



Original Article

## Comparative Outcomes of Percutaneous Nephrostomy and Double-J Ureteral Stenting in Pyonephrosis: A Retrospective Cohort Study of 200 Patients at a Tertiary Care Centre

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### ABSTRACT

**Background:** Pyonephrosis is a life-threatening infection of the obstructed renal collecting system requiring urgent drainage. Percutaneous nephrostomy (PCN) and double-J (DJ) stenting are the two primary decompression modalities, but comparative outcomes remain debated.

**Objective:** To compare the efficacy, safety, time to infection resolution, and patient-reported discomfort between PCN and DJ stenting in pyonephrosis.

**Methods:** A retrospective cohort of 200 adults with radiologically confirmed pyonephrosis managed between 2018–2024 was analyzed. Patients underwent either PCN (n=98) or DJ stenting (n=102). Primary outcome: time to clinical resolution. Secondary outcomes: complications, technical success, length of stay, and patient discomfort (VAS).

**Results:** Clinical success was similar between PCN and DJ stenting (95.9% vs 94.1%, p=0.62). PCN demonstrated marginally faster infection resolution ( $2.8 \pm 1.2$  vs  $3.3 \pm 1.4$  days; p=0.07). Pain scores favored DJ stenting (VAS 3.1 vs 5.6; p<0.001). Complication rates and length of hospital stay showed no significant differences.

**Conclusions:** PCN and DJ stenting remain safe and effective drainage modalities. PCN provides a clinically relevant trend toward faster infection control, while DJ stenting results in higher patient comfort. Modality selection should be individualized.

**Keywords:** Pyonephrosis; Percutaneous nephrostomy; Ureteral stent; Obstruction; Emergency drainage; Urosepsis.

### INTRODUCTION

Pyonephrosis—the accumulation of purulent fluid in an obstructed renal collecting system—is one of the true emergencies in urologic practice [14, 15]. Driven most frequently by obstructing ureteral calculi, strictures, or malignancies, this condition can rapidly deteriorate into systemic urosepsis and irreversible renal damage if the infected system is not swiftly decompressed [10]. For decades, the fundamental tenet of management has been immediate surgical drainage, achieved either through antegrade percutaneous nephrostomy (PCN) or retrograde double-J (DJ) ureteral stenting [1, 12].

[Insert Clinical/Anatomical Diagram Here]

Despite universal agreement on the necessity of drainage, the choice between PCN and DJ stenting remains a complex clinical calculation, balancing physiological efficiency against patient experience [2, 13]. PCN offers a direct, large-caliber external escape route, which mechanically favors the evacuation of thick, viscous pus [5]. On the other hand, DJ stenting provides immediate internal drainage, liberating the patient from the psychological and physical burdens of an external tube [8, 17].

While previous literature confirms that both modalities prevent sepsis and restore flow [4, 16], the subtle but critical differences in infection resolution timelines and patient tolerability are often what drive a surgeon's decision in the emergency department. By analyzing a large, contemporary cohort of pyonephrosis patients, this study seeks to move beyond basic efficacy, exploring how these two drainage methods perform in terms of real-world recovery and patient comfort to help guide nuanced, individualized care.

## METHODS

### Study Design

A retrospective cohort study was conducted utilizing the electronic medical records of patients treated between 2018 and 2024 at a tertiary urology department.

### Inclusion & Exclusion Criteria

Patients were included based on the following criteria:

- Age  $\geq$  18 years
- Radiologically confirmed hydronephrosis with debris or fluid-fluid levels indicative of purulence
- Clinical and laboratory evidence of active infection (fever, leukocytosis, elevated CRP)
- Identified obstructive etiology (e.g., calculi, malignancy, stricture)
- Underwent either PCN or DJ stenting as the primary initial drainage modality.

Exclusion criteria included non-infective hydronephrosis, prior drainage within the same infectious episode, pregnancy, and incomplete clinical documentation.

### Outcome Measures

- **Primary Outcome:** Time to infection resolution, captured as the number of days to sustained clinical defervescence combined with the normalization of white blood cell (WBC) count and C-reactive protein (CRP).
- **Secondary Outcomes:** Technical success, procedural time, immediate drainage output, complication rates (Clavien–Dindo classification), need for secondary drainage, length of hospital stay (LOS), and patient-reported pain/discomfort (Visual Analog Scale, VAS) evaluated prior to discharge.

### Statistical Analysis

Continuous variables are presented as means  $\pm$  standard deviations (SD) and were evaluated using the independent Student's t-test. Categorical variables are reported as frequencies and percentages, analyzed via the Chi-square test or Fisher's exact test where appropriate. A p-value of  $< 0.05$  was considered statistically significant.

## RESULTS

From an initial pool of 247 screened records, 47 patients were excluded (32 due to non-infective obstruction, 15 for incomplete data). The final analysis included 200 patients: 98 (49%) managed with PCN and 102 (51%) managed with DJ stenting. The two cohorts were statistically well-matched regarding baseline demographics, comorbidity profiles, and stone characteristics, ensuring a fair comparison (Table 1).

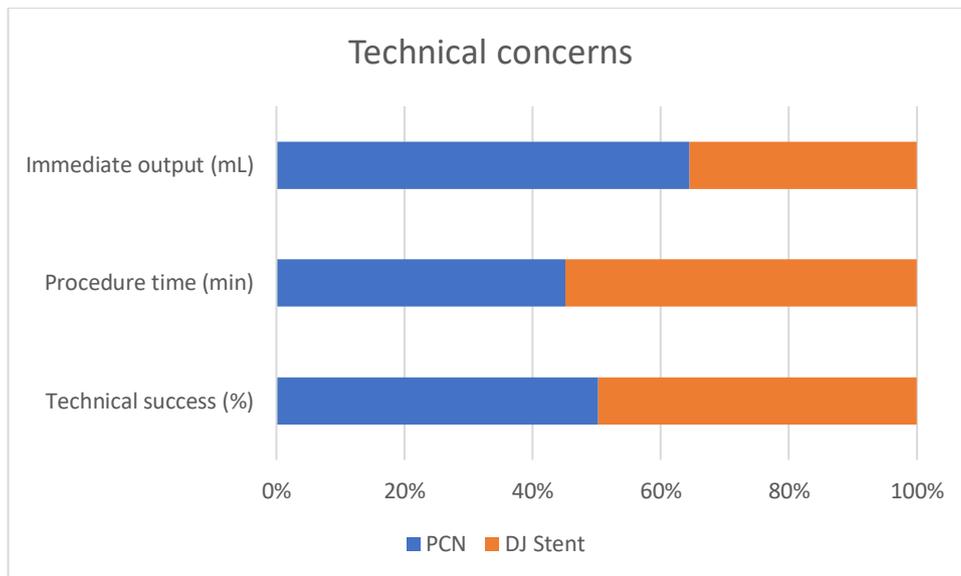
**Table 1. Baseline Characteristics**

Variable	PCN (n=98)	DJ Stent (n=102)	p-value
Age (years)	53.4 $\pm$ 12.8	52.7 $\pm$ 13.1	0.68
Male (%)	57.1	55.8	0.84
Diabetes (%)	36.7	34.3	0.72
Stone-related obstruction (%)	81.6	79.4	0.69
Stone size (mm)	9.8 $\pm$ 4.2	10.1 $\pm$ 4.5	0.59

Both interventions proved highly reliable, with technical success rates exceeding 97% across the board (p=0.74). Notably, PCN was performed significantly faster and yielded vastly larger volumes of immediate purulent output compared to retrograde stenting, highlighting its rapid mechanical efficiency (Table 2).

**Table 2. Procedural Metrics**

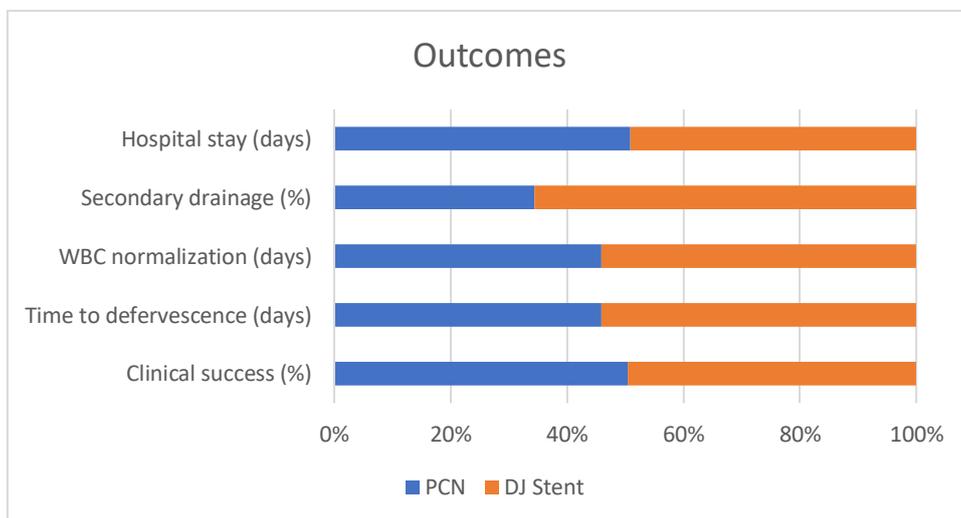
Outcome	PCN	DJ Stent	p-value
Technical success (%)	98.0	97.1	0.74
Procedure time (min)	17.4 $\pm$ 4.8	21.2 $\pm$ 5.1	$<0.001$
Immediate output (mL)	185 $\pm$ 82	102 $\pm$ 54	$<0.001$



While both modalities achieved equivalent overall clinical success, patients in the PCN group trended toward an accelerated recovery. Defervescence occurred roughly half a day sooner in the PCN group (2.8 vs. 3.3 days,  $p=0.07$ ), with a similar trend mirrored in WBC normalization ( $p=0.09$ ). Despite this, the total duration of hospital stay and the subsequent need for secondary drainage procedures showed no significant difference between the two approaches (Table 3).

**Table 3. Clinical Outcomes**

Outcome	PCN	DJ Stent	p-value
Clinical success (%)	95.9	94.1	0.62
Time to defervescence (days)	2.8 ± 1.2	3.3 ± 1.4	<b>0.07</b>
WBC normalization (days)	3.4 ± 1.1	4.0 ± 1.5	<b>0.09</b>
Secondary drainage (%)	3.1	5.9	0.32
Hospital stay (days)	5.8 ± 2.1	5.6 ± 2.3	0.64

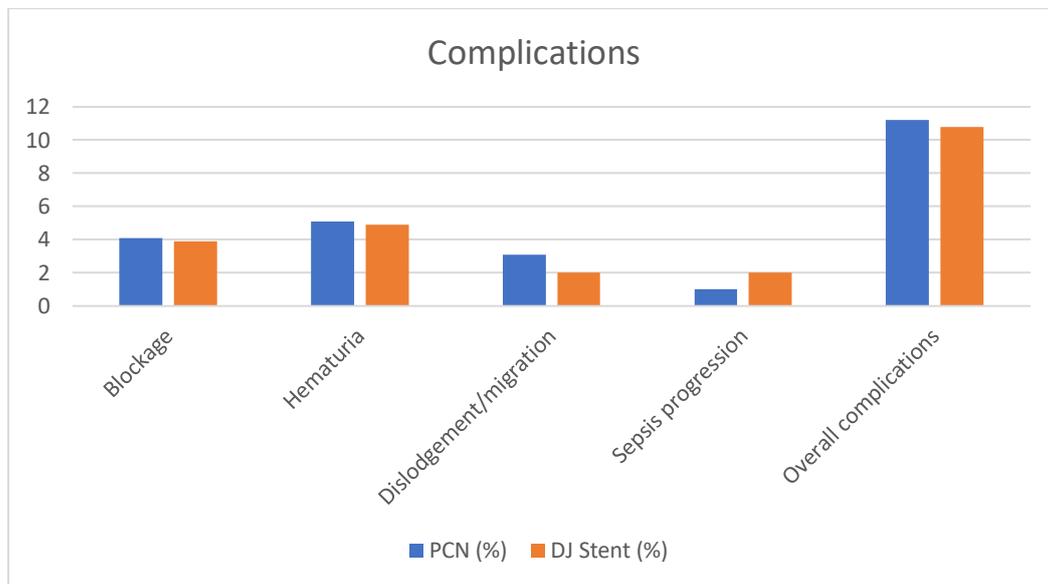


From a safety standpoint, the modalities were indistinguishable; overall complication rates hovered around 11% for both groups. However, the patient experience diverged sharply. Those managed with internal DJ stents reported dramatically lower pain and discomfort scores prior to discharge compared to those tethered to a nephrostomy tube (VAS 3.1 vs 5.6;  $p<0.001$ ) (Table 4).

**Table 4. Complications**

Complication	PCN (%)	DJ Stent (%)	p-value
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Blockage	4.1	3.9	0.94
Hematuria	5.1	4.9	0.92
Dislodgement/migration	3.1	2.0	0.61
Sepsis progression	1.0	2.0	0.54
Overall complications	11.2	10.8	0.91



## DISCUSSION

The acute management of pyonephrosis presents a high-stakes clinical scenario where the primary goal is undeniable: immediately decompress the infected, obstructed renal unit. Our findings in this 200-patient cohort reaffirm the foundational consensus that both percutaneous nephrostomy and retrograde double-J stenting are exceptionally effective and safe tools for achieving this goal, boasting clinical success rates over 94% and complication rates around 11% [1, 4, 7, 16]. However, by looking closer at the nuances of recovery timelines and patient quality of life, a distinct profile emerges for each modality.

From a purely physiological and anatomical standpoint, PCN demonstrates a slight but distinct advantage in rapidly clearing infection. In our cohort, patients treated with PCN showed a clinically meaningful trend toward faster defervescence and earlier normalization of white blood cell counts. This makes intuitive sense when considering the physics of drainage. Thick, highly viscous purulent material flows poorly through the narrow lumen of a long double-J stent [1, 5, 12]. A nephrostomy tube, by contrast, offers a shorter, wider, and more direct external exit route. Furthermore, the antegrade approach of a PCN minimizes the risk of retrograde ureteral manipulation. When placing a DJ stent from below, the passage of guidewires and the injection of contrast can transiently spike intrarenal pressure, risking pyelovenous backflow and pushing infected urine further into the systemic circulation [2, 3, 9]. The fact that PCN procedures in our study yielded nearly double the immediate purulent output confirms its superior initial decompressive power.

Yet, medicine is not solely about physiological mechanics; it is deeply intertwined with the human experience of the patient. Here, the double-J stent proved unequivocally superior. Waking up from a procedure with an external tube protruding from the flank—often leaking, requiring constant dressing changes, and severely restricting movement—takes a heavy psychological and physical toll. Our data reflected this reality, with PCN patients reporting significantly higher pain and discomfort scores (VAS 5.6) compared to those with an entirely internal stent (VAS 3.1). While DJ stents are not without their own morbidities, such as transient hematuria or lower urinary tract symptoms, these side effects are generally well-tolerated and allow the patient to maintain a much higher degree of dignity, comfort, and ambulatory independence during their recovery [8, 17, 18].

Interestingly, the marginally faster infection clearance provided by PCN did not translate into a shorter hospital stay. Length of stay (averaging 5.6 to 5.8 days) was virtually identical between the two groups. This suggests that while a nephrostomy might drain pus more efficiently, the timeline for a patient to feel well enough to go home is dictated by the systemic timeline of urosepsis recovery and the management of underlying comorbidities, rather than the "plumbing" alone [6, 10, 11].

Ultimately, our findings suggest that the choice of drainage should be an exercise in tailored medicine rather than a rigid algorithmic rule. For the patient presenting in extremis—hemodynamically unstable, septic, or with imaging suggesting a massively dilated kidney full of dense debris—PCN is likely the most prudent choice to gain rapid, low-pressure source control [12]. Conversely, for the relatively stable patient with a smaller obstructing stone who places a high value on postoperative comfort and mobility, DJ stenting is not just an acceptable alternative, but likely the preferred one [13]. The primary strength of this study lies in its relatively large cohort and the deliberate inclusion of patient-reported comfort metrics, offering a holistic view of the treatment outcomes. However, the retrospective design inherently introduces selection bias; the unmeasured variables that led a surgeon to choose PCN over a DJ stent in the middle of the night cannot be perfectly controlled for. Future prospective, randomized trials would be invaluable in definitively confirming the physiological benefits of PCN over stenting in severe cases.

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## CONCLUSION

Percutaneous nephrostomy and retrograde double-J stenting are both robust, highly successful interventions for the emergent decompression of pyonephrosis. PCN offers a mechanical advantage, draining purulence more rapidly and demonstrating a trend toward faster clinical resolution of infection. However, DJ stenting provides a vastly superior patient experience by avoiding the pain and burden of an external tube, without prolonging hospital stay. Urologists should lean into these distinct profiles, individualizing their approach based on the severity of the patient's sepsis, the physical characteristics of the obstruction, and the patient's capacity to tolerate external drainage.

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