

Predictors of Auxiliary Procedures After Extracorporeal Shock Wave Lithotripsy: A Retrospective Study

Running Title: Predictors of Auxiliary Procedures after ESWL

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Abstract: **Background:** Extracorporeal Shock Wave Lithotripsy (ESWL) is widely used for urolithiasis; however, a subset of patients require auxiliary procedures for definitive clearance. Identifying predictors can aid in optimal patient selection. **Aim:** To evaluate factors predicting the need for auxiliary procedures following ESWL. **Materials and Methods:** A retrospective study was conducted from April 2025 to March 2026 including 100 patients undergoing ESWL for renal or ureteric calculi. Variables analyzed included age, gender, stone size, location, density (HU), and skin-to-stone distance (SSD). Auxiliary procedure was defined as need for ureteroscopy (URS) or percutaneous nephrolithotomy (PCNL) following failed ESWL. **Results:** Out of 100 patients, 20 required auxiliary procedures (20%). Larger stone size (>12 mm), higher density (>1000 HU), lower pole location, and SSD >10 cm were significantly associated with auxiliary intervention ($p < 0.05$). On multivariate analysis, stone size and HU remained independent predictors. **Conclusion:** Stone size and density are strong predictors of ESWL failure requiring auxiliary procedures. Careful patient selection can reduce the need for secondary interventions.

Keywords: ESWL, auxiliary procedures, urolithiasis, predictors, stone density

1. Introduction

ESWL remains a first-line treatment for small to moderate renal and ureteric calculi due to its non-invasive nature¹. However, not all stones fragment adequately, necessitating auxiliary procedures such as ureteroscopy (URS) or percutaneous nephrolithotomy (PCNL)².

Predicting ESWL failure is crucial to avoid repeated ineffective sessions and delays in definitive management. Factors such as stone size, density, location, and patient body habitus have been implicated^{3,4}.

This study aims to identify predictors for auxiliary procedures following ESWL.

2. Materials and Methods

Study Design:

Retrospective observational study

Duration:

April 2025 – March 2026

Sample Size:

100 patients

Inclusion Criteria

- Age >18 years
- Renal or ureteric calculi ≤ 20 mm
- Underwent ESWL

Exclusion Criteria

- Active urinary tract infection

- Pregnancy
- Coagulopathy
- Congenital renal anomalies
- Prior intervention for same stone
- Incomplete records

Data Collection

- Age, gender
- Stone size (mm)
- Location (renal non-lower pole / lower pole / ureter)
- Density (HU)
- Skin-to-stone distance (SSD)

Outcome

Need for auxiliary procedure (URS/PCNL)

Statistical Analysis

- Chi-square test
- Multivariate logistic regression
- $p < 0.05$ significant

3. Results

Table 1: Patient Characteristics

Variable	Value
Mean age	41.8 ± 11.6 years
Male: Female	68:32:00
Mean stone size	12.1 ± 3.4 mm
Mean HU	980 ± 140

Table 2: Overall Outcome

Outcome	Number	Percentage
No auxiliary procedure	80	80%
Required auxiliary procedure	20	20%

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Table 3: Predictors (Univariate Analysis)

Variable	No Aux (n=80)	Aux (n=20)	p-value
Stone size < or =12 mm	60	6	
Stone size >12 mm	20	14	0.001
HU < or = 1000	55	5	
HU >1000	25	15	0.002
Lower pole	18	10	0.01
SSD < or = 10 cm	65	10	
SSD >10 cm	15	10	0.01

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Table 4: Multivariate Analysis

Variable	Odds Ratio	p-value
Stone size >12 mm	3.5	0.01
HU >1000	3.2	0.02
Lower pole	1.8	0.09
SSD >10 cm	1.9	0.08

4. Discussion

This study demonstrates that approximately 20% of patients undergoing ESWL require auxiliary procedures. Larger stones and higher density were the most significant predictors.

These findings are consistent with existing literature emphasizing the role of stone characteristics in determining ESWL outcomes ^{5,6}. Lower pole location and increased SSD also showed association but were not independent predictors.

Identifying such predictors preoperatively can guide clinicians in selecting alternative modalities such as URSL or PCNL in high-risk patients ^{7,8}.

5. Limitations

- Retrospective Design
- Small Sample Size
- Single-Center Study

6. Conclusion

Stone size >12 mm and density >1000 HU are significant predictors of auxiliary procedures after ESWL. Pre-treatment evaluation of these factors can optimize treatment planning.

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Conflicts of Interest: None declared

Ethics Statement:

This study was approved by the Institutional Ethics Committee. Patient confidentiality was maintained. Due to its retrospective nature, informed consent was waived. Patient confidentiality was maintained.

References

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