

RADIOLOGICAL AND DEMOGRAPHICAL DETERMINANTS OF DOUBLE-J STENT INSERTION SUCCESS FOR OBSTRUCTING URETERIC CALCULI IN TERTIARY HEALTH CARE CENTRE OF NORTH INDIA

Dr. Somdutt Sharma¹, Dr. Diwakar Dutta Tripathi², Dr. Indra Prasad Adhikari^{3*}, Dr. Devendra Sharma⁴, Dr. Sandeep Kumar Sharma⁵, Dr. Raj Kumar⁶

¹Assistant Professor, Department of Surgery, SKS Hospital Medical College & Research centre Mathura U.P

²Assistant Professor, Department of Surgery, MSD Autonomous State Medical College, Bahraich, U.P.

³Assistant Professor, Department of Biochemistry SKS Hospital Medical College & Research centre Mathura U.P.

⁴Assistant Professor, Department of Orthopaedic SKS Hospital Medical College & Research centre Mathura U.P.

⁵Professor, Department of Biochemistry SKS Hospital Medical College & Research centre Mathura U.P.

⁶Professor, Department of Biochemistry, BRD Medical College, Gorakhpur, U.P.

*Corresponding Author: Dr. Indra Prasad Adhikari, Email: harshaladhikari@gmail.com

ABSTRACT

Background: Urolithiasis is a common condition with a lifetime prevalence of 1–15%. Obstructing ureteric calculi accompanied by signs of urinary tract infection and fever represent true urological emergency and warrants urgent upper-tract drainage, with definitive stone treatment deferred until the patient is stabilized and infection resolved. This drainage can be achieved either by inserting internal ureteral stent (DJ stent) or percutaneous nephrostomy tube. This study aimed at studying such demographic and radiological factors affecting the insertion of DJ stent in obstructed ureteric calculi, providing a distinct advantage for the practicing urologists to predict the probability of successful stent passage in such cases pre-operatively.

Materials and Methods: This hospital-based prospective observational study was conducted in the Department of Surgery at SKS Hospital Medical College and Research Center, Mathura, Uttar Pradesh, from 1 July 2025 to 30 June 2026. The study included a total of 51 patients diagnosed with ureteric calculi.

Results: A total of 51 patients with obstructive ureteric calculi were included in the study. The mean age of the study population was 45.0 ± 14.36 years. The mean age of patients in the success and failure group was 44.78 ± 14.69 and 45.37 ± 14.16 years respectively, with no significant difference between the success and failure groups. The study population comprised 29 (56.9%) males and 22 (43.1%) females. mean stone size in failure case was (11.52mm) than success cases (9.43mm), Regarding stone laterality, 28 (54.9%) patients had left-sided ureteric calculi, while 23 (45.1%) had right-sided calculi. Based on stone location, 14 (27.5%) patients had lower ureteric stones, 10 (19.6%) had middle ureteric stones, and 27 (52.9%) had upper ureteric stones, making the upper ureter the most common site of obstruction in the present study.

Conclusion: The present study identified clinical and radiological factors that influence the success of retrograde double-J (DJ) stent placement in patients with unilateral single obstructing ureteric calculi, while demographic variables such as age, sex, stone laterality, and stone location were not significant predictors. However stone size significantly impacted the success/failure of DJ stenting. Preoperative assessment of these predictors may help identify patients in whom retrograde stenting is likely to be unsuccessful, allowing primary percutaneous nephrostomy to be selected as the initial method of urinary diversion.

KEYWORDS: Double-J stent, Percutaneous nephrostomy, Urolithiasis, urinary tract infection, obstructing ureteric calculi

INTRODUCTION

Urolithiasis is a common disease. The lifetime prevalence of kidney stone disease is estimated between 1% to 15%, influenced by factors like age, gender, race, and geographic location¹. Among these calculi, obstructing ureteric stones with signs of urinary tract infection constitute a genuine urological emergency.

Any suggestion of fever in patients with ureteric stones strongly indicates infection proximal to the obstruction site. Regardless of the clinical presentation of the patient, there should be a low threshold for initiating urgent urinary tract drainage. Definitive treatment of the obstructing calculi should be deferred until the patient is stabilized and the infection is fully resolved.

Upper tract drainage is also required in patients with obstructed ureteric calculi, in whom definitive surgery is delayed due to various factors (delay in pre-anesthetic clearance due to untreated co-morbidities), to prevent functional decline of the kidney.

This drainage can be achieved either by inserting internal ureteral stent (DJ stent) or percutaneous nephrostomy tube. Randomized controlled studies have not demonstrated any significant difference in the efficacy of drainage or complication rate between these procedures, nor differences in time to defervescence in the febrile patients.^{2,3}

Furthermore, in patients with coagulopathies, percutaneous nephrostomy insertion is contra-indicated. Therefore, internal stent placement should be the first consideration for these patients. Internal stents provide the benefit of increased patient comfort by avoiding an external catheter and reducing the risk of bleeding complications. One previous study demonstrated that the majority of urologists prefer internal ureteral stent insertion for relieving the obstruction.⁴ However, in some cases, insertion of the stent may be difficult due to various patient-related and stone-related factors.

This study aimed at studying such demographic, clinical and radiological factors affecting the insertion of DJ stent in obstructed ureteric calculi, providing a distinct advantage for the practicing urologists to predict the probability of successful stent passage in such cases pre-operatively. This is relevant in tertiary care centres with heavy workload and long waiting list for surgeries where patients with failed DJ stenting in obstructed calculi, are taken up for second procedure (percutaneous nephrostomy), thereby further using manpower and resources.

If this study can anticipate difficulty in DJ Stent insertion based on the factors included, direct placement of a nephrostomy tube, will be better and safe approach, thereby preventing double procedure and associated complications as well as saving time and resources, especially in high volume centres and resource limited settings.

Several studies have attempted to delineate various predictive factors that could indicate stone impaction during definitive surgery⁵, however there is only one study to the best of our knowledge, which delineated the factors predicting the success of DJ stent insertion in obstructed ureteric calculi.⁶ Hence this study was conducted.

AIMS: To assess the factors affecting the success of DJ stent placement in patients with obstructed ureteric calculus

MATERIALS & METHODS:

This hospital-based prospective observational study was conducted in the Department of Surgery at SKS Hospital Medical College and Research Center, Mathura, Uttar Pradesh, from 1 July 2025 to 30 June 2026. The study included a total of 51 patients diagnosed with ureteric calculi. Patients aged 18 years and above who met the inclusion criteria and provided informed consent were enrolled in the study.

Inclusion Criteria:

1. Patients aged > 18 years with obstructing ureteric calculus planned for DJ Stent insertion

Exclusion Criteria:

1. Multiple ureteric calculi
2. Previous stone-related procedures,
3. Pregnancy
4. Genito-urinary anomalies

Methods of Estimation

All patients presenting to the Department of Surgery, SKS Hospital Medical College and Research Center, Mathura, UP. between 1 July 2025 to 30 June 2026 with clinical features suggestive of renal colic, including radiating or non-radiating flank pain with or without dysuria and/or fever, were evaluated. A detailed clinical history was obtained, followed by assessment of vital signs and thorough clinical examination. All patients underwent relevant hematological, biochemical, urine analysis, and radiological investigations, including ultrasonography (USG) of the whole abdomen. Patients with radiological findings suggestive of renal or ureteric calculi subsequently underwent Non-Contrast Computed Tomography of the Kidney, Ureter, and Bladder (NCCT KUB) or CT urography for confirmation of the diagnosis and assessment of stone characteristics. Patients with a single unilateral ureteric calculus associated with flank pain, fever, urinary tract infection, leukocytosis, varying degrees of hydroureteronephrosis, or unilateral obstructive calculus requiring temporary upper urinary tract drainage due to delayed definitive surgery (secondary to pending pre-anesthetic clearance for untreated comorbidities) and who were planned for DJ ureteral stent insertion were included in the study.

Statistical Analysis:

For statistical analysis a SPSS v20 (IBM©, Chicago, IL, USA) software was used. Quantitative results have been provided as a mean and standard deviation (SD) and have been measured, if appropriate, by the ANOVA (F) method. Different demographic and test parameters were calculated and tabulated in the master chart and analyzed. The data normality was also checked and nullified as per principle. The qualitative results is provided as numbers and percentages and contrasted, if possible, with the Chi-square (X²) method. The value of P was considered statistically significant, when it came <0.05.

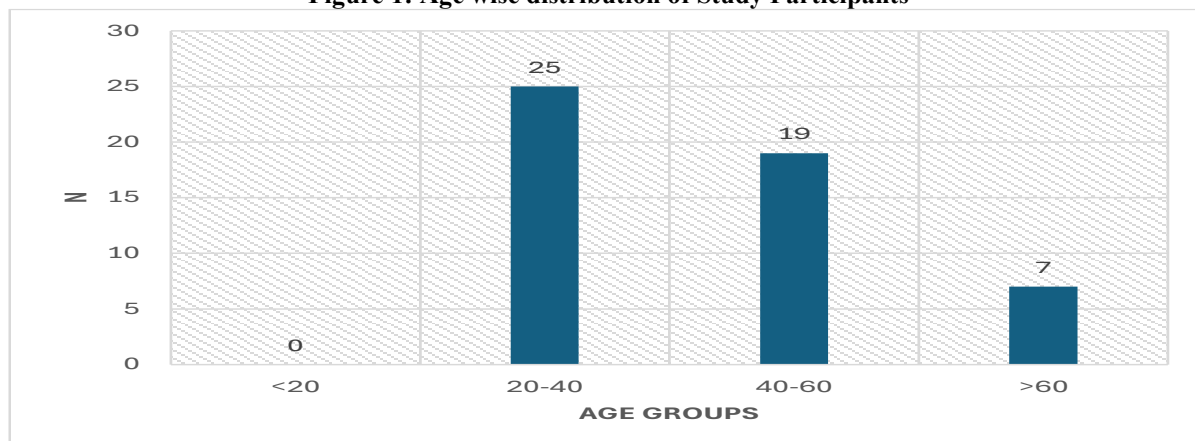
RESULT

The present study has been conducted in Department of Surgery in collaboration with the Department of Urology, SKS Hospital Medical College and Research Centre, Mathura, UP. In the present study total 51 patient with age above 18 years were enrolled as study subjects. The test parameters were tabled as per the master chart. The results were expressed in terms of mean±SD.

Table 1: Age wise distribution of Study Participants

	Frequency	Percent
<20	0	0
20-40	25	49.0
40-60	19	37.3
>60	7	13.7
Total	51	100.0
Mean±SD	45±14.36	Range (22-81)

Nearly half of the patients (49.0%) belonged to the 20–40 years age group, whereas 37.3% were between 40 and 60 years of age. Patients aged more than 60 years constituted 13.7% of the study population. No participant was younger than 20 years. The mean age of the participants was 45.0 ± 14.36 years.

Figure 1: Age wise distribution of Study Participants**Table 2: Age wise data of Study Participants based on DJ Stent Insertion Success/Failure (Success n= 32, Failure=19)**

	Mean	Std. Deviation	Minimum	Maximum	P value
Success (Group 1)	44.78	14.699	22	81	0.88
Failure (Group 2)	45.37	14.163	22	68	

Comparison of age between the success and failure groups revealed no statistically significant difference. The mean age was 44.78 ± 14.70 years in the success group and 45.37 ± 14.16 years in the failure group ($p = 0.88$), suggesting that age did not influence the outcome of DJ stent insertion.

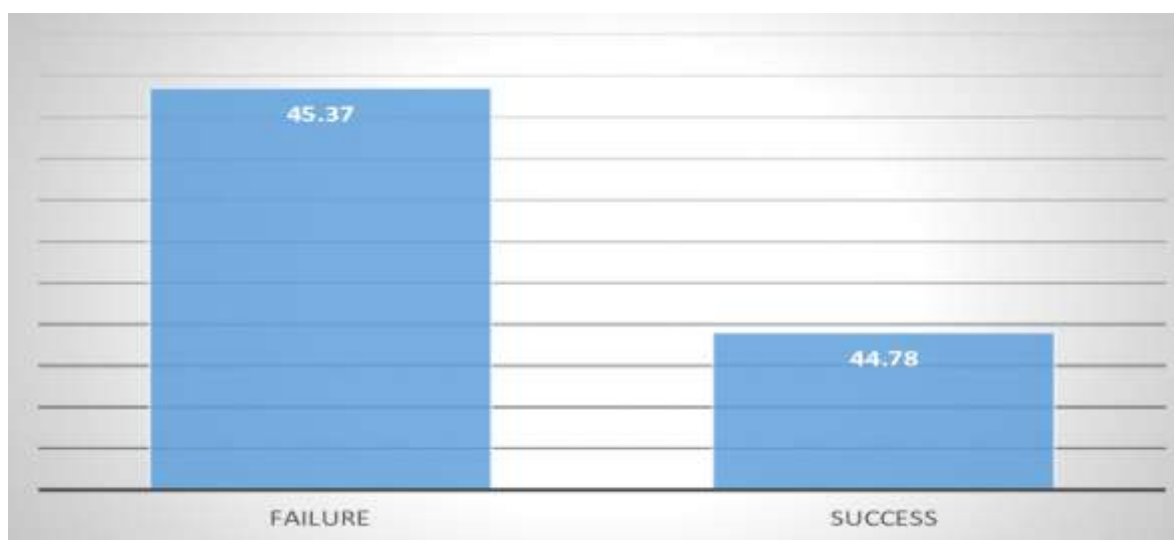
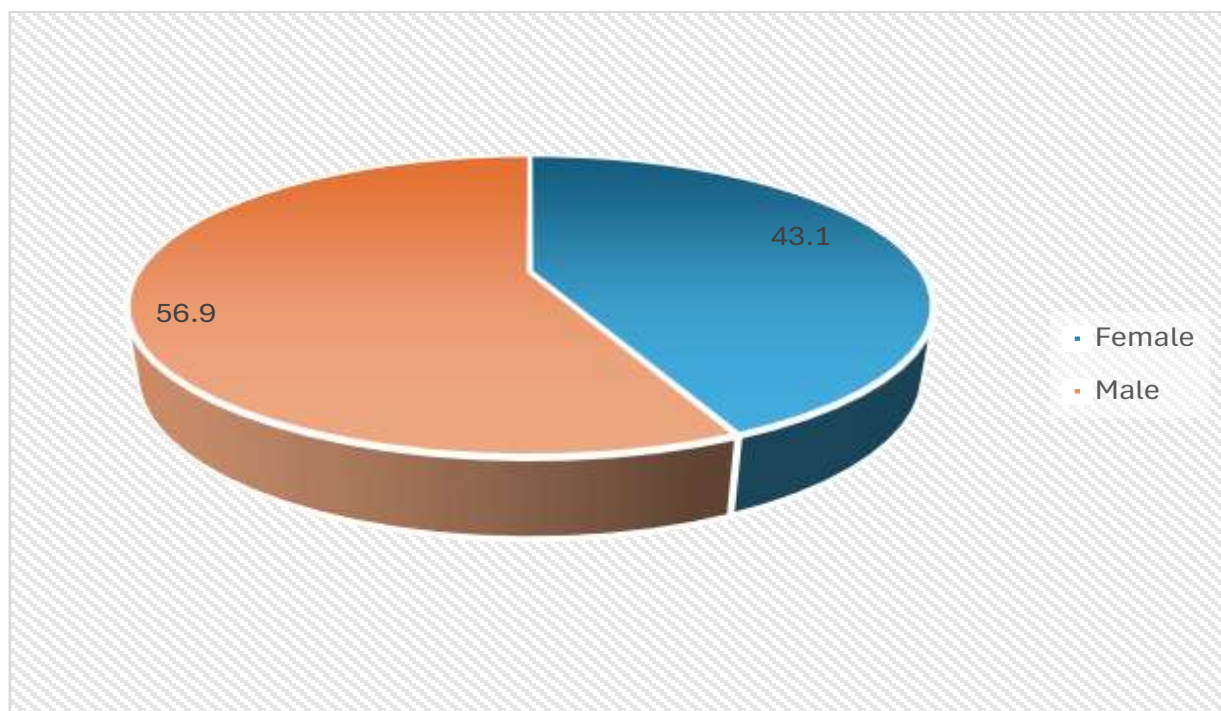
Figure 2: Mean Age of Study Participants based on DJ Stent Insertion Success/Failure (Success n= 32, Failure=19)

Table 3: Gender distribution of the Study Participants

	Frequency	Percent
Female	22	43.1
Male	29	56.9
Total	51	100.0

Of the 51 study participants, 29 (56.9%) were male and 22 (43.1%) were female. Thus, male participants constituted the majority of the study population, with a male-to-female ratio of approximately 1.3:1.

Figure 3: Gender distribution of the Study Participants**Table 4 Gender-wise distribution according to the outcome of DJ stent insertion (Success n= 32, Failure=19)**

			Gender		Total	P value=0.48
			Female	Male		
DJS insertion	Success (Group 1)	N	15	17	32	
		%	46.9%	53.1%	100.0%	
	Failure (Group 2)	N	7	12	19	
		%	36.8%	63.2%	100.0%	
Total		N	22	29	51	
		%	43.1%	56.9%	100.0%	

Among the 32 patients with successful DJ stent insertion, 17 (53.1%) were males and 15 (46.9%) were females. In the failure group (n = 19), 12 (63.2%) were males and 7 (36.8%) were females. Overall, the study population comprised 29 (56.9%) males and 22 (43.1%) females. The difference in gender distribution between the success and failure groups was not statistically significant ($p = 0.48$), indicating that gender was not associated with the success of DJ stent insertion.

Figure 4 Gender-wise distribution according to the outcome of DJ stent insertion (Success n= 32, Failure=19)



Table 5: Stone Laterality in Study Participants

	Frequency	Percent
Left	28	54.9
Right	23	45.1
Total	51	100.0

Among the 51 study participants, 28 (54.9%) had left-sided ureteric calculi, while 23 (45.1%) had right-sided ureteric calculi. Thus, left-sided ureteric stones were slightly more common than right-sided stones in the study population.

Table 6: Stone Laterality in Study Participants based on Success/failure of DJ Stent Insertion (Success n= 32, Failure=19)

			Stone laterality		Total	P value=0.405	
DJS insertion	Success (Group 1)	N	left	Right			
		%	19	13	32		
			59.4%	40.6%	100.0%		
	Failure (Group 2)	N	9	10	19		
			%				
			47.4%	52.6%	100.0%		
Total			N				
			%	28	23	51	
				54.9%	45.1%	100.0%	

Comparison of stone laterality between the success and failure groups showed that 59.4% of patients in the success group and 47.4% in the failure group had left-sided ureteric calculi, while 40.6% and 52.6%, respectively, had right-sided calculi. There was no statistically significant association between stone laterality and the success of DJ stent insertion ($p = 0.405$).

Figure 5: Stone Laterality in Study Participants based on Success/failure of DJ Stent Insertion (Success n= 32, Failure=19)

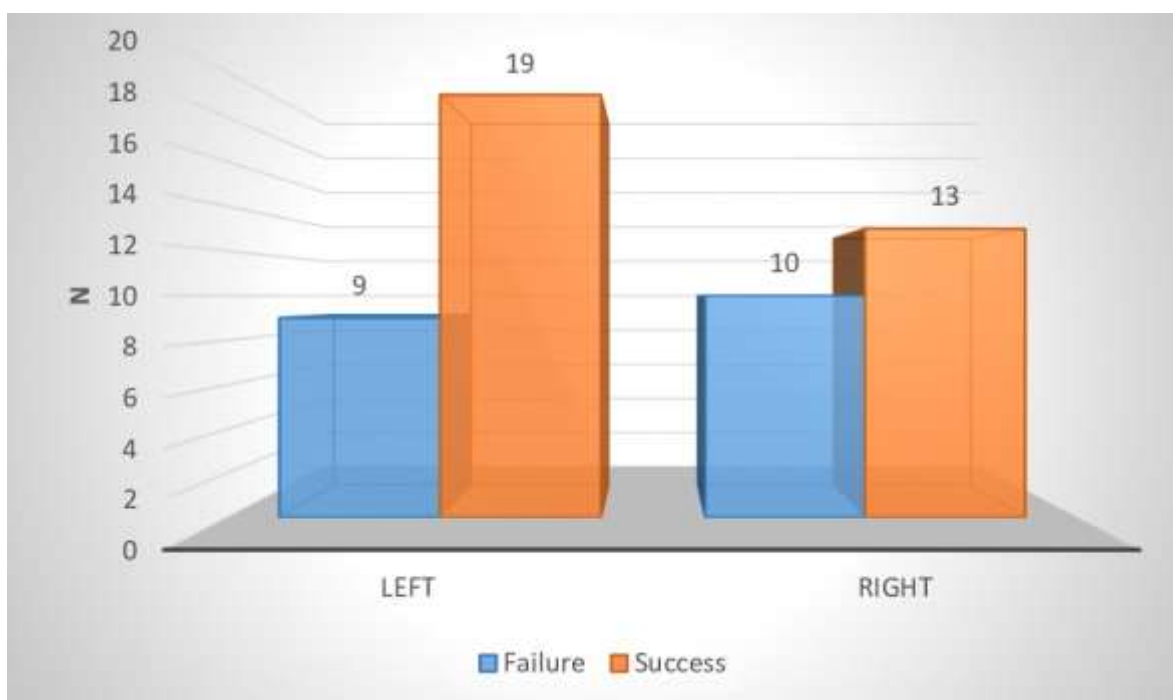


Table 7: Site of Ureteric Stone in the Study Participants

	Frequency	Percent
Lower	14	27.5
Middle	10	19.6
Upper	27	52.9
Total	51	100.0

Site of ureteric stone: Among the 51 study participants, 27 (52.9%) had upper ureteric calculi, 14 (27.5%) had lower ureteric calculi, and 10 (19.6%) had middle ureteric calculi. Thus, upper ureteric stones were the most common, followed by lower and middle ureteric stones.

Figure 6: Site of Ureteric Stone in the Study Participants

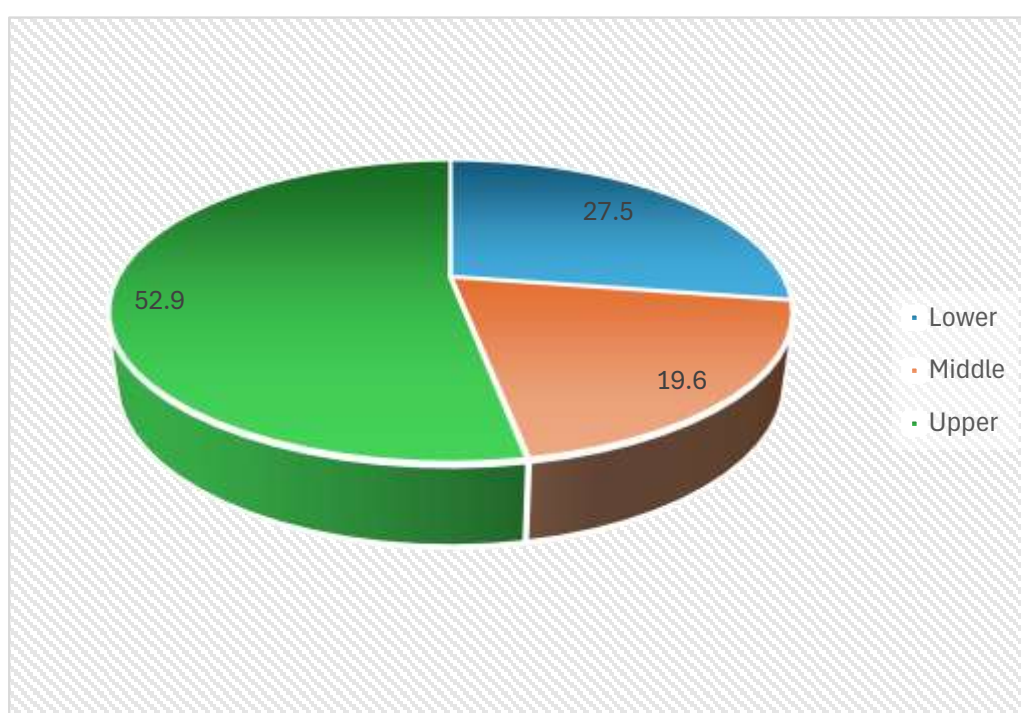


Table 8: Ratio of Psoas thickness to Posterior abdominal wall thickness in Study Participants based on Success/failure of DJ Stent Insertion (Success n= 32, Failure=19)

	Mean	Std. Deviation	P value
Success (Group 1)	0.29	.05	0.49
Failure (Group 2)	0.306	.05	

The mean ratio of psoas thickness to posterior abdominal wall thickness was 0.29 ± 0.05 in the successful DJ stent insertion group ($n = 32$) and 0.306 ± 0.05 in the failed insertion group ($n = 19$). Although the failure group demonstrated a marginally higher mean ratio, the difference between the two groups was not statistically significant ($p = 0.49$), indicating that this radiological parameter was not associated with the success of DJ stent insertion.

Figure 7: Ratio of Psoas thickness to Posterior abdominal wall thickness in Study Participants based on Success/failure of DJ Stent Insertion (Success n= 32, Failure=19)

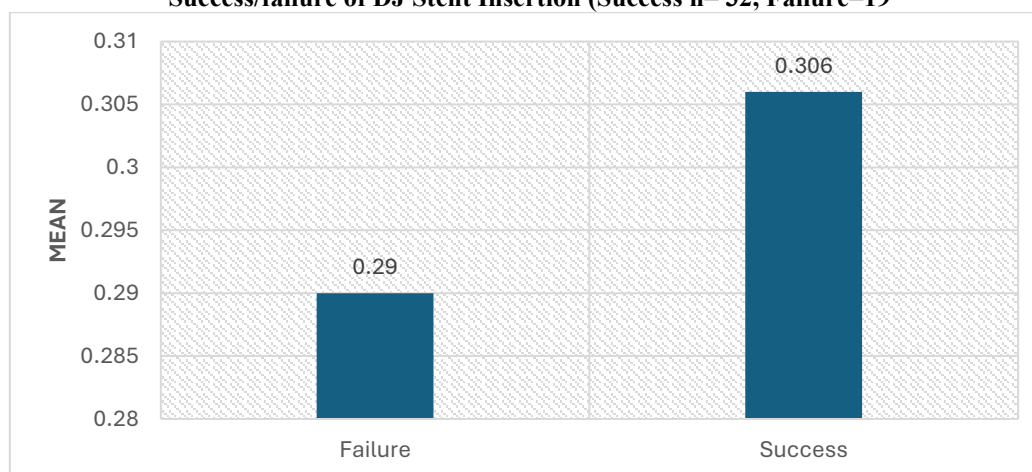


TABLE 9: Stone Size in Study Participants based on Success/failure of DJ Stent Insertion (Success n= 32, Failure=19)

	Mean	Std. Deviation	Minimum	Maximum	P value
Success (Group1)	9.43	2.29	6.00	14.00	0.001 (S)
Failure (Group 2)	11.52	2.73	6.00	15.00	

The mean stone size in the success group (Group 1) was 9.43 ± 2.29 mm (range: 6–14 mm), whereas the failure group (Group 2) had a significantly larger mean stone size of 11.52 ± 2.73 mm (range: 6–15 mm). This difference was statistically significant ($p = 0.001$), suggesting that patients with larger ureteric calculi were more likely to experience failure of DJ stent insertion.

DISCUSSION

In our hospital-based study we have enrolled total 51 patients with unilateral single ureteral calculus associated with flank pain, fever, urinary tract infection, raised leucocyte count, varying degree of hydro-ureteronephrosis, and those with single unilateral obstructed calculus with delay in definitive surgery due to delayed pre-anesthetic clearance (due to untreated co-morbidities) requiring upper tract drainage and were planned for DJ Stent insertion. This study was conducted for assessing the patient related and stone related factors that can predict the success of DJ Stent insertion in patients with obstructed ureteric calculus.

In the present study, 49% of the study participants were between 20-40 years age group while 37.3% study population was in 40-60 years age group. Overall, the mean age of the study participants was 45 ± 14.36 years with a range of 22-81 years. In the study participants, with successful DJ stent insertion, the mean age was 44.78 ± 14.6 years, while in those with failed stenting, the mean age was 45.37 ± 14.1 years. In a study conducted by Sarica et al,⁶ which recruited 227 study participants, overall, the mean patient age was 52.3 ± 16.4 years, with 50.4 ± 17.0 years in cases with successful DJ stent insertion and 53.0 ± 16.2 years in cases with failed stenting which is higher than the present study. This difference can be due to demographic and geographical factors associated with stone formation. In another study, conducted to assess the factors predicting stone impaction, by Elibol et al,⁷ the overall mean patient age was 44.14 ± 13.66 years (range, 20–78 years) which is similar to the present study. In the present study, 56.9% study participants were males and 43.9% were females. In patients with successful DJ stent insertion, 53.1% were males, while in patients with failed DJ stenting 63.2% were males. These results were similar to the study done by Sarica et al,⁶ in which overall 58.5% study participants were males and 41.5 % were females, with 55.5% males in the DJ stenting success group and 66.2% males in the DJ stenting failure group. this

study is similar to the study by conducted by Yoshida et al,⁷ to assess factors predicting the impaction of stone in ureter, overall, 64% study participants were males and 36% were females.

In the present study, overall, 52.9 % participants had upper ureteric stone, while 19.6% had mid-ureteric and 27.5% study population had lower ureteric calculus. Of these patients, 16 (50%), 5(15.6%) and 11(34.4%) study participants had upper, mid and lower ureteric stone respectively, in the DJ stenting success group(n=32), while 11(57.9%), 5(26.3%), 3(15.8%) had stone in upper, mid and lower ureter respectively in the failure group(n=19). In the previous study by Sarica et al,⁶ the proportion of upper, mid and lower ureteric stone was 50.6%, 14.8% and 34.6% respectively, in the DJ stenting success group and 58.5%, 27.7% and 13.8% respectively in the failure group. In another study by Yoshida et al.,⁸ in the subgroup with impacted stones, the stone location in upper, mid and lower ureter was 66%, 30% and 4% respectively. The ratio of psoas muscle thickness to posterior abdominal wall thickness did not differ significantly between patients with successful and failed DJ stent insertion. These findings suggest that this CT-derived morphometric parameter does not appear to influence the technical success of retrograde DJ stent placement in patients with obstructing ureteric calculi. In participants with successful DJ stenting the mean ratio was 0.29 ± 0.05 while it was 0.306 ± 0.05 in failure group. The association with DJ stenting was non-significant. This factor was not included in any previous study

In our study, 32(62.74%) participants had successful DJ stent insertion while DJ stenting failed in 19(37.26%) participants. In the previous study by Sarica et al,⁶ 72.6% population had successful DJ stent placement with failure in 27.4% study participants. This contrasting finding can be due to difference in the mean stone size, which was higher in our study (9.43 ± 2.29 mm vs 7.35 ± 2.55 mm in success group and 11.52 ± 2.73 mm vs 9.7 ± 4 mm in the failure group). Also in the present study, the DJ stenting was done under local anesthesia which could have resulted in higher failure rate owing to pain associated with the procedure.

The mean stone size (transverse diameter) overall was 10.21 ± 2.64 mm in the present study, with a range of 6-15mm. In the study participants with successful DJ stent insertion the mean stone size was 9.43 ± 2.29 mm while it was 11.52 ± 2.73 mm in the failure group. It was higher than the previous study by Elibol et al,⁷ in which the mean stone size was 7.35 ± 2.55 mm and lower than the study by Yoshida et al,⁷ in which the mean stone size was 15mm in the impacted stone group. In the study by Sarica et al,⁶ the mean stone size was 8.3 ± 2.8 mm in internal stent success group, and 9.7 ± 4 mm in the failure group. This difference can be due to difference in inclusion and exclusion criteria for the stone size in the different studies.

In short, this study find that Upper ureteric calculi were the most common stone location. Although a higher proportion of upper ureteric stones was observed among patients with failed stent insertion, stone location alone was not found to be an independent predictor of procedural success. Similarly, the ratio of psoas muscle thickness to posterior abdominal wall thickness, evaluated as a novel anatomical parameter, did not demonstrate a significant association with the outcome of DJ stent placement. Stone size, however, was a significant factor associated with success/failure of DJ Stenting.

CONCLUSION

The present study investigated several patient and stone related demographic and radiological factors affecting the success of DJ stent placement in patients with unilateral single ureteral calculus associated with flank pain, fever, urinary tract infection, elevated leucocyte count, those with single unilateral obstructed calculus with delay in definitive surgery due to delayed pre-anesthetic clearance. Factors such as age, gender, stone laterality, stone location were non-significant in predicting the success of DJ stent insertion, however stone size was significantly impacted the outcome of DJ stenting procedure. Based on the statistically significant factors of this study, in cases where difficult DJ stenting is anticipated, urologists should consider percutaneous nephrostomy directly. This approach can prevent the need of multiple procedures, reducing associated complications, and saving time and resources, particularly in high-volume tertiary care centers. Despite these promising insights, there are potential limitations of this study. As a single center study, with a small sample size, the generalizability of these findings to larger population is limited. Therefore, larger, multi-center studies are necessary to confirm these results and provide more comprehensive data for predicting the success of DJ stent placement.

Conflict of Interests: Authors have no conflict of interests

Financial support and sponsorship: Nil.

Acknowledgments: The authors did not receive any specific grant from any funding agency in the public, commercial, or non-profit sectors.

Authors' contributions: Dr. Somdutt Sharma was responsible for patient recruitment, conducted various procedures. Dr. Indra prasad Adhikari and Dr. Diwakar Dutta Tripathi have designed the study, written the manuscript and experiment guidance. Dr. Devendra Sharma has contributed to the writing of the journal article. Dr Sandeep Kumar Sharma and Dr. Raj Kumar are the research head and have contributed to manuscript preparation, editing the journal article.

REFERENCE

1. Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y. Epidemiology of stone disease across the world. *World journal of urology*. 2017 Sep; 35:1301-20.
2. Hinojosa-Gonzalez, D.E., et al. Emergent urinary decompression in acute stone-related urinary obstruction: A systematic review and meta-analysis. *Journal of Clinical Urology*, 2021. 16: 19.
3. Azwadi IZ, Norhayati MN, Abdullah MS. Percutaneous nephrostomy versus retrograde ureteral stenting for acute upper obstructive uropathy: a systematic review and meta-analysis. *Scientific reports*. 2021;11.
4. Sammon JD, Ghani KR, Karakiewicz PI, Bhojani N, Ravi P, Sun M, Sukumar S, Trinh VQ, Kowalczyk KJ, Kim SP, Peabody JO. Temporal trends, practice patterns, and treatment outcomes for infected upper urinary tract stones in the United States. *European urology*. 2013 Jul 1;64(1):85-92.
5. Özbir S, Can O, Atalay HA, Canat HL, Çakır SS, Ötünçtemur A. Formula for predicting the impaction of ureteral stones. *Urolithiasis*. 2020 Aug;48(4):353-60.
6. Sarica K, Eryildirim B, Akdere H, Camur E, Sabuncu K, Elibol O. Could ureteral wall thickness have an impact on the operative and post-operative parameters in ureteroscopic management of proximal ureteral stones?. *Actas Urológicas Españolas (English Edition)*. 2019 Nov 1;43(9):474-9.
7. Elibol O, Safak KY, Buz A, Eryildirim B, Erdem K, Sarica K. Radiological noninvasive assessment of ureteral stone impaction into the ureteric wall: a critical evaluation with objective radiological parameters. *Investigative and Clinical Urology*. 2017 Sep;58(5):339.
8. Yoshida T, Inoue T, Omura N, Okada S, Hamamoto S, Kinoshita H, Matsuda T. Ureteral wall thickness as a preoperative indicator of impacted stones in patients with ureteral stones undergoing ureteroscopic lithotripsy. *Urology*. 2017 Aug 1;106:45-9.