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## Combined antegrade with retrograde irrigation increasing clearances rates of stones during PCNL

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### Abstract

**Background:** The increasing incidence of kidney stones globally is linked to evolving lifestyles. Percutaneous Nephrolithotomy (PCNL) has emerged as a safe and effective treatment for renal stones, relying on continuous irrigation to enhance visibility and remove stone fragments and blood clots. The effectiveness of PCNL can be influenced by factors such as the type, pressure, speed, and volume of irrigation fluids, which may impact renal function during the procedure. Operative vision clarity, stone washout efficiency, native CT scan stone clearance, operation duration, stone clearance percentage, postoperative temperatures, blood transfusions, time until patient walking, and nephrostomy removal time were compared.

**Method:** In this study, 44 patients undergoing PCNL for kidney stone removal were randomly assigned into two groups: Group I, using antegrade irrigation only, and Group II, employing a combined antegrade and retrograde approach via a ureteric catheter. Patients were monitored for various parameters including operative vision, stone washout, stone clearance (assessed by native CT scan), operation time, stone clearance percentage, postoperative temperatures, blood transfusion necessity, patient mobility post-surgery, and nephrostomy removal time.

**Results:** indicated that Group II (Combined irrigation) had a clearer vision during the operation compared to Group I (antegrade only). The operation time was shorter in Group II, ranging from 23 to 45 minutes, whereas Group I operations lasted between 30 to 60 minutes. Stone clearance was higher in Group II at 99%, compared to 96% in Group I. Additionally, stone washout occurred more rapidly in the combined group.

**Conclusion:** Patients with group II have lower duration of surgery, vision is more clear during surgery and stone clearance is more.

**Keywords:** Antegrade, retrograde, irrigation, clearances rates, stones, PCNL

### Introduction

The prevalence of kidney stones has been rising globally, partly due to lifestyle changes, making Percutaneous Nephrolithotomy (PCNL) an increasingly common and effective treatment method. A critical aspect of PCNL is the continuous irrigation of fluid, which serves multiple purposes. Primarily, it clears the visual field by washing out blood, small stone fragments, and debris, thereby maintaining clear visibility during the operation<sup>[1]</sup>. Additionally, irrigation helps control the intrarenal pressure, which is essential for preventing complications like fluid absorption or renal pelvis rupture<sup>[2]</sup>. Regarding the types of irrigation fluids, Normal saline is frequently used due to its isotonic nature, reducing the risk of hemolysis or electrolyte imbalances<sup>[3]</sup>. Although distilled water is an option, it carries a higher risk of complications such as hemolysis<sup>[4]</sup>. The technique of irrigation varies: Antegrade irrigation employs a water tank or pump placed above the patient's level, usually around 100cm, connected to the nephroscope. In contrast, Retrograde irrigation involves using a retrograde catheter connected to the irrigation fluid<sup>[5]</sup>. However, the use of irrigation fluid is not without risks. Systemic absorption of these fluids can result in hemodilution, akin to fluid absorption observed in transurethral prostate resection. There have been instances of hyponatremia post-PCNL, prompting recommendations for using normal saline as the irrigation fluid to mitigate such risks. While distilled water is a cheaper alternative, it has a higher potential for causing hyponatremia. Moreover, the temperature of the irrigation fluid is crucial, with room temperature fluids being preferred to avoid hypothermia during the procedure<sup>[6]</sup>.

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## Method

This study, conducted between January 2023 and January 2024, involved 44 female patients with left kidney calculi, recruited from three endourology centers in Baghdad: Al Yarmook Teaching Hospital, Al Karama Teaching Hospital, and Al Zaiton Private Hospital. The patients were selected based on specific criteria: female gender, normal preoperative serum sodium levels, renal function, complete blood count, and a CT scan performed at least one day before surgery. Additionally, eligible patients had left renal stones larger than 2 cm, located in the renal pelvis or lower pole, and were medically fit for anesthesia. All participants provided informed consent before inclusion in the study. Normal saline was used as the irrigation fluid for all procedures. The patients were divided into two equal groups for the study. In Group I, antegrade irrigation was used exclusively, with water supplied by gravity from a tank through the port of the nephroscope. Group II underwent a combination of antegrade irrigation via the nephroscope and retrograde irrigation through a 9 Fr ureteric stent. The study monitored several parameters: the clarity of the visual field during the operation, operative time (from the first incision to suturing), stone washout effectiveness, postoperative fluid extravasation, the necessity and fixation of JJ stents, and stone clearance as

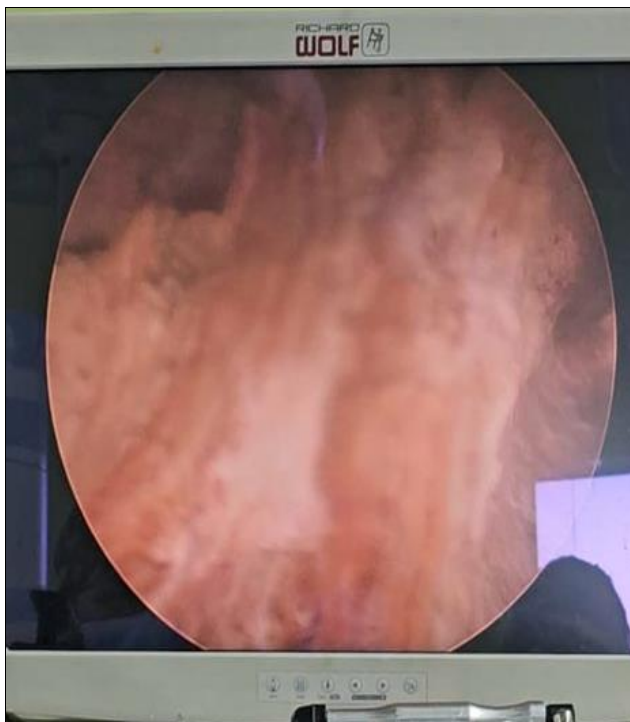
confirmed by postoperative native CT scans. Additional monitoring included postoperative body temperature, timing of nephrostomy removal, and the duration of hospital stay post-surgery. This methodology aimed to compare the effectiveness and outcomes of the two different irrigation techniques in PCNL for large left renal stones in women.

## Results

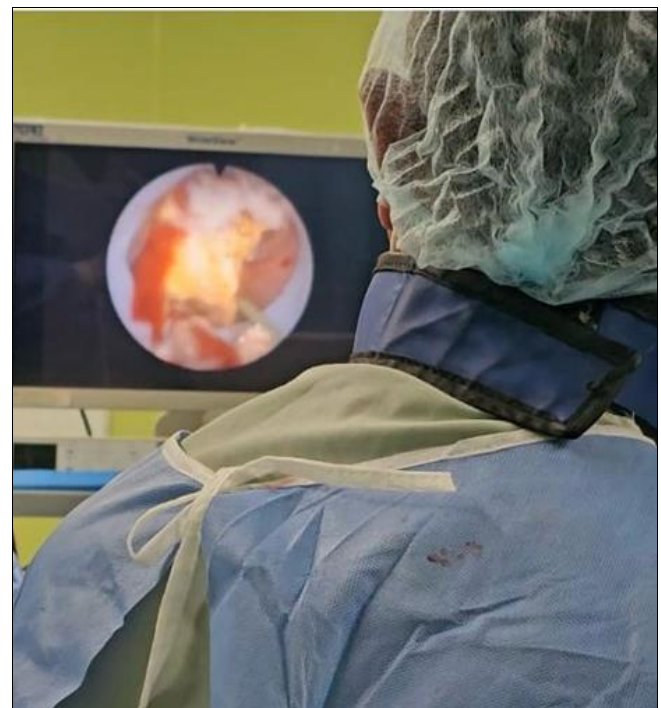
1. There is significantly clear vision for the group II.
2. The operative time of group II is shorter.
3. Clearance of the stone are more especially small particles; dust or residual fragment are more on the group II.
4. Less bleeding on the group II.
5. Collection and extravasation of the irrigation fluid are more on the group I.
6. Number of the assistants are more one on the group II to be responsible for continuous irrigation via retrograde catheter.
7. Water irrigation amount used is more on the group II a little bit.
8. Temperature higher on the group I more than group II.
9. Postoperative walk-is good on the group II because less fluids absorbs.

**Table 1:** These results because two ports of irrigation are better than one port irrigation.

Total N.of Patients (44)		
Variables	Antegrade method (22)	Combined method (22)
Vision ( clear )	19 ( 90%)	20 (95%)
Stone washout		More Quick
Clearance ( monitored by native CT scan )	96%	99%
Time of operation	30-60 min	23-45 min
High postoperative Temperature	18 ( 81%)	15 (68%)
Blood transfusions	2( 5%)	No one
Duration of surgery	Longer	Shorter
Nephrostomy Tube Removal Time		Early removal
Fluid Extravasation	More	Less



**Fig 1:** Two ports method



**Fig 2:** One port method



**Fig 3:** Retrograde irrigation by syringe

### Discussions

Our study presents insights into the efficacy of two-port irrigation systems in percutaneous nephrolithotomy (PCNL) operations. We found that utilizing a dual-port system is more advantageous than a single-port approach. This finding aligns with research by Jangid DK *et al.*, who demonstrated that the use of an amplatz sheath significantly decreases the pressure of irrigation fluid, thereby reducing fluid extravasation and absorption in single-port (Antegrade) systems<sup>[8]</sup>. In the context of our study, employing a two-port system eliminates the need to increase irrigation fluid pressure, a common issue in single-port setups. A critical aspect of PCNL stone surgery is the systemic absorption of irrigation fluid, particularly when there is fluid extravasation due to ruptured pelvicalyceal systems (PCS). In our research, we meticulously excluded patients with PCS injuries to mitigate this risk. Interestingly, our findings suggest that the type of irrigant fluid, whether distilled water or normal saline, does not significantly impact the surgery outcome. This is attributed to the shorter operation times and the eliminated necessity to escalate irrigation fluid pressure. We also observed postoperative conditions, noting that the temperature was significantly higher in patients with single-port irrigation, likely due to increased chances of fluid extravasation<sup>[9]</sup>. Our study corroborates this, highlighting the reduced risk in dual-port systems. Another crucial aspect of PCNL operations is the potential need for blood transfusions due to operative bleeding, which is estimated to be required in about 5% of cases. However, our study presents a remarkable finding: none of the patients undergoing the dual-port approach required blood transfusions. This can be attributed to better surgical visibility, reduced bleeding, and shorter operation durations in the two-port system<sup>[9]</sup>.

### Conclusion

Our research adds to the growing body of evidence supporting the efficiency and safety of two-port irrigation systems in PCNL procedures. These findings are crucial for enhancing patient outcomes and reducing operative complications.

### Conflict of Interest

Not available

### Financial Support

Not available

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