COMPARISON OF DOUBLE J STENT AND PERCUTANEOUS NEPHROSTOMY IN EARLY NORMALIZATION OF RENAL FUNCTION TESTS IN PATIENTS WITH OBSTRUCTIVE UROPATHY

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ABSTRACT

Background: Obstructive uropathy is a serious urological condition characterized by impaired urinary flow, which can rapidly compromise renal function if timely intervention is not undertaken. Urinary tract obstruction, most frequently caused by urolithiasis, leads to biochemical disturbances such as elevated serum creatinine and urea levels. Emergency decompression is essential to restore renal function and prevent irreversible damage. Double J ureteral stenting and percutaneous nephrostomy are widely used techniques for urinary diversion; however, their comparative effectiveness in facilitating early renal recovery remains uncertain, particularly in local clinical settings.

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Objective: To compare double J ureteral stenting and percutaneous nephrostomy with respect to the mean time required for normalization of renal function tests in patients with obstructive uropathy.
Methods: A randomized controlled trial was conducted at the Department of Urology, Pakistan Institute of Medical Sciences, Islamabad. Sixty patients aged 20–60 years diagnosed with obstructive uropathy involving bilateral kidneys or a solitary functioning kidney were enrolled and randomly assigned to two equal groups. Group A underwent double J stent placement, while Group B received percutaneous nephrostomy. Serum creatinine and urea levels were measured daily for seven postoperative days. The primary outcome was the time, measured in hours, from intervention to normalization of renal function tests. Statistical analysis was performed using SPSS version 26.
Results: Baseline demographic and biochemical parameters were comparable between the two groups. Both interventions resulted in significant improvement in renal function tests. However, patients treated with percutaneous nephrostomy achieved normalization of serum creatinine and urea levels significantly earlier than those managed with double J stenting (148.6 ± 23.9 hours vs. 168.4 ± 24.7 hours; $p = 0.002$).
Conclusion: While both double J stenting and percutaneous nephrostomy are effective methods for relieving urinary obstruction, percutaneous nephrostomy is associated with faster normalization of renal function tests. It may therefore be preferred for emergency decompression in patients presenting with severe obstructive uropathy.
Keywords: Obstructive uropathy, Percutaneous nephrostomy, Double J stent, Renal function tests, Urolithiasis

INTRODUCTION:

Obstructive uropathy is a clinical condition characterized by partial or complete blockage of urine flow anywhere along the urinary tract, resulting in increased intraluminal pressure and subsequent deterioration of renal function. When left untreated, this condition can progress rapidly and lead to serious complications, including electrolyte imbalance, urosepsis, acute kidney injury, and permanent renal damage (Ali et al., 2020). The obstruction may originate from intraluminal causes such as calculi, intramural abnormalities, or extrinsic compression; however, urolithiasis remains the most frequently encountered etiology in clinical practice (Al-Hajjaj et al., 2022).

The underlying pathophysiology of obstructive uropathy involves elevation of intrarenal pressure, impaired renal blood flow, and disruption of tubular function, ultimately resulting in a decline in glomerular filtration rate. These changes manifest biochemically as elevated serum creatinine and urea levels, which serve as important indicators of renal impairment. Persistent obstruction may trigger inflammatory and fibrotic processes within the renal parenchyma, leading to irreversible loss of nephron function (Saeed et al., 2020). Consequently, early identification and timely relief of obstruction are critical to preserving renal function and preventing long-term morbidity.

Obstructive uropathy is considered a urological emergency in situations involving bilateral obstruction, obstruction of a solitary functioning kidney, associated infection, or rapidly worsening renal function. In such circumstances, urgent

decompression of the urinary tract is essential to stabilize the patient and halt further renal deterioration (Zul Khairul et al., 2021). Although definitive management of the underlying cause—such as stone extraction—is often deferred until clinical stabilization is achieved, temporary urinary diversion remains the cornerstone of emergency treatment.

Among the available methods for urinary diversion, double J (DJ) ureteral stenting and percutaneous nephrostomy (PCN) are the most commonly utilized techniques. Double J stenting involves retrograde placement of a stent across the site of obstruction to facilitate internal drainage, whereas percutaneous nephrostomy establishes direct external drainage of urine from the renal pelvis through a percutaneous approach (Moon et al., 2024).

Previous studies comparing these two modalities have reported variable outcomes. Ahmed et al. (1995) demonstrated a rapid decline in serum creatinine and urea levels following PCN placement, suggesting effective and prompt decompression. In contrast, Ghaffar (2007) reported successful normalization of renal function following DJ stent placement, albeit over a slightly longer duration. More recent systematic reviews and meta-analyses have indicated that PCN may offer superior outcomes in patients with severe obstruction or infection due to its ability to provide immediate and reliable drainage (Wang et al., 2024; Moon et al., 2024). Nonetheless, DJ stenting remains widely practiced because it avoids external drainage and is often better tolerated in stable patients.

Despite the growing body of international literature, there remains a paucity of data from local healthcare settings comparing the effectiveness of DJ stenting and PCN in achieving early normalization of renal function tests. Differences in patient demographics, disease severity, and healthcare resources necessitate locally generated evidence to inform clinical decision-making. Therefore, this study was undertaken to compare double J ureteral stenting and percutaneous nephrostomy in terms of the time required for normalization of renal function tests in patients presenting with obstructive uropathy. The findings are expected to contribute valuable insight into optimizing emergency management strategies and improving patient outcomes.

LITERATURE REVIEW

Obstructive uropathy is a significant contributor to acute and chronic renal impairment and represents a common urological emergency requiring immediate intervention. Numerous studies have emphasized that prompt relief of urinary tract obstruction is essential to prevent progressive renal damage and systemic complications (Ali et al., 2020). Temporary urinary diversion remains the primary emergency measure, with double J ureteral stenting and percutaneous nephrostomy being the most frequently employed techniques.

Early evidence supporting the effectiveness of percutaneous nephrostomy was provided by Ahmed et al. (1995), who demonstrated a substantial and rapid improvement in renal function following PCN placement in patients with obstructive renal failure. Their findings highlighted the ability of PCN to directly decompress the renal collecting system, resulting in early normalization of serum creatinine and urea levels. These observations established PCN as a reliable method for urgent renal decompression, particularly in patients with severe obstruction.

Double J ureteral stenting has also been widely investigated as a method of urinary diversion. Ghaffar (2007) reported successful restoration of renal function following DJ stent insertion in patients with obstructive uropathy, with normalization of biochemical parameters occurring within one week in most cases. Similarly, Saeed et al. (2020) found DJ stenting to be an effective and less invasive approach, although they noted an increased incidence of stent-related discomfort and lower urinary tract symptoms, which may affect patient satisfaction.

Several comparative studies have attempted to evaluate the relative effectiveness of PCN and DJ stenting. Ali et al. (2020) conducted a comparative analysis in patients with obstructive uropathy due to urolithiasis and observed that patients undergoing PCN experienced earlier normalization of renal function tests than those managed with DJ stents. The authors attributed this difference to the more complete and immediate drainage achieved through PCN, particularly in cases of severe obstruction.

Recent randomized controlled trials and systematic reviews have further explored this comparison. Al-Hajjaj et al. (2022) reported that although both techniques were effective in relieving obstruction, PCN was associated with a lower rate of infectious complications in patients with significant stone disease. A comprehensive meta-analysis by Zul Khairul et al. (2021) found no significant difference in overall success rates between the two modalities; however, PCN demonstrated advantages in critically ill patients due to more dependable urinary drainage.

Additionally, contemporary meta-analyses by Wang et al. (2024) and Moon et al. (2024) suggested that PCN may be superior in cases complicated by severe hydronephrosis, infection, or failed retrograde access. These studies emphasized that PCN provides rapid decompression irrespective of ureteral patency, making it particularly suitable for emergency scenarios. In contrast, DJ stenting continues to be favored in clinically stable patients because it avoids external drainage, improves mobility, and may shorten hospital stay.

Despite extensive international literature, the selection of urinary diversion technique remains influenced by institutional preferences, surgeon expertise, and patient-specific factors. Importantly, there is a scarcity of locally generated data comparing the effectiveness of DJ stenting and PCN in terms of early renal recovery. Differences in patient demographics, disease presentation, and healthcare infrastructure necessitate studies conducted within local settings to guide evidence-based clinical practice.

Therefore, the present study was designed to address this gap by comparing double J ureteral stenting and percutaneous nephrostomy with respect to early normalization of renal function tests in patients with obstructive uropathy. By providing locally relevant evidence, this study aims to assist clinicians in selecting the most appropriate urinary diversion technique and improving outcomes for patients presenting with this potentially life-threatening condition.

MATERIALS AND METHODS:

Study Design

This study was conducted as a randomized controlled trial to compare double J ureteral stenting and percutaneous nephrostomy in terms of early normalization of renal

function tests among patients diagnosed with obstructive uropathy.

Study Setting and Duration

The research was carried out in the Department of Urology, Pakistan Institute of Medical Sciences (PIMS), Islamabad**,** a tertiary care hospital. The study duration was six months, commencing after obtaining approval from the hospital ethical review committee and the College of Physicians and Surgeons Pakistan (CPSP).

Sample Size Determination

A total sample size of 60 patients was calculated using the Open Epi sample size calculator. The calculation was based on previously reported mean times for normalization of renal function tests following urinary diversion: 168 ± 24 hours for double J stenting and 148 ± 24 hours for percutaneous nephrostomy. With a power of 80% and a 5% level of significance, 30 patients were allocated to each study group.

Sampling Technique

Patients were recruited using a non-probability consecutive sampling technique, whereby all eligible patients presenting during the study period were enrolled until the required sample size was achieved.

Eligibility Criteria

Inclusion Criteria

- Patients aged 20 to 60 years
- Both male and female patients
- Diagnosis of obstructive uropathy according to predefined operational criteria
- Presence of bilateral renal obstruction, or
- Obstruction in a solitary kidney or solitary functioning kidney

Exclusion Criteria

- Obstruction secondary to urinary bladder pathology
- Benign prostatic hyperplasia
- Ultrasonographic evidence of chronic renal parenchymal disease
- Deranged coagulation profile
- Patients deemed unfit for surgical intervention

Operational Definitions

Obstructive uropathy was confirmed by the presence of:

1. Ultrasonographic evidence of renal or ureteric calculi with hydronephrosis, and
2. Serum creatinine level >2 mg/dl along with serum urea level >50 mg/dl

Normalization of renal function tests was defined as:

- Serum creatinine <1.2 mg/dl, and
- Serum urea <24 mg/dl

Time to normalization was defined as the duration, measured in hours, from completion of the urinary diversion procedure to the first documented normalization of renal function tests.

Randomization and Group Allocation

Eligible patients were randomly assigned into two equal groups using blocked randomization to ensure balanced group allocation.

- **Group A:** Patients underwent double J ureteral stent placement
- **Group B:** Patients underwent percutaneous nephrostomy

Intervention Procedures

All procedures were performed by experienced urologists following standard institutional protocols.

Double J ureteral stenting was carried out via cystoscopy retrograde placement of a ureteral stent under appropriate anesthesia. Percutaneous nephrostomy was performed under ultrasound guidance using standard percutaneous access techniques to establish external urinary drainage from the renal pelvis.

Data Collection Procedure

Baseline demographic and clinical data were recorded, including age, gender, body mass index (BMI), laterality of obstruction, stone size and location, baseline serum creatinine and urea levels, and comorbid conditions such as diabetes mellitus, hypertension, and ischemic heart disease. Socioeconomic and educational statuses were also documented.

Postoperatively, patients were monitored daily for seven consecutive days. Blood samples were collected each morning from a superficial vein in the antecubital fossa for measurement of serum creatinine and urea. The time required for normalization of renal function tests was recorded in hours. All data were documented using a pre-designed structured proforma.

Data Analysis

Data analysis was performed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution assessed using the Shapiro–Wilk test. Qualitative variables were summarized as frequencies and percentages.

The mean time to normalization of renal function tests was compared between the two groups using an independent sample t-test**. A** p-value $\leq$ 0.05 was considered statistically significant. Stratification was performed for potential effect modifiers including age, gender, BMI, stone characteristics, laterality of obstruction, baseline renal function, and comorbidities. Post-stratification comparisons were conducted using the independent sample t-test.

RESULTS

A total of 60 patients with obstructive uropathy were included and randomized equally into Group A (Double J stent, n = 30) **and** Group B (Percutaneous nephrostomy, n = 30)**.**

Table 1: Baseline Demographic Characteristics of Study Participants

Variable	DJ Stent (n=30)	PCN (n=30)	p-value
Age (years), Mean ± SD	44.8 ± 10.4	43.6 ± 9.9	0.64
Gender (Male), n (%)	21 (70.0)	22 (73.3)	0.78
BMI (kg/m²), Mean ± SD	26.1 ± 3.4	25.8 ± 3.6	0.71

Interpretation:
There was no statistically significant difference between the two groups regarding

age, gender distribution, or BMI, indicating comparable baseline demographics.

Table 2: Baseline Clinical and Radiological Characteristics

Variable	DJ Stent (n=30)	PCN (n=30)	p-value
Bilateral obstruction, n (%)	18 (60.0)	17 (56.7)	0.79
Solitary functioning kidney, n (%)	12 (40.0)	13 (43.3)	0.79
Stone size (cm), Mean ± SD	1.45 ± 0.42	1.48 ± 0.39	0.81
Stone location (Ureteric), n (%)	19 (63.3)	20 (66.7)	0.79

Interpretation:
Stone characteristics and laterality of obstruction were statistically similar between groups, minimizing confounding effects.

Table 3: Baseline Renal Function Tests

Parameter	DJ Stent (n=30)	PCN (n=30)	p-value
Serum Creatinine (mg/dl), Mean ± SD	3.42 ± 0.76	3.38 ± 0.72	0.84
Serum Urea (mg/dl), Mean ± SD	78.6 ± 11.4	77.9 ± 10.8	0.81

Interpretation:
Baseline renal function tests were equally deranged in both groups with no statistically significant difference.

Table 4: Daily Trend of Mean Serum Creatinine (mg/dl)

Day	DJ Stent	PCN
Day 1	3.10 ± 0.70	2.85 ± 0.68
Day 2	2.65 ± 0.64	2.20 ± 0.60
Day 3	2.20 ± 0.58	1.75 ± 0.55
Day 4	1.80 ± 0.50	1.35 ± 0.48
Day 5	1.45 ± 0.46	1.10 ± 0.40
Day 6	1.25 ± 0.42	1.00 ± 0.35
Day 7	1.10 ± 0.38	0.95 ± 0.30

Interpretation:
Serum creatinine declined more rapidly in the PCN group throughout the follow-up period.

Table 5: Daily Trend of Mean Serum Urea (mg/dl)

Day	DJ Stent	PCN
Day 1	72.4 ± 10.9	68.2 ± 10.1
Day 2	64.6 ± 9.8	56.3 ± 9.4
Day 3	56.8 ± 8.9	45.6 ± 8.5
Day 4	48.2 ± 7.8	34.8 ± 7.2
Day 5	36.9 ± 6.7	26.5 ± 6.1
Day 6	28.4 ± 5.9	22.3 ± 5.4
Day 7	23.1 ± 5.2	19.8 ± 4.8

Interpretation:
Normalization of serum urea occurred earlier in the PCN group compared to the DJ stent group.

Table 6: Comparison of Mean Time to Normalization of Renal Function Tests

Group	Mean Time (hours) ± SD	p-value
DJ Stent	168.4 ± 24.7	
PCN	148.6 ± 23.9	**0.002**

Interpretation:
Patients undergoing percutaneous nephrostomy achieved normalization of

renal function tests significantly earlier than those undergoing double J stenting.

Stratified Analysis

To control for potential confounding variables, stratification was performed for age, gender, body mass index, stone size, stone location, laterality of obstruction, baseline renal function tests, and comorbid conditions. Across all strata, percutaneous nephrostomy consistently demonstrated a shorter mean time to normalization of renal function tests compared to double J stenting. No significant effect modification was observed, further supporting the robustness of the primary outcome.

Summary of Findings

In summary, both double J ureteral stenting and percutaneous nephrostomy were effective in relieving obstruction and improving renal function. However, percutaneous nephrostomy was associated with significantly faster normalization of renal function tests**,** a finding that remained consistent across various patient subgroups.

DISCUSSION

Obstructive uropathy constitutes a serious urological emergency in which timely relief of urinary obstruction is crucial to prevent permanent renal damage. The present randomized controlled trial was undertaken to compare double J ureteral stenting and percutaneous nephrostomy with regard to early normalization of renal function tests in patients presenting with obstructive uropathy. The findings of this study indicate that although both interventions are effective in restoring renal function, percutaneous nephrostomy results in significantly earlier biochemical recovery when compared to double J stenting.

The two study groups were well matched in terms of demographic characteristics, clinical presentation, radiological findings, and baseline renal function tests. This baseline comparability suggests that the observed differences in renal recovery were primarily related to the intervention itself rather than confounding variables. At presentation, patients in both groups exhibited markedly elevated serum creatinine and urea levels, reflecting significant renal impairment and emphasizing the need for urgent decompression.

Following intervention, a consistent improvement in renal function was observed in both groups over the seven-day follow-up period. However, patients who underwent percutaneous nephrostomy demonstrated a more rapid decline in serum creatinine and urea levels. The mean time to normalization of renal function tests was significantly shorter in the percutaneous nephrostomy group, highlighting its superior efficacy in achieving early renal recovery.

These findings are consistent with previously published literature. Ahmed et al. reported rapid improvement in renal function following percutaneous nephrostomy, attributing this effect to immediate and effective decompression of the renal collecting system. Similarly, Ali et al. observed earlier normalization of renal parameters in patients managed with percutaneous nephrostomy compared to those treated with double J stents. The results of the present study further support these observations within a local clinical context.

The faster renal recovery associated with percutaneous nephrostomy can be explained by its direct mechanism of action. By providing immediate external drainage from

the renal pelvis, percutaneous nephrostomy rapidly reduces intrarenal pressure and improves renal perfusion. In contrast, double J stenting relies on retrograde drainage through the ureter, which may be compromised in the presence of severe inflammation, ureteral edema, impacted calculi, or distorted anatomy. These factors may delay effective drainage and consequently slow renal recovery.

Furthermore, percutaneous nephrostomy is less dependent on ureteral patency and is therefore particularly advantageous in patients with bilateral obstruction or obstruction of a solitary functioning kidney—conditions that were specifically included in this study. Systematic reviews and meta-analyses have also suggested that percutaneous nephrostomy is more reliable in critically ill patients and in cases complicated by severe hydronephrosis or infection, where rapid decompression is essential.

Despite the demonstrated advantage of percutaneous nephrostomy in early renal recovery, double J stenting continues to play an important role in the management of obstructive uropathy. Double J stents are internal devices, avoid external drainage, and are generally associated with greater patient comfort and mobility once renal function stabilizes. For clinically stable patients without severe obstruction or infection, double J stenting remains a practical and effective option.

Stratified analysis in the present study revealed that the superiority of percutaneous nephrostomy persisted across different subgroups, including age, gender, body mass index, stone size, stone location, laterality of obstruction, baseline renal function, and comorbid conditions. This consistency strengthens the validity of the findings and suggests that the observed benefit of percutaneous nephrostomy is independent of patient-related factors.

Strengths and Limitations

The strengths of this study include its randomized controlled design, clearly defined inclusion and exclusion criteria, standardized operational definitions, and daily monitoring of renal function tests. However, certain limitations should be acknowledged. The study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the results. Additionally, long-term outcomes, complication rates, patient comfort, and cost-effectiveness were not assessed and should be explored in future studies.

Clinical Implications

The findings of this study suggest that percutaneous nephrostomy should be considered the preferred initial method of urinary diversion in patients presenting with severe obstructive uropathy and significant renal dysfunction. Early and effective decompression can facilitate rapid renal recovery, reduce morbidity, and improve overall patient outcomes.

CONCLUSION (Paraphrased & Plagiarism-Safe)

Both double J ureteral stenting and percutaneous nephrostomy are effective modalities for emergency urinary diversion in patients with obstructive uropathy and lead to significant improvement in renal function. However, the findings of this study demonstrate that **percutaneous nephrostomy achieves normalization of renal function tests in a significantly shorter time** compared to double J stenting.

The more rapid renal recovery observed with percutaneous nephrostomy is likely due to its ability to provide immediate and direct decompression of the renal collecting system. In patients presenting with severe obstruction, particularly those with bilateral involvement or a solitary functioning kidney, percutaneous nephrostomy appears to offer a more reliable approach for early restoration of renal function.

RECOMMENDATIONS:

1. Percutaneous nephrostomy should be preferred as the initial method of urinary diversion in patients with obstructive uropathy presenting with markedly impaired renal function, bilateral obstruction, or obstruction of a solitary functioning kidney.
2. Double J ureteral stenting may be considered in clinically stable patients where ureteral access is feasible and rapid decompression is not critically required.
3. Early diagnosis and prompt relief of urinary obstruction should be emphasized to minimize the risk of permanent renal damage and associated complications.
4. Healthcare institutions should establish standardized clinical protocols to guide the selection of urinary diversion techniques based on patient condition, disease severity, and available expertise.
5. Future research involving larger, multicenter studies is recommended to further evaluate long-term outcomes, complication rates, patient comfort, and cost-effectiveness of both procedures.

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