

COMPARISON OF COMPLICATIONS BETWEEN DOUBLE J STENT AND PERCUTANEOUS NEPHROSTOMY IN OBSTRUCTIVE UROPATHY SECONDARY TO UROLITHIASIS

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ABSTRACT

BACKGROUND: Obstructive uropathy is common and requires immediate treatment to prevent renal damage. Double-J (DJ) stent placement and percutaneous nephrostomy (PCN) are two common treatments for this condition, but they have different complications that may affect patient outcomes and intervention choice. This study compares DJ stent and PCN complication rates in urolithiasis-related obstructive uropathy patients to determine their safety and efficacy.

METHODOLOGY: This randomised control trial was conducted at SIUT, Karachi included 296 18-65-year-olds with obstructive uropathy due to urolithiasis and stones larger than 1 cm. Randomisation divided patients into DJ stent (n=148) and PCN (n=148) groups. Prophylactic antibiotics were given to all patients after cystoscopic DJ stent insertion and ultrasound-guided PCNs. Haematuria, procedural failure, fever, trigone irritation, and PCN dislodgement were monitored for 7 days. Statistical analysis compared group complication rates.

RESULTS : The mean age was of the patients were 42.10±14.61 year in the DJ stent group and 40.36±13.69 years in the PCN group, with males representing 74.8% and 71.0% of each group, respectively. Procedural failure rates between groups were (3.7% in DJ stent vs 2.8% in PCN, p=0.500). Fever & septicemia documented in 8.4% of the DJ stent group and 4.7% of the PCN group (p=0.269), whereas hematuria was noted in 12.1% of DJ stent patients and 6.5% of PCN patients (p=0.159). Painful trigone irritation was significantly higher in the DJ stent group (15.0% vs. 0%, p=0.0001). PCN-specific complications, such as dislodgement or blockage, were found in 5.6% of the PCN group, with no cases in the DJ Stent group (p=0.015).

CONCLUSION: It is to be concluded that both DJ stent and PCN are effective in managing obstructive uropathy secondary to urolithiasis, with similar rates of procedural failure, hematuria, & fever, however, DJ stents are linked with significantly higher rates of painful trigone irritation while PCN shows a unique chance of dislodgement or blockage. These findings recommend that the choice between DJ stent and PCN should consider the distinct complication profiles of each method to optimize the patient outcomes

KEYWORDS: Catheterization, Double J Stent, Percutaneous Procedures, Postoperative Complications, Urinary Tract Obstruction, Urolithiasis.

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INTRODUCTION

Obstructive uropathy is defined as hindrance of urine flow, which in turn, increases the collecting system pressure and can lead to renal injury [1]. Obstructive uropathy is the blockage of the flow of urine, either structurally or functionally, and can lead to severe complications, such as renal failure. Obstructive uropathy can be intra- or extra-luminal or intramural. Renal calculi has been documented to be the major etiological cause of obstructive uropathy [2].

When obstruction of the upper urinary tract results in infection, loss of renal function, or severe pain, drainage of the urinary tract is indicated. In the absence of treatment, obstruction in infected patients can trigger serious consequences including sepsis, pyonephrosis, and mortality[3].

Urologists opt for an optimal definitive emergency procedure of decompression (percutaneous nephrostomy/double J stenting) for symptomatic relief from urine obstruction and reversal of renal physiology [4]. Percutaneous Nephrostomy (PCN) is minimally invasive ultrasonography-guided procedure preferred in emergency setting in patients presenting with infective complications of Obstructive Uropathy [5]. Double-J ureteral stenting (DJS) is preferred in non-infective cases of Obstructive Uropathy [6]. Like any other interventional procedure, there are chances of post-operative complications. DJ Stent-related Lower Urinary Tract Symptoms, Hematuria and urinary tract infections are well-known complications of double-J stents [7]. Similarly, ureteral perforation or stent migration can also be expected [8]. PCN may also result in complications including pain at insertion site, hematuria, patient discomfort and urinary tract infections [9].

Both the procedure have advantages and disadvantages in terms of complication rates, costs, Quality of life, and subsequent therapy. But for certain patients, the timing element is crucial and this can determine the type of treatment given [10]. PCN as well as retrograde JJ insertion, for adequate decompression, are recommended in the European Association of Urology (EAU) guidelines [11]. This choice should be informed by local expertise and resources.

The aim of our study is to compare the complications of double stent and percutaneous nephrostomy in patients with obstructive uropathy secondary to Urolithiasis. Various studies have been conducted at international and local levels but show inconsistent results. Some studies show DJ has lesser complications while some shows vice versa result. Moreover, in our local health setting the choice of treatment is based on urologist preference. Findings of our study will help the urologists to use appropriate surgical method for management of uropathy and reduce risk of complications.

METHODOLOGY

A randomized control trial was conducted in the Department of Urology, SIUT, located in Karachi to compare complications between double-J (DJ) stent placement and percutaneous nephrostomy (PCN) in patients with obstructive uropathy secondary to urolithiasis. The total sample of 296 patients (148 in each group) were selected while using the WHO sample size calculator, based on complication rates in previous studies with an 80% power, and a 5% significance level. Patients of either gender, aged 18-65 years, renal stones >1 cm on ultrasound, ASA score II-III, and symptoms of obstructive uropathy were included by using non-probability consecutive sampling. Patients with malignancies, retroperitoneal fibrosis, neurogenic bladder, bladder outlet obstruction, end-stage renal disease, pregnancy, and uncontrolled coagulopathy were excluded from the study. Patients meeting eligibility criteria were provided information about the potential benefits and risks of participating in the study and written consent was obtained prior to random allocation to one of two intervention groups via an opaque sealed envelope technique. DJ stent placement was performed under aseptic conditions using cystoscopy under mild sedation with local anesthesia (2% xylocaine gel) or general anesthesia in group A with a double-J stent (4-6 Fr with side holes) inserted retrograde. The percutaneous nephrostomy was performed under ultrasound guidance in group B. All participants received a single dose of non-nephrotoxic prophylactic antibiotic before the procedure. A single dose of a non-nephrotoxic prophylactic antibiotic was given to all participants before their respective procedures.

Following the intervention, patients were closely monitored for complications, including hematuria, procedural failure, urinary tract infections, fever, and stent-related discomfort, with daily evaluations up to day 7. Hematuria was defined as the presence of three or more red blood cells (RBCs) per high-power field in two

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of three consecutive urine samples collected on day 7. Procedural failure was assessed based on any progression of hydronephrosis on a repeat ultrasound on day 7. Outcome assessors were blinded to the patient's group assignment to minimize observer bias. Data on demographic, clinical, and procedural variables, including age, gender, BMI, diabetes status, hypertension, and any adverse events, were recorded in a structured proforma. Patients without complications were discharged after 7-day follow up, other patients were given reinforced treatment as complications arose. Ethical approval obtained to comply with ethical standards. The study data was analyzed with appropriate statistical technique by through SPSS version 26.0. The Chi-square test was applied to compare complications in both group at 5% level of significance.

RESULTS

Table I indicates the baseline characteristics of participants of the study who were distributed into two groups: DJ Stent (n=107) and PCN (n=107). The mean age of participants in the DJ Stent group was 42.10 ± 14.61 years, while in the PCN group, it was noted as 40.36 ± 13.69 years, with no statistically significant difference ($p=0.370$). BMI was similar between the two groups (25.80 ± 3.32 for DJ Stent vs. 25.52 ± 3.04 for PCN; $p=0.523$). The duration of hospital stay was significantly longer ($p=0.0001$) in the DJ Stent group (2.74 ± 0.63 days) than the PCN group (2.21 ± 0.62 days).

In gender distribution 74.8% males in the DJ Stent group and 71.0% in the PCN group ($p=0.538$). There were no significant differences in the prevalence of hypertension ($p=0.582$) or ischemic heart disease ($p=0.302$) between groups, however, the prevalence of diabetes mellitus was significantly higher in the PCN group (38.3%) as compared to the DJ Stent group (25.2%; $p=0.040$). In terms of causes of obstructive uropathy, stone disease was more common in the DJ Stent group (75.7%) than in the PCN group (64.5%), but this difference was statistically insignificant ($p=0.064$). Carcinomas was noted in 18.7% of the DJ Stent group and 15.9% of the PCN group, with insignificant statistical difference ($p=0.658$), however, pyonephrosis and PUJ obstruction were significantly more common in the PCN group, with p-value found to be statistically significant ($p=0.023$). Table II analyzes post-procedural complications between the DJ Stent and PCN groups. Between groups, the incidence of procedural failure was comparable, 3.7% in the DJ Stent group and 2.8% in the PCN group ($p=0.500$). Fever and septicemia were observed in 8.4% of DJ Stent group and 4.7% of PCN group, with statistically insignificant difference ($p=0.269$). There was no statistically significant difference was noted in incidence of hematuria or bleeding, where such complication was documented in 12.1% of cases of DJ Stent and 6.5% of cases of PCN ($p=0.159$). The DJ Stent group had significantly higher rates of painful trigone irritation (15.0% of patients) compared to the PCN group (0 cases; $p=0.0001$). PCN dislodgement or blockage was unique to the PCN group, affecting 5.6% of patients ($p=0.015$). Ureteral perforation was noted in 1.9% of the DJ Stent group, but no cases were stated in the PCN group, with insignificant statistical difference ($p=0.249$). Stent migration was found to be in 2.8% of DJ Stent group, with no cases in the PCN group ($p=0.123$).

DISCUSSION

The current study added patients diagnosed with obstructive uropathy due to urolithiasis, characterized by urinary obstruction symptoms, & renal stones >1 cm. Patients were aged 18-65 years with an ASA score II-III, reflecting moderate to severe health impacts. This study aimed to compare complication rates linked with double-J (DJ) stenting vs. percutaneous nephrostomy (PCN), both commonly used to relieve obstructions. Findings showed that both procedures effectively managed obstructions; however, DJ stents were associated with significantly higher rates of painful trigone irritation (15%), results consistent with prior studies documenting similar lower urinary tract symptoms (LUTS) related to DJ stents [14,15]. Al-Hammouri et al. [12] and Jain et al. [15] recorded similar findings, with LUTS and discomfort seen with DJ stents compared to PCN, additionally, Liu et al. [19] and New et al. [18] observed that long-term DJ stent use is related with reduced quality of life because of chronic pain and irritative symptoms, supporting this study's findings on high LUTs rates with DJ stents. In contrast, PCN showed fewer irritation-related complications but had unique risks such as dislodgement or blockage in 5.6% of cases, supporting prior research indication that PCN is preferable for high-infection-risk cases [9,19].

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Recent studies reflect a similar complication profile. For example, Ali et al. [2] stated that DJ stents often result in discomfort and LUTS, while PCN provides more direct drainage and chosen in infected obstructive uropathy, a suggestion seconded by the European Association of Urology (EAU) [20]. Ali et al. [13] reported the lower risk of urinary infections with PCN in emergency, further corroborating its benefit in urgent or septic cases. Moon et al. [17] emphasized that PCN, despite its procedural complexity, is effective in cases where rapid decompression is needed, often leading to fewer long-term symptoms compared to DJ stents. Szvalb et al. [16] also reported that PCN, while linked with few risk of dislodgement, had a decreased rate of recurrent infection, adding support to the findings of the study that PCN offers few advantages for at risk patients of severe infection.

The strengths of this study were its randomized controlled design, large sample size and blinded complication assessment which minimized bias & enhanced the reliability. Comprehensive data collection accounted for important demographic and clinical factors, enabling more precise comparisons, however, a limitation is the short follow-up time which may not capture long-term complications, known to increase with extended duration [6,18]. Non-probability sampling is another limitation potentially affecting generalizability by under-representing few patient characteristics. Ray et al. [14] suggest that lengthy follow-ups could better capture long term risks of DJ stent & PCN, giving a broader understanding of their efficacy. Weltings et al. [20] considered the value of diverse patients' samples, to understand the complication profiles in settings, an area that future research could address by considering a broader patient demographic profile. Overall, the study highlights that while both DJ stents & PCN successfully manage obstructions, the intervention selection may consider patient presentations individually, and distinct complication profiles of every method to optimize patient outcomes.

CONCLUSION

It is to be concluded that both DJ stent and PCN are effective in managing obstructive uropathy secondary to urolithiasis, with similar rates of procedural failure, hematuria, & fever, however, DJ stents are linked with significantly higher rates of painful trigone irritation, while PCN shows a unique chance of dislodgement or blockage. These findings recommend that the choice between DJ stent and PCN should consider the distinct complication profiles of each method to optimize the patient outcomes.

Variables	Groups		P-Value	
	DJ Stent (n=107)	PCN (n=107)		
Age in years, Mean ± SD	42.10 ± 14.61	40.36 ± 13.69	0.370	
BMI in kg/m ² , Mean ± SD	25.80 ± 3.32	25.52 ± 3.04	0.523	
Hospital Stay in days, Mean ± SD	2.74 ± 0.63	2.21 ± 0.62	0.0001	
Gender (Male), n (%)	80 (74.8)	76 (71.0)	0.538	
Hypertension, n (%)	45 (42.1)	49 (45.8)	0.582	
Diabetes Mellitus, n (%)	27 (25.2)	41 (38.3)	0.040	
Ischemic Heart Disease, n (%)	18 (16.8)	24 (22.4)	0.302	
Causes of Obstructive Uropathy	Stone Disease, n (%)	81 (75.7)	69 (64.5)	0.023
	Carcinomas, n (%)	20 (18.7)	17 (15.9)	
	Pyonephrosis, n (%)	4 (3.7)	15 (14.0)	
	PUJ Obstruction, n (%)	2 (1.9)	6 (5.6)	

DJ Stent: Double J Stent, PCN: Percutaneous Nephrostomy, BMI: Body Mass Index, PUJ: Pelvic Ureteric Junction

Table II: Comparison of Complications Between Groups

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Variables	Groups		P-Value
	DJ Stent	PCN	
Procedural failure, n (%)	4 (3.7)	3 (2.8)	0.500
Fever & Septicemia, n (%)	9 (8.4)	5 (4.7)	0.269
Bleeding/Hematuria, n (%)	13 (12.1)	7 (6.5)	0.159
Painful Trigone Irritation, n (%)	16 (15.0)	0 (0.0)	0.0001
PCN dislodgement or Blockage, n (%)	0 (0.0)	6 (5.6)	0.015
Ureteral Perforation, n (%)	2 (1.9)	0 (0.0)	0.249
Stent Migration, n (%)	3 (2.8)	0 (0.0)	0.123

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