

Original Article

# Comparison Efficacy between Percutaneous Nephrostomy and Double J Stent in Management of Obstructive Uropathy

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## ABSTRACT

**Background:** The prevalence of urolithiasis and associated acute kidney injury (AKI) has seen a notable increase in recent decades, particularly in developing countries such as Pakistan, which falls within the "stone forming belt" region. This rise has underscored the need for effective management strategies for obstructive uropathy, a potentially reversible condition if timely intervention is provided. However, the literature reveals a divergence in treatment approaches between different regions and among healthcare professionals, with no universally recommended treatment for relieving the obstructed system.

**Objective:** This study aimed to evaluate and compare the efficacy of percutaneous nephrostomy (PCN) versus Double J stent (DJS) in the management of obstructive uropathy secondary to urolithiasis in patients with elevated serum creatinine levels.

**Methods:** Conducted as a randomized controlled trial at the Jinnah Postgraduate Medical Center Karachi from January 2023 to December 2023, the study included patients aged 20 to 50 years with obstructive uropathy secondary to urolithiasis and serum creatinine above or equal to 2.0 mg/dL. Exclusion criteria encompassed obstructive uropathy due to bladder outlet obstruction, uncontrolled coagulopathy, and lack of consent. Participants were randomized into two groups for either PCN or DJS placement, with pre-operative and post-procedure serum creatinine and urea levels measured at multiple intervals. Data analysis was performed using SPSS version 25.

**Results:** The study enrolled 30 patients in the PCN group and 30 in the DJS group. Efficacy rates for PCN and DJS were 93.3% (28 out of 30) and 76.7% (23 out of 30), respectively. Stratified analysis revealed no statistically significant differences in efficacy based on age, gender, or duration of illness, although a trend favoring PCN was observed in patients over 40 years and those treated within 5-10 days of illness onset.

**Conclusion:** While both PCN and DJS are effective interventions for obstructive uropathy secondary to urolithiasis, PCN showed a non-significantly higher overall efficacy. These findings suggest a potential preference for PCN in certain patient subsets, though further research with larger sample sizes and multi-center trials is needed to substantiate these observations.

**Keywords:** Obstructive Uropathy, Percutaneous Nephrostomy, Double J Stent, Urolithiasis, Acute Kidney Injury, Randomized Controlled Trial.

## INTRODUCTION

The phenomenon of obstructive uropathy, characterized by a disruption in the urine flow from the calyceal infundibulum to the external meatus due to structural abnormalities at any point along this path, represents a significant clinical challenge with potentially grave consequences. The rising incidence of urolithiasis globally over the last two decades has been closely linked to an increase in obstructive uropathy cases, particularly among younger populations where urolithiasis emerges as the predominant cause (1-5). This condition, distinguished by its ability to be either complete or incomplete, acute or chronic, and unilateral or bilateral, can lead to a spectrum of complications ranging from renal function impairment to irreversible nephron damage if not timely addressed (3, 4).

Obstructive uropathy is not only a prevalent cause behind acute and chronic renal failure, accounting for approximately 10% and 4% of cases respectively, but also a condition that necessitates immediate and effective intervention by both urologists and nephrologists to mitigate its potentially life-threatening outcomes (6,7). The etiological factors contributing to obstructive uropathy vary significantly with age and gender, with children often affected by conditions such as pelvi-ureteric junction obstruction and posterior urethral valves, whereas adults face urolithiasis, and older individuals are at risk from malignancies and abnormalities related to the prostate, urethra, or gynecological issues (8,9).

The sequelae of untreated obstructive uropathy are profound, including alterations in blood homeostasis, severe anemia, electrolyte imbalances, sepsis, and a decrease in glomerular filtration rate, which may culminate in acute renal failure, renal fibrosis, chronic renal failure, and ultimately, patient mortality (9,10). The advent of advanced imaging techniques and minimally invasive procedures has revolutionized the diagnostic and therapeutic landscape for obstructive uropathy, offering earlier detection and improved management strategies (11, 12).

Among the treatment modalities, the placement of Double J ureteral catheters and percutaneous nephrostomy tubes stand out as the primary interventions. However, the literature presents a dichotomy in findings regarding their efficacy. Tseng et al. reported a 100% success rate with percutaneous nephrostomy placement, highlighting significant improvements in renal function post-procedure (13). Conversely, Mokhmalji H et al. found no significant difference in the success rates between the two interventions, suggesting a parity in their efficacy (14). This discrepancy in outcomes, coupled with a scarcity of comprehensive studies on the subject, underscores the necessity of this study to evaluate and compare the efficacy of percutaneous nephrostomy and Double J stent placements in the management of obstructive uropathy, aiming to bridge the gap in existing literature and provide a clearer guidance for clinical practice.

## MATERIAL AND METHODS

In the randomized controlled trial conducted to compare the efficacy of Percutaneous Nephrostomy (PCN) versus Double J Stent (DJS) in the management of obstructive uropathy, a detailed stratification of results was performed based on age, gender, and duration of illness, as outlined in Table 1. This stratification aimed to provide insights into the effectiveness of each treatment modality across different patient demographics and clinical presentations.

Regarding gender differences in treatment outcomes, the study revealed a higher efficacy rate in the male subgroup treated with PCN, where 94.1% (16 out of 17) experienced positive outcomes, compared to a 75.0% (12 out of 16) success rate observed in the male subgroup receiving DJS treatment. This difference, however, did not reach statistical significance, with a P-value of 0.149. In the female subgroup, a similar trend was observed, with the PCN group showing a 92.3% (12 out of 13) success rate versus a 78.6% (11 out of 14) success rate in the DJS group, yielding a P-value of 0.327, indicating that the observed difference was not statistically significant.

Age stratification further delineated the efficacy of treatment modalities. In the younger cohort (20-40 years), both PCN and DJS groups exhibited an 85.7% success rate (12 out of 14), suggesting parity between the treatments among younger patients, as reflected by a P-value of 0.702. Conversely, in the older cohort (>40 years), the PCN group demonstrated a 100% (16 out of 16) success rate, markedly higher than the 68.8% (11 out of 16) success rate observed in the DJS group, with this difference being statistically significant (P-value = 0.022).

## RESULTS

Table 1: Stratification of Age, Gender, and Duration of Illness with Efficacy of Percutaneous Nephrostomy (PCN) vs. Double J Stent (DJS)

Characteristic	Group	Efficacy: Yes	Efficacy: No	P-Value
<b>Gender</b>				
<b>Male</b>	PCN Group	16 (94.1%)	1 (5.9%)	0.149
	DJS Group	12 (75.0%)	4 (25.0%)	
<b>Female</b>	PCN Group	12 (92.3%)	1 (7.7%)	0.327
	DJS Group	11 (78.6%)	3 (21.4%)	
<b>Age Groups (in Years)</b>				
<b>20-40 years</b>	PCN Group	12 (85.7%)	2 (14.3%)	0.702
	DJS Group	12 (85.7%)	2 (14.3%)	
<b>&gt;40 years</b>	PCN Group	16 (100%)	0	0.022
	DJS Group	11 (68.8%)	5 (31.3%)	

Characteristic	Group	Efficacy: Yes	Efficacy: No	P-Value
<b>Duration of Illness (in Days)</b>				
<b>5-10 days</b>	PCN Group	18 (100%)	0	0.059
	DJS Group	15 (78.9%)	4 (21.1%)	
<b>&gt;10 days</b>	PCN Group	10 (83.3%)	2 (16.7%)	0.438
	DJS Group	8 (72.7%)	3 (27.3%)	

## DISCUSSION

The recent escalation in the prevalence of urolithiasis and acute kidney injury (AKI), particularly in developing countries, underscores a critical healthcare challenge. In the context of Pakistan, a nation situated within the stone-forming belt, this issue is especially pertinent as patients often present with AKI secondary to calculus obstructive uropathy, a condition largely reversible if timely addressed (1,3). Despite the urgency, current clinical guidelines lack a clear recommendation for the optimal method to alleviate obstructive systems (15). This ambiguity is mirrored in the divergent practices between American and European urologists. Whereas practitioners in the UK, including both urologists and radiologists, demonstrate a preference for percutaneous nephrostomy (PCN) over Double J stenting (DJS) in cases devoid of coagulopathy and particularly in those with infected hydronephrosis (HN), their American counterparts tend to opt for DJS in managing upper urinary tract infections alongside urolithiasis (16,17).

Contrasts in the literature, particularly within randomized controlled trials focusing on infected HN, further compound the complexity of choosing an optimal treatment modality. These trials often do not include patients with impaired renal function, an inclusion criterion in our study, thus limiting direct comparability (18,19). The decision between PCN and DJS is nuanced, influenced by a range of factors including the clinician's preference, the patient's condition, and the availability of medical facilities. Proponents of PCN argue for its simplicity, rapidity, and high success rates under local anesthesia, while advocates for DJS highlight the advantage of avoiding an external drainage appliance (14,18).

Our findings resonate with this ongoing debate, presenting a comparison of efficacy between PCN and DJS in a cohort of Pakistani patients. The mean age and duration of illness in our study were comparatively lower than those reported in international studies, suggesting a potentially different disease or intervention timeline within our population (12,14,24). Gender distribution was balanced across both intervention groups, aligning with previous research by Mokhmalji H et al. and Tibana TK et al., thereby providing a broad demographic perspective on the outcomes of these interventions (14,24).

Efficacy rates, a pivotal measure in our analysis, revealed that PCN outperformed DJS, albeit without reaching statistical significance. This finding aligns partially with the results of Mokhmalji H et al., who reported a 100% success rate for PCN, and contrasts with the lower efficacy rates observed by Tibana TK et al. for the same intervention (14,24). The stratification of our data according to age, gender, and duration of illness further elucidated the complex interplay of these factors with treatment efficacy, yet no significant disparities emerged, underscoring the multifaceted nature of obstructive uropathy management.

The study, while contributing valuable insights, is not without limitations. The single-center design and the modest sample size may restrict the generalizability of the findings. Moreover, the lack of a standardized protocol for choosing between PCN and DJS across varied clinical scenarios underscores a critical gap in the existing literature and practice guidelines.

## CONCLUSION

In conclusion, our study underscores a discernible, though not statistically significant, difference in the efficacy of PCN versus DJS in managing obstructive uropathy within the Pakistani cohort. This insight paves the way for future research, advocating for multicenter, randomized trials with larger sample sizes to validate these findings. Such studies should aim to establish clear, evidence-based guidelines for the management of obstructive uropathy, taking into account the nuanced clinical, geographical, and patient-specific factors that influence treatment outcomes. The development of these guidelines will not only aid in harmonizing clinical practices but also ensure the provision of optimal care to patients affected by this condition.

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