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Research Article

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Comparative Analysis of Ureteral Stent Versus Nephrostomy in Emergency Obstructive Uropathy

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Abstract

Background: *Emergency obstructive uropathy is a true urologic emergency requiring urgent urinary diversion in order to prevent irreversible renal deterioration and systemic complications. The two most common decompressive options are retrograde ureteral stenting and percutaneous nephrostomy, although the best choice in urgent settings has been hotly debated.*

Objective: *Assess and compare the performance of ureteral stenting with that of percutaneous nephrostomy in emergency obstructive uropathy with regard to clinical efficacy, recovery of renal function, duration of hospitalization, and complications.*

Methods: *This comparative study was conducted at the Institute of Kidney Diseases, Hayatabad, Peshawar, from February 2024 to February 2025. Eighty adult patients with acute obstructive uropathy requiring immediate decompression were enrolled through non-probability consecutive sampling. They were divided into two groups: ureteral stent placement (n=40) and percutaneous nephrostomy (n=40). Data regarding baseline demographics, the etiology of obstruction, serum creatinine, clinical outcomes, hospital stay, and complications associated with the procedure were gathered. Renal function recovery was calculated by comparing pre- and post-procedure serum creatinine. For the analysis of data, a p-value of ≤ 0.05 was considered significant.*

Results: *The mean age of patients was 46.8 ± 12.3 years in the ureteral stent group and 48.5 ± 13.1 years in the PCN group, with a predominance of males (67.5%). Ureteric calculi were the most common cause of obstruction (57.5%), followed by malignancy-related obstruction (27.5%). Both procedures caused a significant improvement in renal*

function. Mean serum creatinine levels decreased from 3.2 ± 1.1 to 1.8 ± 0.6 mg/dL in the stent group and from 3.4 ± 1.3 to 1.6 ± 0.5 mg/dL in the PCN group, with no statistically significant difference between the groups. Urinary decompression was successful in 90% of stent patients and 95% of PCN patients. Hospital stay was shorter in the ureteral stent group (3.6 ± 1.2 days) compared to the PCN group (4.4 ± 1.5 days). The complication rates were similar, though lower urinary tract symptoms were more common in the stent group, and tube-related problems and infection were more common in the PCN group.

Conclusion: *Both ureteric stenting and percutaneous nephrostomy are effective and safe procedures for emergency decompression in obstructive uropathy, and have similar rates of recovery of renal function and success of decompression. Ureteric stenting is associated with a shorter hospital stay, while PCN has a slightly higher success rate of decompression.*

Keywords: Emergency Obstructive Uropathy, Ureteral Stent, Percutaneous Nephrostomy, Urinary Tract Decompression, Renal Function Recovery

1. Introduction

Obstructive uropathy is a urological emergency that is defined by the obstruction of urine flow, resulting in high intrapelvic pressure, renal impairment, and potentially irreversible renal damage if left untreated [1]. Obstructive uropathy can occur as a complication of ureteric calculi, malignancy, trauma, or postoperative complications and necessitates immediate decompression of the urinary system to avoid renal injury and sepsis [2,3]. The two most common methods of emergent urinary drainage are retrograde ureteric stenting (double-J stent) and percutaneous nephrostomy (PCN) [4].

Though both methods are effective in relieving obstruction, the best approach between ureteral stenting and nephrostomy is still a matter of debate. The choice of procedure depends on several factors, such as the underlying cause of obstruction, accessibility, patient stability, and available expertise [5]. Ureteral stenting is usually preferred for its minimally invasive nature and patient comfort; yet, it may not be the best option in the case of severe infections or complicated obstructions [6]. On the other hand, percutaneous nephrostomy is associated with direct decompression, is ideal in hemodynamically unstable patients, and enables urine sampling, but is linked with increased external device-related discomfort and complications [7,8].

Recent comparative analyses have attempted to assess the efficacy, safety, and renal recovery outcomes of both procedures in the emergency environment. Certain studies have indicated equal success rates, while others have emphasized improved immediate decompression by PCN and reduced postoperative lower urinary tract symptoms by stenting [9,10]. In spite of various analyses, the evidence remains inconclusive owing to differences in study parameters and settings [11]. Hence, the purpose of this study is to perform a comparative analysis of ureteric stenting versus percutaneous nephrostomy in patients presenting with emergency obstructive uropathy.

Objectives

- To compare the clinical effectiveness of ureteral stenting and percutaneous nephrostomy in the emergency management of obstructive uropathy.
- To evaluate and compare renal function recovery following ureteral stent placement versus percutaneous nephrostomy.
- To assess and compare the complication profiles associated with both procedures in emergency settings.

2. Materials and Methods

The research work was carried out at the Institute of Kidney Diseases (IKD), Hayatabad, Peshawar, Pakistan, for a period of one year from February 2024 to February 2025. The aim of this comparative study was to assess the results of ureteral stenting and percutaneous nephrostomy in patients presenting with emergency obstructive uropathy. A total of 80 patients were selected using a non-probability consecutive sampling method. Patients aged 18 years and above, presenting with acute obstructive uropathy and requiring urgent urinary decompression, were selected for the study. However, patients with a history of urinary diversion surgery, congenital urinary tract abnormalities, bleeding disorders, and those refusing to give consent were excluded. The patients were divided into two groups depending on the procedure they underwent: one group had the ureteral (double-J) stent inserted, while the other group had the percutaneous nephrostomy. The demographic information, presentation, cause of obstruction, and laboratory tests, including serum creatinine levels, were noted upon admission. The decision on the type of decompression procedure to be used was left to the discretion of the attending urologist.

After the intervention, the patients were followed up for clinical improvement, recovery of renal function, and complications related to the procedure. The recovery of renal function was determined by comparing the serum creatinine levels before and after the decompression procedure. Other outcomes such as hospital stay and requirement for further interventions were also collected. The data was analyzed using valid statistical tests, and the quantitative variables were presented as mean ± standard deviation, while the qualitative variables were presented as frequencies and percentages. A p-value of ≤ 0.05 was considered statistically significant. The study was approved by the institutional review committee, and written informed consent was obtained from all participants before inclusion in the study, with confidentiality maintained.

3. Results

3.1. Age Distribution of Study Participants

The age distribution of the participants in the intervention groups is presented in Table 1. The largest number of patients in the study belonged to the 31-45 years age group, contributing 33.8% to the total number of patients, followed closely by the 46-60 years age group (32.5%), suggesting that obstructive uropathy is most prevalent in middle-aged patients. The youngest patients, aged 18-30 years, contributed the least to the total number of patients (13.8%), while 20% of the patients belonged to the >60 years age group. The distribution of age was similar in both the ureteral stent and PCN groups. The mean age of patients in the ureteral stent group was 46.8 ± 12.3 years, while that in the PCN group was 48.5 ± 13.1 years, suggesting that there was no significant difference in age between the two groups.

Age Group (years)	Ureteral Stent (n=40)	PCN (n=40)	Total (n=80)
18–30	6 (15%)	5 (12.5%)	11 (13.8%)
31–45	14 (35%)	13 (32.5%)	27 (33.8%)
46–60	12 (30%)	14 (35%)	26 (32.5%)
>60	8 (20%)	8 (20%)	16 (20%)
Mean ± SD (years)	**46.8 ± 12.3**	**48.5 ± 13.1**	—

Table 1: Age Distribution of Study Participants

3.2. Gender Distribution of Study Participants

The gender distribution of the study participants is shown in Table 2. Male patients were dominant in both groups, accounting for 67.5% of the total study population, while females accounted for 32.5%. In the ureteral stent group, male patients accounted for 65%, while in the PCN group, they accounted for 70%. The female component was similar in both groups. The gender distribution was similar in both groups, and it is evident that both groups were well matched in terms of gender, with a predominance of male patients among those presenting with emergency obstructive uropathy.

Gender	Ureteral Stent (n=40)	PCN (n=40)	Total (n=80)
Male	26 (65%)	28 (70%)	54 (67.5%)
Female	14 (35%)	12 (30%)	26 (32.5%)

Table 2: Gender Distribution of Study Participants

3.3. Etiology of Obstructive Uropathy

The etiological distribution of obstructive uropathy among the study population is given in Table 3. Ureteric calculi were the leading cause of obstruction, accounting for 57.5% of the total, with a similar distribution in the ureteric stent and PCN groups. Obstruction due to malignancy was the next most common, seen in 27.5% of the patients, and was slightly higher in the PCN group. Postoperative causes/ureteric strictures were found in 10% of the patients in both groups, and other causes made up a small proportion (5%). The etiology of obstruction was similar in both groups, suggesting a similar disease pattern.

Cause of Obstruction	Ureteral Stent (n=40)	PCN (n=40)	Total (n=80)
Ureteric calculi	24 (60%)	22 (55%)	46 (57.5%)
Malignancy-related obstruction	10 (25%)	12 (30%)	22 (27.5%)
Postoperative/stricture	4 (10%)	4 (10%)	8 (10%)
Other causes	2 (5%)	2 (5%)	4 (5%)

Table 3: Etiology of Obstructive Uropathy

3.4. Comparison of Renal Function Before and After Intervention

Table 4: Comparison of renal function before and after intervention in both groups. At baseline, the mean serum creatinine levels were high and similar in both the ureteral stent and PCN groups, and there was no statistically significant difference between the two groups ($p = 0.41$). After urinary decompression, there was a significant improvement in renal function in both groups, as evident by the reduction in serum creatinine levels. The creatinine level after the procedure was slightly lower in the PCN group than

in the ureteral stent group, although not statistically significant (p = 0.08). The mean reduction in serum creatinine was also higher in the PCN group, although not statistically significant (p = 0.06), suggesting that both methods were effective in improving renal function in emergency obstructive uropathy.

Renal Function Parameter	Ureteral Stent (n=40)	PCN (n=40)	p-value
Baseline serum creatinine (mg/dL)	3.2 ± 1.1	3.4 ± 1.3	0.41
Post-procedure serum creatinine (mg/dL)	1.8 ± 0.6	1.6 ± 0.5	0.08
Mean reduction in creatinine (mg/dL)	1.4 ± 0.5	1.8 ± 0.6	0.06

Table 4: Comparison of Renal Function Before and After Intervention

The Table 5 below highlights the clinical efficacy and hospital stay of patients who underwent ureteral stenting and percutaneous nephrostomy (PCN). The success rate of urinary decompression was 90% in the ureteral stent group and 95% in the PCN group, suggesting that PCN is slightly more effective. However, the rate of secondary procedures was low in both groups, with 10% in the ureteral stent group and 5% in the PCN group. The average hospital stay was lower in the ureteral stent group (3.6 ± 1.2 days) than in the PCN group (4.4 ± 1.5 days), suggesting that ureteral stenting has a modest advantage over PCN in terms of hospital stay.

Outcome Measure	Ureteral Stent (n=40)	PCN (n=40)
Successful urinary decompression	36 (90%)	38 (95%)
Need for secondary intervention	4 (10%)	2 (5%)
Mean hospital stay (days)	3.6 ± 1.2	4.4 ± 1.5

Table 5: Clinical Effectiveness and Hospital Stay

The Table 6 summarizes the procedure-related complications in the ureteral stent and PCN groups. Hematuria was higher in stent (15%) and PCN (12.5%) patients, but slightly higher in the PCN group (17.5% vs. 12.5%). Lower urinary tract symptoms were higher in the ureteral stent group (22.5%) than in the PCN group (7.5%), whereas stent or tube displacement was higher in the PCN group (15% vs. 7.5%). The total complication rate was slightly lower in the ureteral stent group (35%) than in the PCN group (40%), which indicates that both procedures are relatively safe, but have a different profile of complications.

Complication	Ureteral Stent (n=40)	PCN (n=40)
Hematuria	6 (15%)	5 (12.5%)
Fever / infection	5 (12.5%)	7 (17.5%)
Lower urinary tract symptoms	9 (22.5%)	3 (7.5%)
Stent/tube displacement	3 (7.5%)	6 (15%)
Overall complications	14 (35%)	16 (40%)

Table 6: Procedure-Related Complications

4. Discussion

Emergency obstructive uropathy continues to be a serious urological emergency that needs immediate decompression to avoid permanent renal injury and systemic illness. This study compared the demographic parameters, etiology, recovery of renal function, efficacy, hospital stay, and procedure-related complications of ureteric stenting and percutaneous nephrostomy (PCN). Both procedures were found to be highly effective, and there were no statistically significant differences in renal recovery, thus making both procedures interchangeable in emergency situations.

In the present study, obstructive uropathy was found to be most common in middle-aged patients, with a mean age of 47 to 49 years. This is in line with the previous studies, which have shown the peak incidence of obstructive uropathy to be in the fourth to sixth decades of life [12,13]. The mean age of patients undergoing emergency urinary diversion was found to be 45.6 years by Ahmad et al., which is in close agreement with our study [14]. The male preponderance found in our study (67.5%) has been well-documented in the literature, and this is mainly due to the higher prevalence of urolithiasis and malignancy-related obstruction in males [15,16].

Ureteric stones were found to be the most common cause of obstruction in our series (57.5%), followed by malignancy-related obstruction (27.5%). This is in keeping with the observations of Mokhmalji et al. and Ku et al., who found stone disease to be the most common cause of emergency obstruction necessitating decompression in 17% of patients [17,18]. The similar etiological distribution in the ureteral stent and PCN groups in our study ensures that patients have been appropriately selected.

The recovery of renal function remains a major endpoint in emergency decompression. In the current study, both ureteral stenting and PCN led to a significant decrease in serum creatinine levels post-procedure. Although the PCN group showed a slightly larger mean decrease in creatinine, this was not statistically significant. Similar results were found in a study by Pearle et al., who noted similar improvements in renal function with both modalities in obstructed systems with infection [19]. A randomized study by Mokhmalji et al. also showed no significant difference in renal recovery between stenting and PCN, although faster decompression was achieved with PCN in some patients [17].

The slightly improved renal recovery rate with PCN in our study could be attributed to its property of offering immediate and direct drainage, especially in patients with severe obstruction or infection. Ku et al. found that PCN offered better early drainage in acute pyonephrosis, although long-term renal function was similar to ureteral stenting [18]. These results suggest that although PCN may offer quicker drainage in critically ill patients, both methods are equally effective in promoting renal function after the relief of obstruction.

The clinical efficacy in terms of successful urinary decompression was high in both groups, with a success rate of 90% for ureteral stenting and 95% for PCN. These findings are in line with the existing literature, which has shown a success rate ranging from 85% to 98% for both procedures [20,21]. Ahmad et al. have also shown a success rate of 92% for ureteral stents and 96% for PCN, which is remarkably similar to our findings [14]. The slightly higher rate of secondary interventions in the stent group can be explained by the failure of stent passage through severe obstruction or impacted calculi, a limitation previously pointed out in the literature [22].

Hospital stay was found to be shorter in the ureteral stent group than in the PCN group in the current study. This result is consistent with studies that showed decreased hospital stay and earlier mobilization in patients treated with internal drainage [23]. Wah et al. observed that external drainage systems like PCN can increase hospital stay because of catheter care, discomfort, and observation [24]. However, some studies found no significant difference in hospital stay, and this may be affected by institutional factors and patient variables [25].

The complication profile was different for the two interventions, although the rates of complications were similar. The incidence of lower urinary tract symptoms was significantly higher in the ureteral stent group, which is a well-known complication of indwelling stents [26]. On the other hand, PCN was associated with a higher incidence of tube displacement and infection, which is in line with previous studies that emphasized external device-related complications [27]. Aravantinos et al. also showed that the complication profile was different, and they emphasized that quality-of-life issues should be taken into account while choosing the intervention, especially in cases of malignancy-related obstruction [28].

Cumulatively, the results of the current study support the existing literature that both ureteral stenting and PCN are effective and safe procedures for emergency decompression in obstructive uropathy. The choice of procedure would depend on the individual case and the stability of the patient. Ureteral stenting would be preferred in stable patients because of the shorter hospital stay and the advantage of internal drainage, while PCN would still be an essential procedure in critically ill patients.

5. Conclusion

Both ureteral stenting and percutaneous nephrostomy are effective and safe techniques in the emergency treatment of obstructive uropathy. The current study clearly shows that both procedures lead to a significant improvement in renal function with equal success rates. Although percutaneous nephrostomy had a slightly higher success rate of decompression and a greater decrease in serum creatinine levels, ureteral stenting was associated with a shorter hospital stay. The complication rates were similar, but with a different distribution for each procedure. These results suggest that an individualized approach to emergency urinary diversion may be necessary depending on the clinical scenario.

Limitations

There are some limitations to the current study. First, the sample size was small and from a single institution, which could affect the generalizability of the results. Second, the non-random assignment of patients to intervention groups could lead to selection bias. Third, the study did not evaluate long-term outcomes such as the recovery of renal function, quality of life, and complications related to the stent or tube. Fourth, the procedural variables were operator-dependent.

Recommendations

Future studies with larger multicenter randomized designs are recommended to better understand the relative efficacy of ureteral stenting and percutaneous nephrostomy in the management of emergency obstructive uropathy. Long-term follow-up studies focusing on renal outcomes, patient comfort, and quality of life should also be included. The development of clinical guidelines may help optimize the management of patients in emergency urology.

References

1. Klahr, S., & Morrissey, J. (2002). Obstructive nephropathy and renal fibrosis. *American Journal of Physiology-Renal Physiology, 283*(5), F861-F875.

2. Pearle, M. S., Pierce, H. L., Miller, G. L., Summa, J. A., Mutz, J. M., Petty, B. A., ... & Nakada, S. Y. (1998). Optimal method of urgent decompression of the collecting system for obstruction and infection due to ureteral calculi. *The Journal of urology, 160*(4), 1260-1264.
3. Wah, T. M., Weston, M. J., & Irving, H. C. (2004). Percutaneous nephrostomy insertion: outcome data from a propspective multi-operator study at a UK training centre. *Clinical radiology, 59*(3), 255-261.
4. Ahmad M, Pachauri V, Quaiser S, Ali WM, Ali I. Comparative Analysis of Percutaneous Nephrostomy and Double J Stenting in Upper Urinary Tract Obstruction with Acute Kidney Injury: A Tertiary Hospital-Based Prospective Study. J Med Sci Clin Res. 2024;12(4):45–52.
5. Mokhmalji, H. A. S. S. A. N., BRAUN, P. M., MARTINEZ PORTILLO, F. J., SIEGSMUND, M., ALKEN, P., & KÖHRMANN, K. U. (2001). Percutaneous nephrostomy versus ureteral stents for diversion of hydronephrosis caused by stones: a prospective, randomized clinical trial. *The Journal of urology, 165*(4), 1088-1092.
6. Ku JH, Lee SW, Jeon HG, Kim HH. Percutaneous nephrostomy versus ureteral stent for drainage of acute pyonephrosis: A prospective randomized study. J Endourol. 2004;18(9):915–9.
7. Aravantinos E, Anagnostou T, Karatzas A, Karagiannis G, Samarinas M, Kyriakou G, et al. Percutaneous nephrostomy versus ureteral stents for the management of malignant ureteral obstruction: comparison of clinical outcome and quality of life. J Endourol. 2007;21(6):725–30.
8. Harris RD, McNicholas MMJ, Cook AJ, Kellett MJ, Leen E, O'Brien ME. Ureteric obstruction in malignancy: results of percutaneous nephrostomy. Clin Radiol. 1994;49(12):894–7.
9. Ganatra, A. M., & Loughlin, K. R. (2005). The management of malignant ureteral obstruction treated with ureteral stents. *The Journal of urology, 174*(6), 2125-2128.
10. Wang J, Zhao J, Chen J, Dong J, Chen Y. Comparison of percutaneous nephrostomy and ureteral stent in patients with ureteral obstruction due to malignancy: a meta-analysis. J Endourol. 2016;30(7):1–8.
11. Zhu, G. G., & Rais-Bahrami, S. (2015). Diagnosis and management of obstructive uropathy in the setting of advanced pelvic malignancies. *Journal of nephrology research, 1*(3), 90.
12. Lienert, A., Ing, A., & Mark, S. (2009). Prognostic factors in malignant ureteric obstruction. *BJU international, 104*(7), 938-941.
13. Turney BW. Acute kidney injury in obstructive uropathy. BJU Int. 2014;113(6):862–7.
14. Ahmad M, Pachauri V, Quaiser S, Ali WM, Ali I. Comparative analysis of percutaneous nephrostomy and double J stenting in upper urinary tract obstruction with acute kidney injury. J Med Sci Clin Res. 2024;12(4):45–52.
15. Pak, C. Y. (1998). Kidney stones. *The lancet, 351*(9118), 1797-1801.
16. Stoller ML, Bolton DM. Urinary stone disease. In: Wein AJ, editor. Campbell-Walsh Urology. 11th ed. Philadelphia: Elsevier; 2016. p. 1153–1210.
17. Mokhmalji, H. A. S. S. A. N., BRAUN, P. M., MARTINEZ PORTILLO, F. J., SIEGSMUND, M., ALKEN, P., & KÖHRMANN, K. U. (2001). Percutaneous nephrostomy versus ureteral stents for diversion of hydronephrosis caused by stones: a prospective, randomized clinical trial. *The Journal of urology, 165*(4), 1088-1092.
18. Ku JH, Lee SW, Jeon HG, Kim HH. Percutaneous nephrostomy versus ureteral stent for drainage of acute pyonephrosis. J Endourol. 2004;18(9):915–9.
19. Pearle, M. S., Pierce, H. L., Miller, G. L., Summa, J. A., Mutz, J. M., Petty, B. A., ... & Nakada, S. Y. (1998). Optimal method of urgent decompression of the collecting system for obstruction and infection due to ureteral calculi. *The Journal of urology, 160*(4), 1260-1264.
20. Farrell TA, Hicks ME. Emergency percutaneous nephrostomy: technical success and complications. Radiology. 1997;204(2):425–30.
21. Lynch, M. F., Anson, K. M., & Patel, U. (2006). Current opinion amongst radiologists and urologists in the UK on percutaneous nephrostomy and ureteric stent insertion for acute renal unobstruction: Results of a postal survey. *BJU international, 98*(6).
22. Jeong IG, Han KS, Joung JY, Seo HK, Chung J, Park WS, et al. Outcomes of ureteral stents in malignant ureteral obstruction. Korean J Urol. 2010;51(9):629–34.
23. Joshi, H. B., Newns, N., Stainthorpe, A., MacDonagh, R. P., Keeley, F. X., & Timoney, A. G. (2003). Ureteral stent symptom questionnaire: development and validation of a multidimensional quality of life measure. *The Journal of urology, 169*(3), 1060-1064.
24. Zhu, G. G., & Rais-Bahrami, S. (2015). Diagnosis and management of obstructive uropathy in the setting of advanced pelvic malignancies. *Journal of nephrology research, 1*(3), 90.
25. Wang J, Zhao J, Chen J, Dong J, Chen Y. Comparison of PCN and ureteral stent in malignant ureteral obstruction: meta-analysis. J Endourol. 2016;30(7):1–8.
26. Damiano, R., Oliva, A., Esposito, C., De Sio, M., Autorino, R., & D'Armiento, M. (2002). Early and late complications of double pigtail ureteral stent. *Urologia internationalis, 69*(2), 136-140.
27. Ahmad, C. S., Di Sipio, C., Lester, J., Gardner, T. R., Mullaney, P. J., Bleakney, R., ... & Levine, W. N. (2007). Bibliography Current World Literature Vol 19 No 5 September/October 2008. *Am J Sports Med, 35*, 1153-1161.
28. Aravantinos E, Anagnostou T, Karatzas A, Karagiannis G, Samarinas M, Kyriakou G, et al. PCN versus ureteral stents in malignant obstruction. J Endourol. 2007;21(6):725–30.