



Predictors of Bleeding and Transfusion Requirement in Percutaneous Nephrolithotomy: A Retrospective Analytical Study

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Abstract

Background:

Bleeding remains one of the most significant complications of percutaneous nephrolithotomy (PCNL), occasionally necessitating blood transfusion. Identifying predictors of bleeding can improve perioperative planning and patient safety.

Aim:

To evaluate clinical and operative factors predicting significant bleeding and transfusion requirement following PCNL.

Materials and Methods:

A retrospective analytical study was conducted including 100 patients who underwent PCNL between January 2025 and December 2025 at a tertiary care center. All procedures were performed using a standardized surgical technique. Patient demographics, stone characteristics, and operative variables were analyzed. Outcomes included hemoglobin (Hb) drop and transfusion requirement. Statistical analysis was performed using univariate and multivariate logistic regression.

Results:

The mean age was 42.6 ± 13.2 years. Mean stone size was 2.4 ± 0.8 cm. The mean Hb drop was 1.8 ± 0.9 g/dL. Blood transfusion was required in 11% of patients. On univariate analysis, stone size >2.5 cm ($p=0.01$), multiple access tracts ($p=0.003$), operative time >90 minutes ($p=0.002$), and supracostal access ($p=0.01$) were significantly associated with transfusion. Multivariate analysis identified multiple tracts (OR 3.2, $p=0.02$) and prolonged operative time (OR 2.8, $p=0.03$) as independent predictors.

Conclusion:

Multiple access tracts and prolonged operative time are significant independent predictors of bleeding requiring transfusion following PCNL. Careful surgical planning may help reduce complications.

Keywords: PCNL, bleeding, transfusion, predictors, nephrolithiasis

Introduction

Percutaneous nephrolithotomy (PCNL) is the standard treatment for large renal calculi ¹. Despite advances in technique and instrumentation, bleeding remains a notable complication, sometimes requiring blood transfusion or angioembolization ².

The incidence of transfusion after PCNL ranges from 5% to 15%. Various patient-related and intraoperative factors influence bleeding risk ³. Identifying these predictors is essential for optimizing patient outcomes and reducing morbidity ⁴.

This study aims to evaluate predictors of bleeding and transfusion requirement following PCNL using a retrospective cohort.

Materials And Methods

Study Design : Retrospective observational analytical study

Study Duration : January 2025 to December 2025

Sample Size : 100 patients

Inclusion Criteria

- Patients undergoing PCNL for renal calculi
- Age >18 years

Exclusion Criteria

- Coagulopathy
- Incomplete records
- Concurrent procedures

Surgical Technique

All procedures were performed under fluoroscopic guidance using a standardized technique.

Data Collected :

Patient Variables

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Results

- Age, sex, BMI
- Comorbidities
- Preoperative Hb

Stone Variables:

- Stone size
- Staghorn calculus

Operative Variables:

- Number of tracts
- Operative time
- Supracostal access

Outcome Measures:

- Hb drop
- Blood transfusion (Yes/No)

Statistical Analysis

- Continuous variables: Mean ±SD
- Categorical variables: Chi-square test
- Multivariate logistic regression
- p < 0.05 considered significant.

Table 1: Baseline Characteristics

Variable	Value
Mean Age (years)	42.6 ± 13.2
Male/Female	62/38
Mean BMI	25.1 ± 3.4
Mean Stone Size (cm)	2.4 ± 0.8
Staghorn Calculi	18%

Table 2: Operative Variables

Variable	Value
Mean Operative Time	88 ± 22 min
Multiple Tracts	22%
Supracostal Access	19%

Table 3: Outcomes

Outcome	Value
Mean Hb Drop	1.8 ± 0.9 g/dL
Transfusion Required	11%

Table 4: Univariate Analysis (Transfusion Predictors)

Variable	Transfusion (%)	p-value
Stone >2.5 cm	18% vs 6%	0.01
Multiple tracts	23% vs 7%	0.003

Table 5: Multivariate Logistic Regression

Variable	Odds Ratio	p-value
Multiple tracts	3.2	0.02
Operative time >90 min	2.8	0.03

Discussion

This study demonstrates that bleeding and transfusion following PCNL are influenced by both stone-related and operative factors. The transfusion rate of 11% is consistent with previously reported literature 5,6.

Multiple access tracts significantly increase parenchymal injury, leading to higher bleeding risk 7. Similarly, prolonged operative time reflects procedural complexity and correlates with increased vascular injury 8,9.

Although stone size and supracostal access were significant on univariate analysis, they did not remain independent predictors.

Limitations

1. Retrospective design
2. Single-center study
3. Limited sample size

Conclusion

Multiple tracts and prolonged operative time are independent predictors of transfusion following

PCNL. Minimizing tract number and operative duration may reduce bleeding complications.

Ethics Committee Statement

This study was conducted after approval from the Institutional Ethics Committee. Due to the retrospective nature of the study, informed consent was waived.

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