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Original Article
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Bipolar Cauterization of Access Tract Significant Bleeding during Percutaneous Nephrolithotomy and Its Outcomes

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Abstract

Introduction: *Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure and the gold standard for kidney stone larger than 2cm, complex renal stone and upper ureteric stone. Most of the urologist use nephrostomy tube after standard percutaneous nephrolithotomy for drainage, hemostasis and tract healing purpose. Recently some urologist avoiding this tube placement. Placement of nephrostomy tube may lead to urinary leakage. In Nephrostomy free PCNL, bleeding is one the most serious complication in early post operative period. We perform the bipolar cauterization of significant bleeding point to keep the PCNL tract bloodless. We aimed to evalute the efficacy and safety of bipolar cauterization of tract bleeding during percutaneous nephrolithotomy.*

Materials and Methods: *This study is a prospective study conducted in Metropolitan speciality centre for kidney diseases & urology, Chattagram from March 2023 to March 2025. Total 314 patients underwent supine tubeless PCNL in the form of standard and miniperc. Out of which, in (group-1) 82 cases following standard tubeless PCNL with significant tract bleeding, bipolar cauterization performed following screening of tract. Rest 232 cases (group 2) following tubeless PCNL tract closure done without cauterization due to insignificant bleeding. Two groups were divided on the basis of severity of tract bleeding. We used 24 fr amplatz sheath during standard PCNL. We defined tract site bleeding as, When bleeding starts across the tract and obscure the vision while withdrawing the amplatz sheath after completion of procedure. Bleeding point was checked and cauterized. We used bipolar resectoscope inner sheath assembled with irrigation port and working element with cutting loop/ roller ball for specific cauterization of bleeding point. Bleeding point was checked and cauterized after placement of D-J stent. No use of Nephrostomy tube. All data were collected and statistically analyzed.*

Result: *In demographic characteristics, male was predominate in both group 64.63% vs 65.52% and mean age was 39.82 ± 12.6 vs 42.3±12.81 years. In terms of stone clearance in both group, there is no significant difference. Mean stone size 3.14±1.8 cm vs 3.98±1.5cm. Mean operative time 68.57±15.8 min vs 60.12±13.3 min, Postoperatively 1.21% (1 case) in group 1 where 5.17% (12 cases) in group-2 required blood transfusion. Hospital stay was less in group-1 but statistically not significant. Transient hematuria (within 1st 24 hours) was numerically higher in group-2 but statistically not significant. Minor complications like fever (8.53% vs 12.5%) and urinary tract infection (9.75% vs 9.05%) developed in both both group.*

Conclusion*: Bipolar cauterization of bleeding point in PCNL access tract at the end of the procedure make the tract bleeding less and reduce the hospital stay, analgesic requirement, need of blood transfusion. This modification of bleeding control is safe and effective and provide a more secure procedure.*

Keywords: Percutaneous nephrolithotomy, Bipolar cauterization, Hemostasis

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Introduction

Treatment of urolithiasis depends on site, size and others associated condition. Non obstructing <6mm stones usually does not require surgical treatment [1,2].The goal of surgical stone management is to achieve maximal stone clearance with minimal morbidity to the patient [3,4]. Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure and the gold standard for kidney stone larger than 2cm, complex renal stone and upper ureteric stone. Percutaneous nephrolithotomy is popular due to high stone clearance rate with low morbidity[5,6]. But in comparison with flexible ureteroscopy morbidity is more in case of percutaneous nephrolithotomy[7].

Most of the urologist use Nephrostomy tube after standard Percutaneous nephrolithotomy for drainage, haemostasis and tract healing purpose. But placement of Nephrostomy tube causes discomfort and pain. Now a days tubeless PCNL gaining popularity. Placement of Nephrostomy tube may lead to urinary leakage. In Nephrostomy free PCNL, bleeding is one the most serious complication in early post operative period [8, 9,10]. Different technique use to control PCNL tract bleeding like- pressure compression, haemostatic agent and placement of PCN [11,12]. Bipolar cauterization of selective bleeding point to keep the PCNL tract bloodless may be the good option. Tubeless PCNL following bipolar cauterization confirm blood less tract, short hospital stay, less pain and less analgesia and blood transfusion requirement [13,14].

This prospective study aimed to observe the effectiveness and safety of bipolar cauterization of access tract following standard Percutaneous nephrolithotomy. Safety and effectiveness was measured by drop in hemoglobin level, hematuria, catheterization time, hospital stay and post operative complications. There is no standard procedure to measure per operative blood loss during Percutaneous nephrolithotomy due to use of irrigation fluid.

Materials and methods:

This prospective study conducted in Chattogram metropoliton speciality centre for kidney diseases and urology, Chattogram from March, 2023 to March, 2025. Study population included the patients admitted in metropoliton specialized centre for kidney diseases & urology, Chattogram with kidney stone and upper ureteric stone during the period of study. Patient with stone size more than 2 cm, sterile urine, functioning kidney were included and multiple tract, renal failure, pregnancy, uncontrolled bleeding disorder, associated pyonephrosis, congenital anomalies of kidney and calyceal injury (one) were excluded. Two groups were divided on the basis of severity of tract bleeding.

All the patients were thoroughly examined to assess general condition & concomitant other diseases & advise for hospitalization. All the findings of history, examination and reports of investigations recorded in a data collection sheet prepared for this purpose. Informed written consent obtained from the patients after explanation of the ultimate outcome, complications and purpose of the study. They were informed of their right to withdrawn from the study at any stage. Non contrast CT scan of KUB is a investigation of choice. It is very helpful to detect site, size and density of stone as well as perirenal structure especially colon, liver and spleen.

The modified supine position was employed using a special type of bag made of foam & lather under ipsilateral shoulder and buttock. Under general anesthesia patient was place in dorsal lithotomy position with the ipsilateral hip and knee flexed and the contralateral leg is abducted and supported in an extended position. Ipsilateral arm is supported with flexed elbow over chest. Before positioning, it is important to mark the tip of 12th rib, iliac crest and the posterior axillary line to maintain orientation. After retrograde pyelogram, desired calyceal puncture was performed under fluoroscopic guidance using 18gauge needle & confirmed by spontaneous flow of water or by aspiration. 0.035 hydrophilic guide wire was placed and confirmed position whether it pass into ureter or coiled in calyceal system. 24 fr amplatz sheath was placed after tract dilatation using single shoot fascial dilator. Lithotripsy was done by ultrasonic / pneumatic lithotripter. Fragmented stone was suction out / removed. Stone clearance was confirmed by fluoroscopy. After placing D-J stent, tract was observed for any active bleeding point following gradual withdrawn of amplatz sheath. Hemostasis of active bleeding point was done using bi-polar loop / ball in selected cases. Urethral catheter removed after 24-48 hours. Stitch removedss on 8th post-operative day and checked for wound infection, leakage. Cystoscopic removal of D-J stent was done after 2-3 weeks.

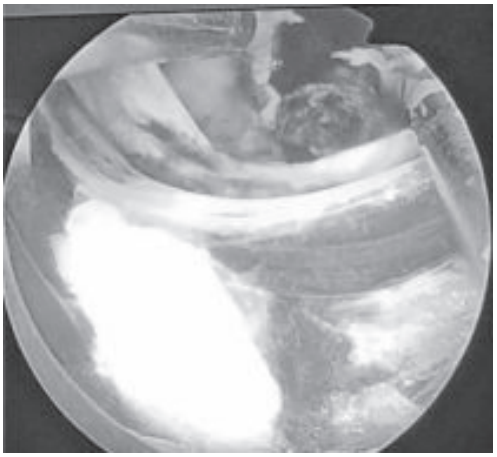

Figure-1: *Selective Bipolar cauterization of tract using bipolar ball.*

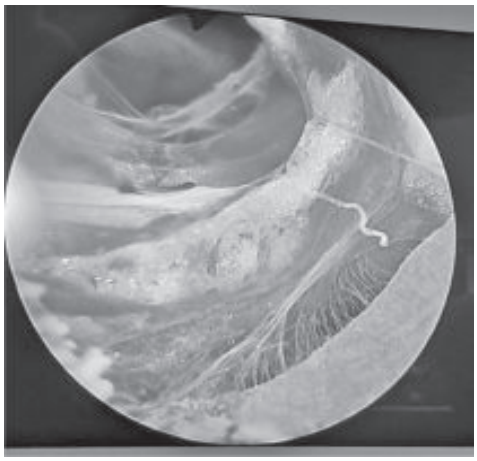

Figure-2: *PCNL tract without active bleeding point.*

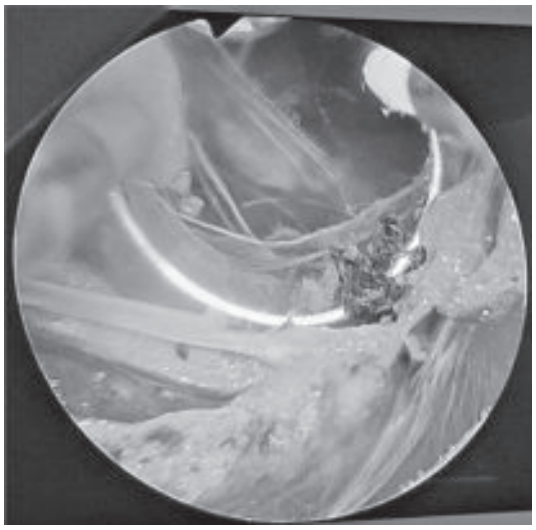

Figure-3: *Cauterization of selective bleeding point using biplor loop.*

Results:

A total 314 patients underwent supine percutaneous nephrolithotomy. Out of which, in 82 cases selective bipolar cauterization was done. Group of was divided on the basis of severity of tract bleeding. In demographic characteristics, male was predominate (64.63% vs 65.52) in both group and mean age was 39.82±12.6 vs 42.3±12.81 years. In terms of stone characteristics, 41 cases were Lt. sided stone (50%) , 33 cases were Rt. sided stone (40.24%) and 8 cases were bilateral stone (9.76%) in group-1 where 107 (46.12%) cases Rt, 110 (47.41%) cases Lt and 15 (6.47%) cases bilateral in group -2. Non stag horn stone (84.15%) and stag horn stone cases were (15.85%) in group-1, where 90.5% non stag horn and 9.5% cases were stag horn stone in group-2. Mean stone size 3.14±1.8 cm in group-1 and 3.98±1.5 cm in group -2.

Table 1: *Demographic Characteristics of patients -*

Variables		Group-A Tubeless PCNL with tract Inspection & cauterization	Group- B Tubeless PCNL without tract inspection & cauterization	P
Sex (80)	Male	53 (64.63%)	152 (65.52%)	0.6
	Female	29 (35.37%)	81(34.38%)	0.3
Age (years)	Range	20 – 75	20 – 77	0.3
	Mean ±SD	39.82 ± 12.6	42.3 ± 12.81	
Co-morbidities	DM	21 (25.6%)	68 (29.3%)	0.3
	HTN	18 (21.95%)	71 (30.6%)	0.3
	COPD	13 (15.85 %)	39 (16.81%)	0.17
Stone Size	Range ,cm	1- 5.25	1- 4.7	0.15
	Mean ±SD	3.14±1.8	3.98±1.5	
Stone side	Right	33 (40.24%)	107 (46.12%)	
	Left	41 (50%)	110 (47.41%)	
	Bilateral	8 (9.76%)	15 (6.47%)	
	Stag horn	13 (15.85%)	22 (9.5%)	0.11
	Non staghorn	69 (84.15%)	210 (90.5%)	0.9

Table II

Per operative and post operative characteristics-

Variables	Group – A Tubeless PCNL with tract inspection & cauterization	Group- B Tubeless PCNL without tract inspection & Cauterization	p value
Puncture (Calyx)			
Lower	61 (74.4%)	142 (61.2%)	
Middle	17 (20.73%)	64 (27.6%)	
Upper	4 (4.87%)	26 (11. 2%)	
Operative time- (Minute)			
Mean	68.57 ± 15.8	60.12± 13.3	0.41
Haematuria (1st 12 hours)	3 (3.65%)	23 (9.9%)	0.082
Blood transfusion (Post-operative)	1 (1.21%)	12 (5.17%)	0.051
Hemoglobin drop (1st 12 hours).	1.21±0.6	2.32±0.9	0.08
Stone clearance	98.87%	98.12%	0.81
Hospital stay (hours)			
Mean	24 ±5.2	48±8.4	0.23
Transient fever	7 (8.53%)	29 (12.5%)	
UTI	8 (9.75%)	21 (9.05%)	
Angio-embolization	0	0	

Mean operative time 68.57±15.8 min group-1 where 60.12±13.3min in group-2. Haematuria within first 12 hours was 3.65% vs 9.9% and hemoglobin drop in group-1 was 1.21±0.6 where 2.32±0.9 in group-2. Blood transfusion in both group were 1.21% vs 5.17%. Stone clearance was 98.87% vs 98.12 % and hospital stay was 24 ±5.2 hours vs 48±8.4 hours. In terms of complications minor complications like fever (8.53% vs 12.5%) and urinary tract infection (9.75% vs 9.05%) developed.

Discussion:

Percutaneous nephrolithotomy is the treatment of choice for large, complex renal stone. Now a days most of the urologist preferred tubeless PCNL, because it offers less pain, less analgesic requirements, shorter hospital stay and decreased cost but post-operative bleeding is concern. Although it is controversial but suppose to have a role of nephrostomy tube as a tamponade. Screening of tract and selective bipolar cauterization of bleeding point provide a bloodless tract, less post operative hemoglobin drop and perirenal hematoma formation with out use of nephrostomy. Tubeless PCNL safe in patient with anticoagulant therapy and chronic kidney disease[15,16].

Patient with intra-operative bleeding due to wrong puncture site, over dilatation of tract may lead to post-operative bleeding. But there is no acceptable method to measure blood loss during PCNL due to use of irrigation fluid. Operative blood loss measured by preoperative and post operative hemoglobin level.

The mean age of patient was 39. 82 ± 12.6 years in group-A where 42.3± 12.8 years in group-B . Male was predominate in both group. Mean stone size was 3.14 ± 1.8 cm in group-A, 3.98± 1.5 cm in group-B and statistically found no significant difference (p>0.05).

Post PCNL, 0.8% patient following tubeless PCNL with tract inspection and cauterization required blood transfusion where 5.17% patient with tubeless PCNL without tract inspection and cauterization required blood transfusion which is almost similar to study conducted by Yun et al [17],de la Rosette et al [18].There was no significant difference of hemoglobin drop in first 12 hours between two group.

Stone clearance rate of both group almost same (98.87 vs 98.12). Higher rate of stone clearance may be due to supine position – beneficial in terms of ergonomics and anesthetics view , suctionable amplatz sheath, instrumental advancement and accustomed with different technique of stone handling.

Mean operative time of group –A patient were 68.57 ±15.8 minute where 60.12± 13.3 minute in group –B. Although statistically not significant , numerically more operative time in group-A may be due to extra procedure of PCNL tract inspection and cauterization. Study conducted by Fazil et al, reported less operative time in tubeless Percutaneous nephrolithotomy [19].

Preoperative completion of 5-7 days course of culture sensitive antibiotic reduce the chance of UTI, sepsis. In this study, post-operative minor complications like fever (8.53% vs 12.5%) and urinary tract infection (9.75% vs 9.05%) observe in both group and treated by conservative treatment according to culture sensitivity. No re-admission was required. No major complications develop during study like pneumothorax, bowel injury, urinoma and urinary leakage. These may be due to pre operative evaluation of CT scan findings, per operative RGP findings for meticulous planning of puncture, dilatation , post operative use of D-J stent and positioning of the patient during the procedure. Incidence of retrorenal colon is less in supine position [20]. Post operative confirmation of distal clearance and placement of D-J stent allow unhindered urinary flow which prevent urine leak as well as formation of urinoma.

Instrumental and technological improvement, avoiding nephrostomy tube reduce post operative pain and hospital stay. Mean hospital stay in this study 24±5.2 hours in group A and 48.51±8.4 hours in group B that is almost similar to study conducted by Chen et al.[21].

Conclusion:

Study showed that selective bipolar cauterization of PCNL access tract is safe, effective technique provide bloodless access tract that leads to shorter hospital stay, less analgesia and blood transfusion requirement.

Limitation of this study:

This is a small size, single center study. Multicenter, large scale study may be considered for further validation.

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Conflict of interest: None

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