETRIC CALCULUS	20.50%	9.50%
COMPLETE STAG	10.50%	8.50%

TABLE 2: STONE DISTRIBUTION

STONE BURDEN	SUPRACOSTAL	SUBCOSTAL
2CMS	16.16%	26.46%
2-3 CMS	23.43%	24.54%
3-4 CMS	38.49%	34.57%
4-5 CMS	21.92%	14.45%

TABLE 3: STONE BURDEN

OT DURATION	SUPRA COSTAL	SUB COSTAL
60 MIN	71.40%	65.00%
90 MIN	21.42%	25.00%
100 MIN	7.14%	8.00%
120 MIN	0.00%	3.00%
AVERAGE	69.28±15 MIN	72.0±17.2 MIN

TABLE 4: OT DURATION

P Value=0.9 (Not Significant).

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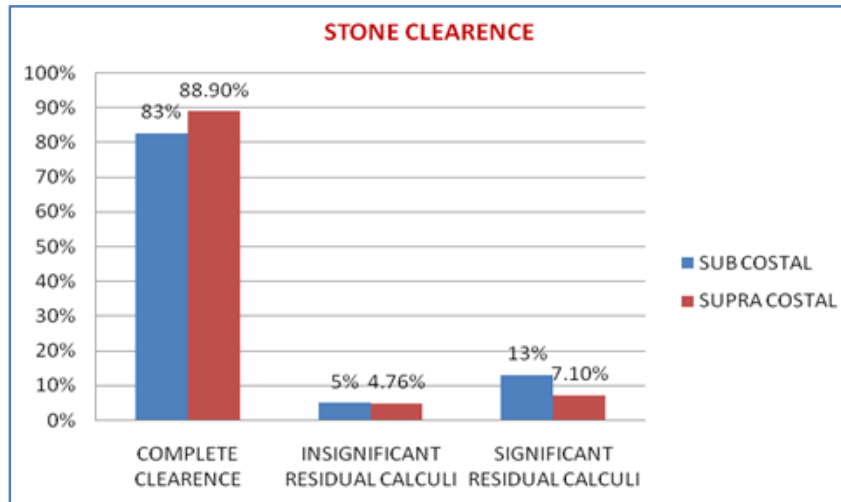


FIG. 1

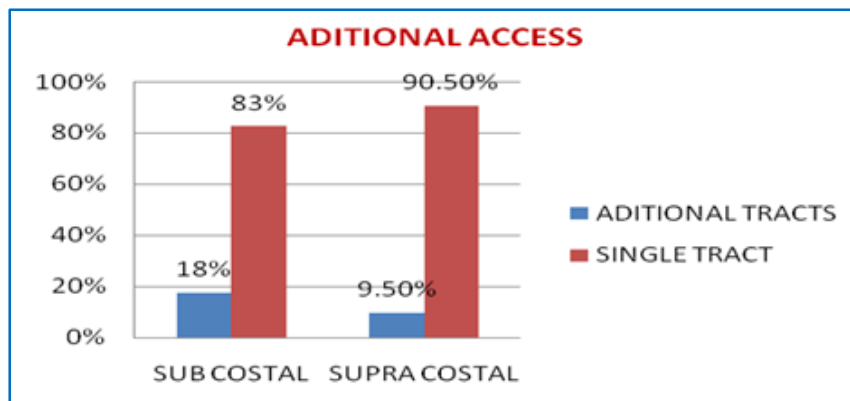


FIG. 2

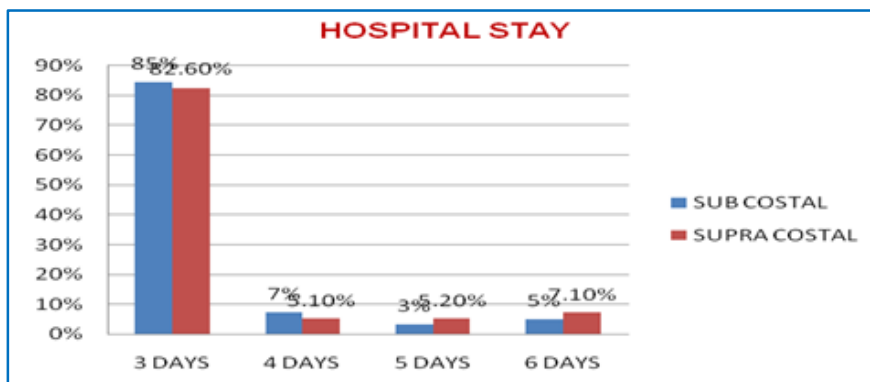


FIG. 3

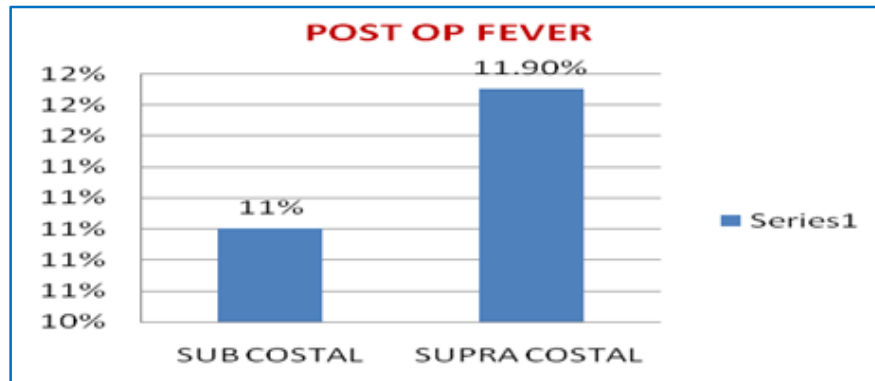


FIG. 4

IN SUPRACOSTAL GROUP (42 CASES):

Mid Calyceal Puncture: Done in 5(11.9%) cases.

Upper Calyceal Puncture: Done in 37(88.1%) cases.

Post-Operative X-Ray Chest: On day one normal in 39(92.85%) cases and 3(7.15%) cases developed hydrothorax.

Post-Operative Pain Assessment: Visual analogue score on average - 6.5.

Post-Operative X-Ray Kub: On day two showed insignificant calculi in 2(4.76%) cases and significant calculi in 3(7.1%) cases.

ANCILLARY PROCEDURE: Needed for 3(7.1%) cases with significant calculi, one case (2.4%) required relook PCNL and for two cases (4.7%) ESWL was done.

Blood transfusion required for 3 cases (7.1%).

Other organ injury like liver injury, splenic injury and bowel injury, and other pulmonary complications like pneumothorax, hemothorax, and renoplural fistula were not seen in any of the cases.

IN SUBCOSTAL GROUP (164 CASES):

Mid Calyx Puncture: Done in 70 (42.7%) cases.

Lower Calyx Puncture: Done in 94 (57.3%) cases.

Post-Operative X-Ray Chest: X-ray chest negative for pleuropulmonary complications like pneumothorax, hydrothorax or hemothorax or pulmonary injury.

Post-Operative Pain Assessment: Visual analogue score on average - 4.5.

Post-Operative X-Ray Kub: On day two showed insignificant calculi in 8 cases (5%) and significant calculi in 21 cases (12.5%).

ANCILLARY PROCEDURES:

- Required in 21 cases (12.5%).
- ESWL used as ancillary procedure for significant residual calculi in 8 cases (5%) and relook PCNL in 13 cases (7.5%) of subcostal PCNL cases.
- Blood transfusion was required for four cases (2.5%).
- Two cases (1.2%) had bowel injury, which were managed conservatively.

ORIGINAL ARTICLE

- Other organ injury like liver injury, splenic injury and pulmonary complications like pneumothorax, hydrothorax, hemothorax and renoplueral fistula were not seen in any of the cases.

Study	No.	Supra-12 th supra-11 th (%)	Overall number of complications (%)	Sepsis/ Bacteremia (%)	Thorasic (%) Pnuemothorax Hydrothorax Hemothorax Renoplueral fistula (%) Needed treatment.	Other organ injury (%)	Significant blood loss /required blood tranfusion (%)
Present Study	42	41 1	8(19.0)	5(11.9)	3(7.1) 0(0) 3(7.1) 0(0) 0(0) 2(4.76)	0(0)	3(7.1)
Kekre et al ⁽²⁶⁾ 2001	102	102(100)	10(9.8)	0(0)	10(9.8) 1(1) 9(8.8) 0(0) 9(8.8)	0(0)	0(0)
Gupta et al ⁽²⁷⁾ 2002	62	62(98.4) 1(1.6)	14(22.2)	7(11)	7(11) 0(0) 7(11) 0(0) 4(6, 3)	0(0)	6(9.5)
Lojanapiwat et al ⁽²⁸⁾ 2006	170	170(100)	31(18.2)	1(0.6)	26(15.3) 0(0) 26(15.3) 0(0) 9(5)	0(0)	4(2.4)
shah et al ⁽²⁹⁾ 2006	144	110(76) 35(24)	19(13.2)	6(4.1)	5(3.5) 0(0) 5(3.5) 0(0) 1(0.7)	0(0)	7(4.9)
sukumar et al ⁽³⁰⁾ 2008	110-	110(110)	13(11.8)	2(1.8)	10(9.1) 0(0) 10(9.1) 10(9.1)	0(0)	2(1.8)
shaban et al ⁽³¹⁾ 2008	30	24(80) 6(20)	4(13.3)	1(3.3)	2(6.6) 0(0) 1(3.3) 1(3.3) 2(6.6)	0(0)	1(3.3)

TABLE 5: Comparison of complications of supra costal PCNL

ORIGINAL ARTICLE

Study	No.	Additional access (%)	Overall stone free rate (%)	Ancillary procedures (%)
Present study	42	0(0)	37(88.23)	3(7.1)
Kekre et al ⁽²⁶⁾ 2001	102	Not Specified	81(79.5)	Not Specified
Gupta et al ⁽²⁷⁾ 2002	63	15(23.8)	57(90)	13(20.6)
Lojanapiwat ⁽²⁸⁾ 2006	170	0(0)	140(82.4)	6(3.5)
Shah et al ⁽²⁹⁾ 2006	144	22(15.3)	127(88.2)	5(3.5)
Sukumar et al ⁽³⁰⁾ 2008	110	9(8.2)	95(86.4)	15(13.6)
Shaban et al ⁽³¹⁾ 2008	30	11(36.7)	24(88.9)	3(11.1)

TABLE 6: Comparison of stone clearance rate and ancillary procedures

	SUPRA COSTAL GROUP	SUB COSTAL GROUP
Additional tracts	9.50%	17.50%
OT duration	69.28±15mins	72±17.2 mins
Blood transfusion rate	7.10%	2.50%
Post op pain (vas)	6.5	4.5
Post of sepsis	10.00%	11.9%
Pluero pulmonary complications	7.10%	0.00%
Bowel injury	0.00%	1.2%
Hospital stay	3.5±0.9 days	3.5±0.9 days
Ancillary procedure	7.10%	12.50%
Stone clearance rate	88.90%	82.50%

TABLE 7: Comparison of supra costal PCNL vs sub costal PCNL

DISCUSSION: We have evaluated 42 cases with supracostal PCNL and 164 cases with subcostal PCNL for this prospective study to know the safety and efficacy of supracostal PCNL in terms of hospital stay, intrathoracic complications, other organ injury, need for blood transfusion, stone clearance rate and need for ancillary procedures.

In supracostal group 57.14% were males and 42.85% were females and in 43.60% of patients PCNL done on right side, 56.40% on left side. In the subcostal group majority of patients were males (67.34%) and predominantly right sided (53.5%).

In the present study supracostal PCNL done in patients with 23% of complete/partial staghorn calculi, 20.5% of upper 1/3rd ureteric stone, 21.42% of PUJ calculus and 35% of large renal calculi with upper pole stone burden. In majority of patients subcostal PCNL was indicated for large

ORIGINAL ARTICLE

renal calculi (50.5%) with lower pole stone burden, upper 1/3rd ureteric calculus (9.5%) and partial staghorn calculi (17.5%), PUJ calculus (15.42%) and complete staghorn (8.5%).

Sudhir sukumar et al,⁽³⁰⁾; Indications for supracostal PCNL access included large pelvic stones (35.5%), partial or complete staghorn calculi (31.8/29.09%), upper ureteric stones (3.6 %).

N. S. Kakre et al,⁽²⁶⁾; Indications of supracostal PCNL, large solitary renal stones (66.5%), multiple stones (15.7%). Staghorn (19.6%) and upper ureteric stones (32.4%) constituted commonest indication.

In the present study renal access in supracostal group was either upper calyx in 37 (88.1%) cases or mid calyx in 5 cases (11.9%). In subcostal group either lower calyx in 94 (57.5%) cases or mid calyx in 70 (42.5%) cases were punctured. Supra 11th rib puncture was done in one case (2.3%) in supracostal group, who had large renal calculi with upper pole stone burden. Constituting supra 12th access 97.7% and supra 11th 2.3%.

These results are comparable with Gupta et al,⁽²⁷⁾ supra 12th /supra 11th (98.4/1.6%), Shah et al,⁽²⁹⁾ (76/24%) and Shaban et al,⁽³¹⁾ (80/20%). As supra 11th rib access is associated with more chances of plueropulmonary complications, it should be avoided if possible.

Regarding additional access in the present study double tracts were needed in 4(9.5%) cases in supracostal group and 28(17.5%) cases of the subcostal group to achieve complete stone clearance. These results are comparable with other studies like Sukumar et al,⁽³⁰⁾ (8.2), Shah et al,⁽²⁹⁾ (15.3), Gupta et al,⁽²⁷⁾ (23.8). Although these additional tracts significantly increase stone clearance rate but increases risk of other complications like excessive bleeding, increase operative time, increase post op pain and hospital stay. Hence supra costal PCNL is better choice when stone burden is more and when additional tracts are anticipated.

In both groups, patients had mild to moderate pain at the PCN site for 1-2 days, severity of pain in supracostal group 6.5 and 4.5 in sub costal group on VAS, which was managed adequately by analgesics. We used tramadol hydrochloride 50mg twice daily in all patients for 2 days post-operatively and as and when required thereafter. There was no statistically significant increased chest pain or respiratory related incidences in supracostal group in any age groups. In a study by Karim kader,⁽³²⁾ et al., Placement of 8.5/6Fr nephroureterostomy catheter at the end of the procedure, diminishes post-operative pain and decreases hospital stay of 1 v/s 4 days in comparison to 24Fr malecots catheter, Severity of pain is more in supra costal group because, tract traverses through diaphragm and inter costal muscles which can be reduced by using small caliber PCN tube and it can be avoided if possible in selected cases.

Post-operative period was uneventful except for pain and fever which were managed conservatively. The duration and severity of pain and the need of analgesia were comparable in both the groups. There was no need for extended hospital stay and need for analgesia for respiratory related events in supracostal group.

In our study groups PCN tubes were removed on day one post-operatively in most of the cases, chest x-ray was within normal limits in sub costal group where as in supra costal group 3 cases (7.1%) developed hydrothorax.

The present study pulmonary complications, in the form of hydro thorax seen in 3 cases (7.1%) of supra costal group. Out of which one case (2.3%) required inter costal tube drainage, one (2.3%) case was managed by needle aspiration, one (2.3%) case managed conservatively. Other thoracic complications like pnuemothorax (0%), hemothorax (0%), renoplueralfistula (0%) were not seen.

ORIGINAL ARTICLE

These complications were comparable with others studies like N. S. Kakre et al,⁽²⁶⁾ pneumothax (1%), hydrothorax (8.8%), hemothorax (0%), renoplueralfistula (0%).

Guptaetal,⁽²⁷⁾ pneumothax (0%), hydrothorax (81%), hemothorax (0%), renoplueralfistula (0%), Lojanapiwatetal,⁽²⁸⁾ pneumothax (0%), hydrothorax (15.3%), hemothorax (0%), renoplueralfistula (0%), Shabanetal,⁽³¹⁾ pneumothax (0%), hydrothorax (3.3%), hemothorax (0%), renoplueralfistula (0%).

These pulmonary complications can be minimized by avoiding supra 11th access and judicious use and positioning of Amplatz sheath to avoid leakage in to pleural space and maintenance of low pressure system as well as adequate drainage post operatively.

Residual calculi in the present study in post-operative x-ray KUB/CT KUB done on day two, showed insignificant calculi in 2(4.76%) cases and significant calculi was seen in 3(7.1%) cases in supra costal group where as insignificant calculi in 8(5%) cases and significant calculi in 21(12.5) cases in subcostal group. Patients with significant calculi in both groups underwent relook PCNL and ESWL as an ancillary procedure subsequently they were rendered stone free. Ancillary procedures in subcostal group accounts for 12.5% and in supracostal group 7.1%. Patients with insignificant calculi were not subjected to any ancillary procedures in our study. These results were similar with other studies like Gupta et al,⁽²⁷⁾ ancillary procedure (20.6%), Lojanapiwat et al,⁽²⁸⁾ (3.5%), Shah et al,⁽²⁹⁾ (3.5), Sukumar et al,⁽³⁰⁾ (13.6%), Shaban et al,⁽³¹⁾ (11.1%). Thus incidence of residual calculi and ancillary procedures were less in supra costal group because of upper calyceal entry, which can easily access in to other calyx and PUJ and upper ureter.

Post-operative urosepsis/bacterimia in the present study was (11.9%) in supra costal group, (10.00%) in sub costal group which was managed conservatively with higher antibiotics based on culture sensitivity and this was comparable with other studies Gupta et al,⁽²⁷⁾ (11%), Lojanapiwat⁽²⁸⁾ (0.6%), Shah et al,⁽²⁹⁾ (4.1%), Sukumar et al,⁽³⁰⁾ (1.8), Shaban et al,⁽³¹⁾ (3.3%). Urosepsis was more in supra costal group because it is indicated in large number of staghorn calculi and large renal pelvic calculi which is struvite stone harbouring more bacterial load, this can be minimized by using pre-operative culture sensitivity based antibiotics.

In the present study significant blood loss, which required blood transfusions in 7.1% cases of supra costal group and 2.5% cases of sub costal group. These results were similar with other studies, Gupta et al,⁽²⁷⁾ (9.5%), Lojanapiwat,⁽²⁸⁾ (2.4%), Shah et al,⁽²⁹⁾ (4.9%), Sukumar et al,⁽³⁰⁾ (1.8%) and Shaban et al,⁽³¹⁾ (3.3%). This high rate of excessive bleeding in supra costal group was because of more vascularity of upper pole and injury to inter costal vessels. It can be reduced by using ALKENS telescopic metallic dilator or single step dilatation of tract.

Bowel injury not seen in supra costal group but 1.2% of subcostal group, these colonic injuries were identified intra operatively and managed conservatively by keeping wide bore tube in colon and DJS in kidney since they were extra peritoneal. These can be avoided by avoiding more lateral punctures (lateral to posterior axillary line) especially thin females.

Other Organ injuries like liver injury (0%), splenic injury (0%), injury (0%) were not noted in either of the study group of present study, which were same in all mentioned study groups.

Expected hospital stay of 3 days seen in 67.04% of supracostal group and 70% in subcostal group, which is not statistically significant. Extended hospital stay of 4 to 6 days was seen in 33% of cases in supracostal and 30% of patients in subcostal group. The cause of the extended stay in all the patients was post-operative fever. Culture sensitive higher antibiotics were initiated in all patients post-operatively and were thus managed conservatively.

ORIGINAL ARTICLE

In subcostal group, surgery was completed in 60 minutes in 65% and surgery was extended upto 90 minutes or more when the stone burden is more than 3cm. In 71.4% of the patients, supracostal PCNL procedure was completed in 60 minutes and it took 90 minutes or more in 28.56% of cases, as the stone burden increased (>3cm). Abdul Kadir et al,⁽³³⁾ The mean operative time was 78 minutes in both the groups, the fluoroscopy screening time was 3-50 mins. The fluoroscopy time was prolonged in patients with increased stone burden and multiple tracts.

In our study, associated co-morbidities like diabetes mellitus, hypertension were seen in 40% (P value = 0.4 not significant) of subcostal group and 47.59% of supracostal group, there was no increased morbidity.

Overall complication rate in the present study was 19.0% which shows similar results with other studies Kekre et al,⁽²⁶⁾ 9.8%, Gupta et al,⁽²⁷⁾ 22.2%, Lojanapawit et al,⁽²⁸⁾ 18.2% Shah et al,⁽²⁹⁾ 13.2%, Sukumar et al,⁽³⁰⁾ 11.8% and Shaban et al,⁽³¹⁾ 13.3%.

The present study has shown that supra costal PCNL can be safely done in extreme ages of patients 11-20yrs (2%) to 71-80yrs (2%).

Finally overall stone clearance rate in this present study was 88.23% and with ancillary procedure it was 95.33%, our study results of stone clearance rate was similar with other study groups, Kekre et al,⁽²⁶⁾ overall stone free rate 79.5%, Gupta et al,⁽²⁷⁾ 90%, Lojanapiwat,⁽²⁸⁾ 82.4%, Shah et al,⁽²⁹⁾ 88.2%, Sukumar et al,⁽³⁰⁾ 86.4%, and Shaban et al,⁽³¹⁾ 88.9%.

CONCLUSIONS: Supracostal PCNL is a safe procedure with acceptable morbidity. When the puncture site is well planned, keeping it on or lateral to posterior axillary line and performed during expiration, would minimize thoracic complications. Supra costal PCNL has high rate of stone clearance (more than 90%) specially when the stone is complex, burden is in upper pole and stone is of staghorn type. The need for ancillary procedures for complete stone clearance is less. The requirement of multiple tracts and their attendant complications are less with supracostal PCNL. It can be done safely in pediatric as well as elderly population.

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