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COMPARATIVE STUDY OF STANDARD AND TUBELESS PERCUTANEOUS NEPHROLITHOTOMY AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Introduction:

Standard PCNL, where a nephrostomy tube is placed at the end of the surgery, is the predominant modality in the treatment of renal stones at present. With the advancement of techniques however, a new method has developed where tube placement is omitted. More and more studies are being done to evaluate the benefits of tubeless PCNL over the standard PCNL.

Objectives:

To compare the perioperative characterstics , analgesics requirement(according to VAS score) ,duration of hospital stay, post surgical complication, to know the which one is more beneficial to patient

Methods:

The study was done in Muzaffarnagar Medical College and Hospital, Muzaffarnagar, U.P. on indoor patients of the General Surgery department by following inclusion and exclusion criteria, clinical examinations, and interpretation of laboratory results.

Results:

Tubeless PCNL is better than the standard pcnl in terms of analgesics requirement, duration of hospital stay and complication.

Conclusion:

Standard PCNL has a longer operating time, that leads to more bleeding and drop in haemoglobin. Tubeless pcnl has a lesser analgesic requirement, lower rates of complications and shorter duration of hospital stay, as well as more cost effectiveness.

Keywords: PCNL, Tubeless PCNL, Stone free rate, Standard, Nephrostomy tube

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INTRODUCTION

“Nephrolithiasis is the major cause of morbidity in today's world. The total prevalence of renal stones is 21.11 % in the world, with 24.3% in men and 18.7% in women. The global data showed that the prevalence of renal stones has been increasing among both sexes[1],[2] ;this increase in prevalence may be due to environmental factors, lifestyle, and diet.[3] However, the newer diagnostic procedures or techniques for asymptomatic stones also partially explain this trend.[2],[4] The risk of renal stone increases with age, and it is found more commonly among men than women. Also, the risk decreases with increasing consumption of fluids, fruits, vegetables, and a restricted diet.[5] There are different types of kidney stones, which include calcium oxalate, calcium phosphate, struvite, uric acid, and mixed stones, among which calcium stones are the most common and account for 70 to 80% of the total renal stones.[2],[6]”

The symptoms of kidney stones can be excruciating and include severe pain in the back, side, abdomen, or groin, as well as nausea, vomiting, and blood in the urine, these symptoms can be treated by various methods such as ‘ Pain management, Increased fluid intake, medications to help pass the stones, shock wave lithotripsy (breaking up the stones using sound waves), ureteroscopy (using a small scope to remove the stones), or surgical procedures like PCNL (Percutaneous Nephrolithotomy) or open surgery, According to the size and location of the stones.

Percutaneous nephrolithotomy “(PCNL) is regarded as the typical treatment for those with sizable renal calculi”. Traditionally, after the kidney stones were removed, a “percutaneous nephrostomy tube” was inserted as a crucial step in pcnl drainage. “ However, advancements in techniques and equipment have led to the development of a modified approach known as "tubeless" PCNL.[1]

In Tubeless PCNL, instead of placing a Nephrostomy tube, A double-J stent is inserted for Internal drainage. This modification has several potential advantages, decrease postoperative pain, Shorter hospital stay, and Quicker recovery time for patients.

The decision to perform “standard PCNL with a nephrostomy tube or tubeless PCNL with a double-J stent depends on various factors, including the size and location of the renal calculi, the patient's overall health, and the surgeon's preference and expertise”.

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MATERIAL AND METHOD

Study design - This was a hospital based prospective observational study conducted in Department of General Surgery, Muzaffarnagar Medical College & Hospital, Muzaffarnagar, U.P, India for a period of 18 months, from July 2022. The study included patients of renal stones and its complications who were admitted in Department of General Surgery, and underwent tubeless and standard PCNL and outcomes measured. After explaining the risk, benefits, and complications Verbal and written consent was taken from all the participants for this research. Approval from Institutional Ethics Committee was obtained.

Inclusion criteria & Exclusion Criteria

In both the group patient with both the sexes and age more than 18 years were included, they should be diagnosed with renal stone disease and require PCNL, and that were admitted in our institute, patient undergone tubeless and standard PCNL depending on other factors , and gave consent for participation in our study were included in the study.

Paediatric patients and patients requiring b/l PCNL or contraindication for PCNL was present were excluded.

Method

The study was conducted in Muzaffarnagar medical College and Hospital, Muzaffarnagar, U.P. on 100 indoor patients of General Surgery department by following inclusion and exclusion criteria, history taking, general physical examination and relevant clinical examinations and interpretation of laboratory results. The data of the patients was collected in Case Record Form. The collected data was entered into Microsoft Excel spreadsheet.

Statistical data analysis & software :

The Mean $\pm$ SD was calculated for quantitative data. Percentage and proportion were calculated for qualitative data. Chi-square test was used to find out association between categorical variables. Using SPSS (Version 20) Software, p value < 0.05 was considered as statistically significant.

Result

Present study includes 100 patients in total and 50 in each in each group, the demographic features in both the group were comparable.

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The below table provides comparisons between standard Percutaneous Nephrolithotomy (PCNL) and tubeless PCNL procedures across various parameters, including age, fall in hemoglobin (Hb), number of days of hospital stay, post-operative analgesic requirement, stone size, operative time, and pre-operative creatinine levels.

	STANDARD PCNL		TUBELESS PCNL		Z	p-value
	Mean	SD	Mean	SD		
AGE	51.72	16.52	46.48	14.21	-1.838	0.066
FALL IN Hb (gm/dl)	0.56	0.19	0.47	0.14	-2.909	0.004
NO OF DAYS OF HOSPITAL STAY	3.90	0.65	3.36	0.72	-3.612	0.001
POS- OP ANALGESIC REQUIREMENT	138.00	37.20	122.00	28.86	-2.189	0.029
STONE SIZE	2.74	0.51	2.83	0.60	-0.835	0.403
OPERATIVE TIME (MINUTES)	42.44	4.68	38.92	6.86	-3.627	0.001
PRE OP CREATINE(mg/dl)	0.88	0.40	0.95	0.47	-0.679	0.497

The mean age of patients for standard PCNL is 51.72 years with a standard deviation (SD) of 16.52, while for tubeless PCNL, it is 46.48 years with a SD of 14.21 and p-value of 0.066. The mean fall in Hb for standard PCNL is 0.56 gm/dl with a SD of 0.19, whereas for tubeless PCNL, it is 0.47 gm/dl with a SD of 0.14 with a p-value of 0.004, no statistically significant difference was seen in mean age, mean fall in hb similarly there was no statistically significant difference was seen in stone size and post op creatinine level in two groups i.e standard PCNL and tubeless PCNL.

It was observed that Standard PCNL has a mean hospital stay of 3.90 days with a SD of 0.65, while tubeless PCNL has a mean stay of 3.36 days with a SD of 0.72 with a p-value of 0.001, indicating a statistically significant difference also the mean analgesic requirement for standard PCNL is 138.00 with a SD of 37.20, and

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for tubeless PCNL, it is 122.00 with a SD of 28.86with a p-value of 0.029, indicating a statistically significant difference, with patients underwent tubeless PCNL had significant less hospital stay and required less post op analgesia.

Table: 1Post operative complication in between the two groups

		STANDARD PCNL		TUBELESS PCNL		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
POST OP COMPLICATION IF ANY	BLEEDING	2	4.0%	2	4.0%	4	0.344	0.842
	UROSEPSIS	1	2.0%	2	4.0%	3		
	NO	47	94.0%	46	92.0%	93		
Total		50	100.0%	50	100.0%	100		

The table compares the occurrence of post-operative complications among patients who underwent standard Percutaneous Nephrolithotomy (PCNL) and tubeless PCNL procedures.

For bleeding complications, both standard PCNL and tubeless PCNL procedures each had 2 cases (4.0%). Similarly, for urosepsis complications, standard PCNL had 1 case (2.0%) while tubeless PCNL had 2 cases (4.0%). The majority of cases did not experience any post-operative complications, with 47 cases (94.0%) in the standard PCNL group and 46 cases (92.0%) in the tubeless PCNL group.

The chi-square value calculated for bleeding complications is 0.344 with a corresponding p-value of 0.842, indicating no statistically significant association between the type of PCNL procedure and the occurrence of bleeding complications. Similarly, for urosepsis complications, the chi-square value is not provided, but the p-value of 0.842 suggests no significant association between the type of procedure and the occurrence of urosepsis complications.

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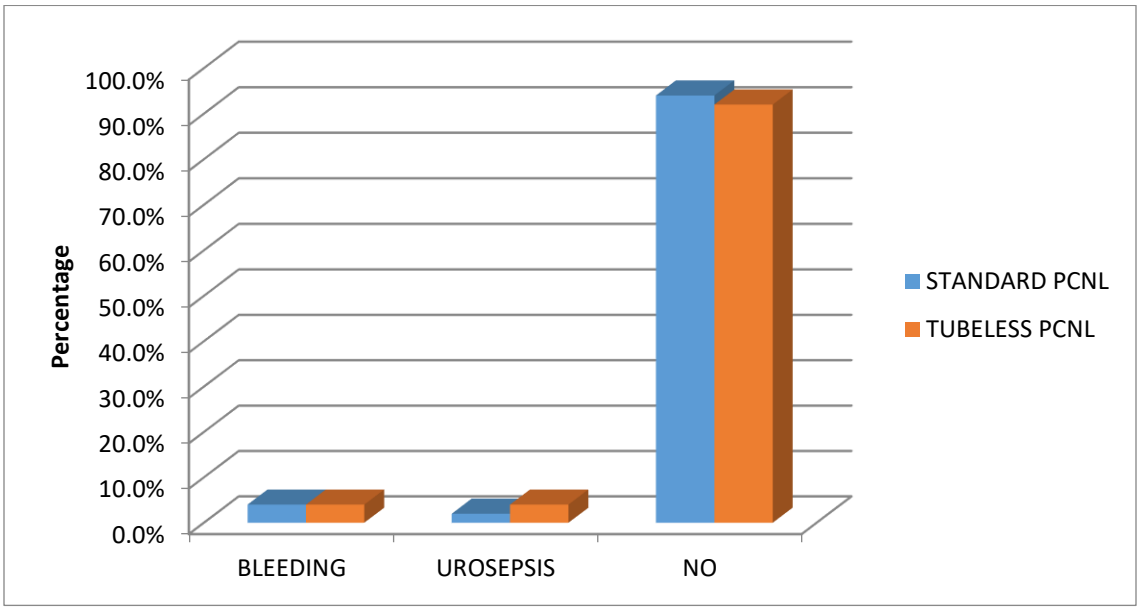

1. **Figure 15: Post operative complication in between the two groups**

Table 2 Comparison of Blood transfusion in between the two groups

		STANDARD PCNL		TUBELESS PCNL		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
BLOOD TRANSFUSION	1	6	12.0%	3	6.0%	9	1.0999	0.295
	NIL	44	88.0%	47	94.0%	91		
Total		50	100.0%	50	100.0%	100		

Among patients who received blood transfusion, there was 1 case (6.0%) in the " standard PCNL group and 3 cases (6.0%) in the tubeless PCNL group". For patients who did not require blood transfusion, there were 44 cases (88.0%) in the " standard PCNL group and 47 cases (94.0%) in the tubeless PCNL group."

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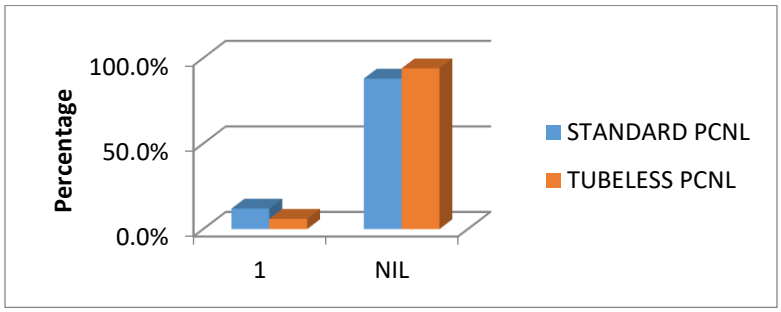

Figure 13: Comparison of Blood transfusion in between the two groups

p-value of 0.295. This indicates that there is no statistically significant association between the occurrence of blood transfusion and the type of PCNL procedure performed at the standard threshold of 0.05 for significance.

Table 3 Comparison of stone clearance in between the two groups

		STANDARD PCNL		TUBELESS PCNL		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
STONE CLEARANCE	INCOMPLETE	3	6.0%	2	4.0%	5	0.211	0.646
	YES	47	94.0%	48	96.0%	95		
Total		50	100.0%	50	100.0%	100		

The table compares stone clearance outcomes between standard Percutaneous Nephrolithotomy (PCNL) and tubeless PCNL procedures.

Among the cases analyzed, 3 cases (6.0%) in the standard PCNL group and 2 cases (4.0%) in the tubeless PCNL group were classified as having incomplete stone clearance. The majority of cases achieved stone clearance, with 47 cases (94.0%) in the" standard PCNL group and 48 cases (96.0%) in the tubeless PCNL group."

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The chi-square value calculated is 0.211 with a corresponding p-value of 0.646. This indicates that there is no statistically significant association between the type of PCNL procedure performed and the outcome of stone clearance at the conventional significance level of 0.05.

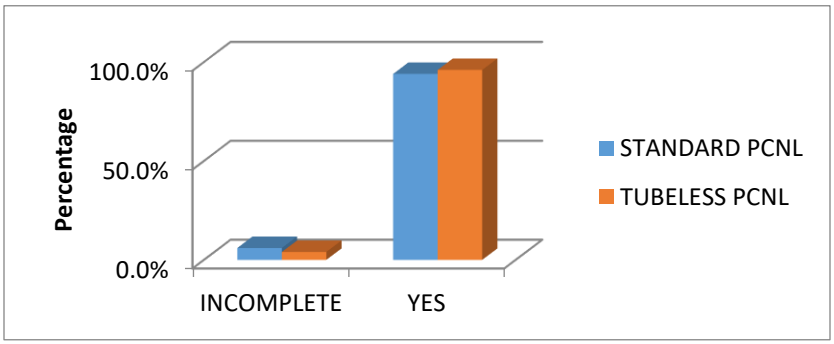

Figure 16: Comparison of stone clearance in between the two groups

The table provides a breakdown of cases by comorbidities (diabetes mellitus, diabetes mellitus/hypertension, hypertension, and none) and post-operative complications for patients undergoing standard Percutaneous Nephrolithotomy (PCNL) and tubeless PCNL procedures.

Table 4Cormordity in between two groups

COMORBIDITY			STANDARD PCNL		TUBELESS PCNL		Total	Chi-square value	p-value
			No. of cases	%age	No. of cases	%age			
DM	POST OP COMPLICATION IF ANY	BLEEDING	0	0.0%	1	11.1%	1	0.944	0.331
		NO	8	100.0%	8	88.9%	16		
	Total		8	100.0%	9	100.0%	17		
DM/HTN	POST OP COMPLICATION IF ANY	NO	1	50.0%	1	100.0%	2	0.386	0.386
		UROSEPSIS	1	50.0%	0	0.0%	1		
	Total		2	100.0%	1	100.0%	3		
HTN	POST OP	NO	4	100.0%	1	50.0%	5	2.4	0.121

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	COMPLICATION IF ANY	UROSEPSIS	0	0.0%	1	50.0%	1		
	Total		4	100.0%	2	100.0%	6		
NO	POST OP COMPLICATION IF ANY	BLEEDING	2	5.6%	1	2.6%	3	1.337	0.512
		NO	34	94.4%	36	94.7%	70		
		UROSEPSIS	0	0.0%	1	2.6%	1		
	Total		36	100.0%	38	100.0%	74		

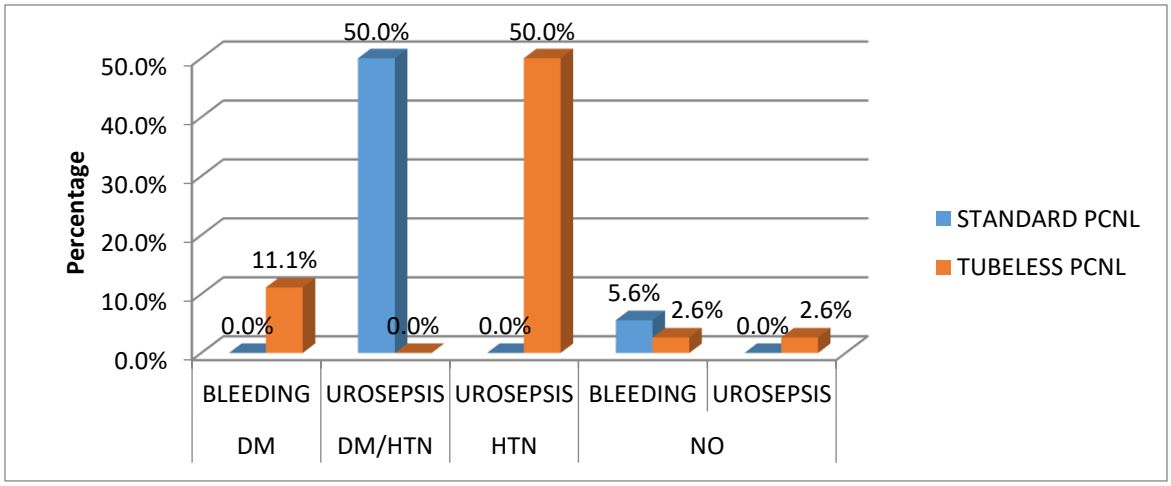

Figure 24: Cormordity in between two groups

DISCUSSION

It is true that " percutaneousnephrolithotomy (PCNL) has become the gold standard for treating renal calculi. Its adaptability has made it the treatment of choice for a wide variety of stone types, including those that have proven resistant to traditional shock wave lithotripsy (SWL). Also, PCNL is a good option to SWL for patients who can't have their stones removed that way". Urology has advanced thanks to PCNL because of its effectiveness in treating a variety of stone types and patient characteristics.

With the introduction of tubeless pcnl, the goal was to reduce the morbidity that comes with using larger nephroscopes and tubes.

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Individuals over the age of 60 made up the most proportion in this study, making about 29% of all instances. 19% of the cases, were individuals aged 51-60. Approximately 17% of the cases fell into the age brackets of 41–50 and 31–40, showing a fairly uniform distribution within this range. Furthermore, there was a significant presence across all age groups, with individuals under the age of 30 constituting 18% of the cases. With a mean age of 51.72 years, Standard PCNL is more common than tubeless PCNL, which has a slightly lower mean age of 46.48 and a standard deviation of 14.21. [7] The mean age of patients in group A was 31 years (range 21-57) and in group B it was 33 years (range 18-55), which differs from the study done by Aggarwal MS et al in 2008. [7],[8]

While the mean pre-operative creatinine level for regular PCNL is 0.88 mg/dl with a standard deviation of 0.40, it is slightly higher for tubeless PCNL at 0.95 mg/dl with a standard deviation of 0.47. [97] The average sr. creatinine level in group A was 1.3 (range 0.8-1.5) mg/dL, whereas in group B it was 1.2 (range 0.9-1.7) mg/dL, in comparison to the 2008 study by Aggarwal MS et al. [7]
A mean of 3.90 days with a standard deviation of 0.65 was found for conventional PCNL in the present study; a significantly lower mean of 3.36 days with a standard deviation of 0.72 was reported for tubeless PCNL. [9] The statistical analysis yields a p-value of 0.001 and a Z-score of -3.612. A p-value of 0.001 is considered statistically significant because it is lower than the commonly accepted standard of 0.05.[9] The tubeless group's average hospital stay was 21.8 hours, which was substantially less than the normal PCNL group's 54.2 hours ($P < 0.01$), according to a study by Aggarwal MS et al. in comparison. [9]The time it took for patients with standard PCNL to fully recover was 8 to 10 days, while patients with tubeless PCNL only needed 5 to 7 days ($P < 0.01$). Bhat S et al. [7] (2017) divided 75 patients into three groups of 25 patients each and gave each group a distinct set of instructions for performing percutaneous nephrolithotomy (PCNL). [7] Group 1 had conventional percutaneous nephrolithotomy (PCNL) with nephrostomy tubes, Group 2 had PCNL without tubes but with a ureteric stent and no nephrostomy, and Group 3 had PCNL without tubes but with a ureteric catheter and no nephrostomy at all [7] With $F = 13.102$ and $P = 0.001$, a statistically significant difference in the length of hospital stays was observed between the categories. [7]

The most common consequence of PCNL, necessitating a blood transfusion in 3-12% of cases, is hemorrhage. [10] There was no significant difference in hemoglobin decline between standard and tubeless PCNL, according to a meta-analysis by Borges et al. ($P = 0.09$) .[10] The mean hemoglobin reduction (g%) in the regular PCNL group was 1.3 and in the tubeless PCNL group it was 1.7, according to the research by Tefekli et al. [11]

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A blood transfusion was necessary in one case (6.0%) out of fifty cases of regular PCNL and in three cases (6.0%) out of fifty cases of tubeless PCNL. [11]Based on the data, it appears that there is no significant relationship between the type of PCNL method (standard vs. tubeless PCNL) and the requirement for blood transfusion at the usual significance level of 0.05, with p-value of 0.295. [11]

Based on the statistical analysis, it appears that the type of PCNL technique did not influence the observed variances in blood transfusion requirements and postoperative fever incidence.

There was a statistically significant difference (P = 0.001) in the mean opioid analgesic demand (tramadol in milligrams) between the conventional group and the tubeless and completely tubeless groups in a 2017 study by Bhat S et al.[7] In their study, Agrawal et al. found that the standard group required significantly more opioid analgesics than the tubeless group (P = 0.001).[9] Postoperative analgesic needs for conventional PCNL were found to be 138.00 with a standard deviation of 37.20 in the present study, but those for tubeless PCNL were slightly lower at 122.00 with a standard deviation of 28.86 .[9] A p-value of 0.029 and a Z-score of -2.189 are the results of the statistical analysis.

Bhat S et al. (2017) found that patients reported more discomfort after surgery if foreign entities, including nephrostomy tubes or double J stents, were presentwith a p-value of 0.001, a statistically significant difference was discovered between the groups.[7,9] Agrawal et al. found a p-value of less than or equal to 0.01, which is consistent with our results.[9] In their study, the regular PCNL group reported an average pain score of 5.9, whereas the tubeless PCNL group reported an average pain score of 3.1. [9] In light of these findings, it is clear that postoperative pain management strategies should take foreign body presence or absence into account. Patients may find relief from postoperative discomfort using tubeless or completely tubeless PCNL techniques.

CONCLUSION

This randomized trial demonstrates statistically significant advantages of tubeless PCNL over standard PCNL in terms of postoperative discomfort and morbidity, hospital stay, and period of complete convalescence. [9] The adoption of tubeless and totally tubeless Percutaneous Nephrolithotomy (PCNL) techniques represents safe and effective advancements in the management of renal stone. [9] These modifications in the PCNL procedure offer several benefits, including reduced pain, decreased analgesic requirement, and lower incidence of postoperative complications. Importantly, these improvements contribute to facilitating early discharge from the hospital, thereby alleviating the financial burden on patients. Specifically, the totally tubeless PCNL method

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demonstrates even lower requirements for analgesia compared to the tubeless approach, further enhancing patient comfort and recovery. Overall, these advancements in PCNL techniques signify significant progress in renal stone management, promoting better patient outcomes and quality of life.

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