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Original Research Article

Predictive Factors for Post-Operative Bleeding in Percutaneous Nephrolithotomy.

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ABSTRACT

Introduction: Post-operative bleeding is a serious complication necessitating prompt attention in Percutaneous Nephrolithotomy (PCNL). A number of factors dictate the severity of post PCNL bleeding. Identification of these risk factors helps prevent the bleeding complication. **Methods:** In this observational cross-sectional study, a total of 126 patients with renal stones >10mm or stag-horn stones underwent PCNL. All the relevant pre- and intra-operative factors were noted and analyzed. Hemoglobin difference between pre- and post-operative levels was considered for the evaluation of blood loss. Univariate and multivariable logistic regression analysis were done. The strength of association was examined using Odds Ratio and 95% confidence intervals derived from the logistic regression. A p value <0.05 was considered statistically significant. **Results:** The mean age of the patients was 31.9 ±4.47 years. The mean drop in hemoglobin was 1.83 ±0.98 gm/dl. Age, stone size, number of tracts, size of Amplatz sheath and number of stones significantly affected the blood loss in univariate analysis. Among the variables mentioned above only the number of stones could maintain the significance in multivariable analysis (p<0.05). Number of stones increase the risk of bleeding post PCNL by 4.4 times. **Conclusion:** Stone size, number of tracts, size of Amplatz sheath and the number of stones significantly affect the blood loss post PCNL. Identification of these risk factors should be considered for minimizing bleeding in PCNL.

Keywords: Bleeding, Percutaneous Nephrolithotomy, Risk factors

INTRODUCTION:

Percutaneous nephrolithotomy (PCNL) has become one of the procedures of choice for the removal of kidney stones measuring two cm or larger.[1] Modifications of PCNL can also be done for the stones less than two cm. However, despite recent advancements, complication rate following PCNL has been reported up to 23.3%.[2] Post PCNL bleeding, immediate or delayed, is one of the most serious complications necessitating prompt attention.[3,4]

Various factors like stone complexity (Guy's Stone Score Grades 3 and 4), prior history of ipsilateral renal stone surgery, intra-operative pelvicalyceal perforation, lower degree of hydronephrosis, low pre-operative hematocrit values, bigger stones, greater parenchymal thickness and longer operative time have all been associated with post PCNL bleeding.[3] Syahputra F A et al., on the other hand, implicates the stone burden as the only influential factor for post PCNL bleeding.[5]

Identification of these risk factors is crucial in minimizing post PCNL bleeding. This study, therefore, aims at identifying the significant predictors for bleeding in patients post PCNL.

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METHODS:

This was an observational cross-sectional study conducted in the Department of Surgery, Lumbini Medical College and Teaching Hospital (LMCTH) over a period of one year from January 2018 to December 2018. Ethical approval was obtained from the Institutional Review Committee (IRC-LMC06-E/018).

The sample size was calculated using the formula, $n \geq \{Z1-\alpha/2\ \sigma/d\}^2$. From a previous study, mean drop in hemoglobin (Hb) was taken as 1.5gm/dl and estimated standard deviation (σ) as 0.4.[3] Taking α=0.005 and estimation error (d)=0.1, the minimum sample size was calculated to be 62.

Symptomatic patients (≥18 years) with renal stones>10 mm or stag horn stones visiting the surgical out-patient department (OPD) were enrolled into the study. All routine pre-operative work up including abdomino-pelvic sonogram and intravenous urography (IVU) were done. Those with urinary tract infection, coagulopathy and under anti-coagulant treatment were excluded. Patients with Hb<10gm% were transfused pre-operatively with fresh/whole blood. Body mass index (BMI) of the patients was calculated.

Patients were admitted a day prior to the surgery. Pre-operative antibiotics were given the night before, according to the hospital protocol. All surgeries were done under general anesthesia. A 5 French (Fr) ureteric catheter (Nidhi Meditech,India) was introduced using 21Fr cystoscope (Karl Storz, Germany) in lithotomy position. A puncture using 18G needle under C-arm guidance (Allengers, India) in prone position was done. Serial dilatation of the track was done using fascial dilators (Cook,Germany). After the placement of Amplatz sheath, a 19 Fr or 21Fr nephroscope (Karl Stortz, Germany) was used depending upon the stone size. The stones were then broken down into pieces using lithotripter (Nidhi Meditech, India). Stones were retrieved with forceps. The time duration of the procedure was limited to 60 minutes according to our hospital protocol.

At the end of the procedure, an 18Fr or a 20Fr tube was placed according to the track size or multiple nephrostomy tubes were kept if multiple tracks were made for the removal of the stone. It was clamped for 24 hours which was released on the first post-operative day. Foley's catheter was continued. We routinely placed double J stent which was removed after three weeks. Hemoglobin level was checked on the first post-operative day. The nephrostomy tube was removed on the third post-operative day.

Hemoglobin level, diabetes, hypertension, BMI, grade of hydronephrosis, previous ipsilateral open surgery, stone size and site were the factors considered pre-operatively. The intra-operative factors analysed were number of tracts, operation time and size of Amplatz sheath. Post operatively, drop in Hb was analyzed.

Hemoglobin difference between pre- and post-operative levels was considered for the evaluation of blood loss. Those below 10gm% were transfused with fresh/whole blood.

All the pre-, intra- and post-operative data were collected in a preformed proforma and entered into Microsoft Excel spreadsheet version 2007. They were then imported to Statistical Package for Social Sciences (SPSS™) software version 16 for statistical analysis. Continuous variables were presented in mean with standard deviation and categorical variables in frequencies and percentages. Univariate and multivariable logistic regression analysis were done. The strength of association was examined using Odds Ratio (OR) and 95% confidence intervals (CI) derived from the logistic regression. A p value <0.05 was considered statistically significant.

RESULTS:

A total of 126 patients (58 males and 68 females) underwent PCNL during the study period. The mean age of the patients was 31.9 years ($\pm$4.47). Patients were categorized according to BMI as normal (n=96), overweight (n=28) and obese (n=2).

The pre- and peri-operative variables were assessed and are shown in Table1.

The mean drop in Hb was 1.83 $\pm$0.98 gm/dl. Twenty-one patients (16.6%) received blood transfusion. All the patients responded to conservative treatment, none requiring angioembolization or other interventions.

All the potential pre- and peri-operative factors affecting blood loss post PCNL were analyzed using binary logistic regression analysis

Table 1. Pre- and peri-operative findings in the study population (N=126).

Variables		Frequency (percentage)
Diabetes mellitus		14 (11.1%)
Hypertension		39 (15.9%)
Previous renal surgery		22 (17.9%)
Degree of hydronephrosis	None	2 (1.6%)
	Grade I	20 (15.9%)
	Grade II	60 (47.67%)
	Grade III	36 (28.6%)
	Grade IV	8 (6.3%)
Stone size	1-2 cm	98 (77.8%)
	>2 cm	28 (22.2%)
Number of access tracts	Single	110 (87.3%)
	Multiple	16 (12.7%)
Size of Amplatz sheath	<20 Fr	98 (77.8%)
	≥20 Fr	28 (22.2%)
Duration of surgery	<30 mins	34 (27.0%)
	≥30-60 mins	92 (73.0%)

(Table 2). Age (p=0.001), stone size (p=0.0001), number of tracts (p=0.023), size of Amplatz sheath (p=0.000), number of stones (p=0.001) were shown to have significant effect on blood loss post PCNL (Table 2). However, among these variables, only the number of stones maintained the significance for post PCNL bleeding in multivariable analysis (p=0.025, OR=4.44, 95% CI: 1.204-16.4). The number of stones was thus shown to increase the risk of bleeding post PCNL by 4.4 times.

DISCUSSION:

PCNL compared to open surgery is associated with lesser hospital stay due to minimal invasive approach.[6] Hence there is a decline in open renal stone surgeries these days at hospitals.[7] But PCNL also bears complications. One of the common complications of PCNL is bleeding which can be managed conservatively most of the time. Arterial bleeding giving rise to arterio-venous fistula or pseudo aneurysms require angiographic embolization. There are numerous studies published that highlight the factors contributing to post PCNL bleeding. But post PCNL bleeding factors are controversial.[6,8,9] Previous ipsilateral open surgery increased the bleeding in a study conducted by Yesil et al., [10] which was not so according to the study by Kukreja et al., [11]. In our study too, there was no increased incidence of bleeding in patients who had undergone previous renal surgery. But our findings cannot be generalized as the number of patients who underwent PCNL post renal surgery were small in number. Factors that contribute to bleeding post PCNL according to Shakhawan HA Said are Guy's stone score grade 3 and 4,past history of same sided open renal stone surgery and intraoperative pelvicalyceal perforation.[3] According to Gok A and Cift A higher stone burden, thick renal parenchyma, longer duration of operation, lower grade of hydronephrosis and lower preoperative hematocrits are associated with post PCNL bleeding.[12] But in our study age, stone size, number of tracts, size of amplatz sheath, and number of stones significantly affected the blood loss post PCNL in univariate analysis (p<0.05). It was the number of stones that showed significance in multivariate analysis as well. In our study, Guy's stone score, intraoperative pelvicalyceal perforation and parenchymal thickness were not taken into account.

Stoller et al. reported 23% of blood transfusion in post PCNL patients which is almost similar to our study.[13] Whereas in a study conducted by Basnet R B the bleeding post PCNL was 2.8% which is much less compared to ours which might be due to stringent inclusion criteria they employed in their study, where they have excluded 43 study patients from their study.[14] Most of the bleeding in post PCNL patients can be managed conservatively and likewise in our study all the patients were managed conservatively. Angioembolization was not required even in a single patient in our study. Tan et al. reported severe bleeding in post PCNL patients with inferior calyx puncture which we cannot justify as the calyceal puncture with post PCNL bleeding was not accounted in our study.[15] It is important to identify the risk factors that can lead to post PCNL bleeding as we can be more alert and proceed with precautions for the same, that can reduce the morbidity and sometimes mortality in the patient. Out of many factors compared in our study it was age, stone size, number of tracts, size of Amplatz sheath and number of stones significantly affecting the blood loss in post PCNL patients.

The present study has a few limitations. The duration of study was short with small sample size. Different surgeons were included in the study and the experience of surgeons in performing PCNL was

Table 2. Univariate analysis of factors affecting blood loss (N=126)

Variables		Without bleeding	With bleeding	P value*
Age group (years)	<40	84 (91.3%)	8 (8.7%)	
	≥40	21 (61.8%)	13 (38.2%)	0.0001
Sex	Male	48 (82.8%)	10 (17.2%)	
	Female	57 (83.3%)	11 (10.2%)	0.873
BMI	18.5-24.9	80 (83.3%)	16 (16.7%)	
	25-29.9	25 (89.3%)	3 (10.7%)	
	≥30	0 (0%)	2 (100%)	0.40
DM 2	No	95 (84.8%)	17 (19.2%)	
	Yes	10 (71.4%)	4 (28.6%)	0.214
Hypertension	No	90 (84.9%)	16 (19.1%)	
	Yes	15 (75%)	5 (25%)	0.281
Previous surgery	No	85 (81.7%)	19 (18.3%)	
	Yes	20 ((90.9%)	2 (9.1%)	0.305
Hydronephrosis grade	0	1 (50%)	1 (50%)	
	1	18 (90%)	2 (10%)	0.169
	2	50 (83.3%)	10 (16.7%)	0.269
	3	30 (83.3%)	6 (16.7%)	0.454
	4	6 (75%)	2 (25%)	0.5
Stone size	10-20 mm	90 (91.8%)	8 (8.2%)	
	>20 mm	15 (53.6%)	13 (46.4%)	0.001
Operation time	<30 mins	32 (94.1%)	2 (5.9%)	
	≥ 30mins	73 (79.3%)	19 (20.7%)	0.065
Number of tracts	Single	95 (86.4%)	15 (13.6%)	
	Multiple	10 (62.5%)	6 (37.5%)	0.023
Size of Amplatz sheath	< 20 Fr	90 (91.8%)	8 (8.2%)	
	>20 Fr	15 (53.6%)	13 (46.4%)	0.0001
Number of stones	Single	83 (90.2%)	9 (9.8%)	
	Multiple	22 (64.7%)	12 (35.3%)	0.001

** p value calculated by binary logistic regression analysis.*

not taken into account. It was a single center study. Blood loss was only determined with Hb difference and no other robust methods.

CONCLUSION:

Age, stone size, number of tracts, size of Amplatz sheath and number of stones significantly affected the blood loss in post PCNL patients. Identification of these risk factors should be considered for the prevention of bleeding post PCNL.

Conflict of interest: Authors declare that no competing interest exists.

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