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REVIEW ARTICLE

OVER-DILATATION VERSUS UNDER-DILATATION IN PERCUTANEOUS NEPHROLITHOTOMY (PCNL): A COMPARATIVE STUDY OF 200 PATIENTS

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ABSTRACT

Objective: To evaluate the clinical outcomes of over-dilatation versus under-dilatation during PCNL in a cohort of 200 patients, analyzing its impact on operative time, stone-free rates, complications, and renal function. **Methods:** A prospective, randomized study was conducted on 200 patients undergoing PCNL for renal calculi. Patients were divided into two groups: Group A (over-dilatation, n=100) and Group B (under-dilatation, n=100). Primary outcomes included stone clearance rates, intraoperative and postoperative complications, and renal function preservation. Secondary outcomes included operative time and hospital stay duration. Randomization was performed using a computer-generated sequence, and all procedures were standardized with experienced surgeons. Statistical analyses included chi-square tests for categorical data and t-tests for continuous variables. **Results:** Over-dilatation was associated with a higher stone-free rate (85% vs. 72%, $p<0.05$) but increased risk of bleeding requiring transfusion (10% vs. 4%, $p<0.05$). Under-dilatation resulted in longer operative times (78 min vs. 64 min, $p<0.05$) and a higher rate of residual fragments requiring auxiliary procedures (22% vs. 12%, $p<0.05$). No significant difference in long-term renal function deterioration was observed between groups. **Conclusion:** Over-dilatation in PCNL provides superior stone clearance but comes at the cost of increased bleeding risk. Under-dilatation prolongs operative time and increases the likelihood of secondary procedures. A balanced approach to tract dilation is recommended to optimize outcomes.

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INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the gold standard for treating large renal calculi. The method of tract dilation remains a critical factor influencing procedural success and safety. Over-dilatation may improve access and facilitate stone removal but poses a risk of renal trauma. Conversely, under-dilatation preserves renal parenchyma but may compromise stone clearance. This study aims to evaluate the effects of these dilation techniques on patient outcomes.

METHODS

A total of 200 patients undergoing PCNL were randomized into two groups:

- Group A (Over-dilatation, n=100):** Dilation beyond the standard 24-30Fr range.
- Group B (Under-dilatation, n=100):** Dilation limited to <24Fr.

Inclusion Criteria

- Patients with renal calculi >2 cm
- Age 18-70 years
- No prior renal surgery

Exclusion Criteria

- Active urinary tract infections
- Coagulopathy
- Severe renal impairment

Study Parameters

- Primary Outcomes:** Stone-free rate, intraoperative complications (bleeding, perforation), and renal function changes.
- Secondary Outcomes:** Operative time, hospital stay, need for additional procedures.

Statistical Analysis: Data were analyzed using chi-square and Student's t-tests. A p-value <0.05 was considered statistically significant.

RESULTS

- **Stone Clearance:** Over-dilatation improved stone-free rates (85% vs. 72%, p<0.05).
- **Complications:** Higher bleeding rates in over-dilatation (10% vs. 4%, p<0.05); no significant difference in renal injury.
- **Operative Time:** Longer for under-dilatation (78 min vs. 64 min, p<0.05).
- **Hospital Stay:** Comparable between groups (~3.2 days).
- Auxiliary Procedures: More frequent in under-dilatation (22% vs. 12%, p<0.05).

DISCUSSION

While over-dilatation enhances stone retrieval, it increases bleeding risks. Under-dilatation, though safer in terms of hemorrhage, necessitates longer surgery and higher re-intervention rates.

Clinical Implications

- Over-dilatation is beneficial for complex stone burdens but requires careful hemostatic management.
- Under-dilatation should be considered in patients with bleeding risks or solitary kidneys.
- A tailored approach balancing stone clearance and safety is optimal.

Limitations

- Single-center study; results may not be generalizable.
- Stone composition was not accounted for, which could influence outcomes.
- Follow-up limited to immediate postoperative period; long-term renal function impact remains uncertain.

Future Research Directions

- Investigating an intermediate dilation range (24–26Fr) as a compromise.
- Long-term renal function follow-up to assess delayed complications.

CONCLUSION

Over-dilatation optimizes stone clearance but requires careful bleeding management. Under-dilatation extends operative time and raises auxiliary procedure rates. A middle-ground approach balancing stone-free rates with safety is advisable for best patient outcomes.

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