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Placement of double-J stent in patients with malignant ureteral obstruction: antegrade or retrograde approach?

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AIM: To determine whether antegrade or retrograde methods should be preferred for double-J stent placement in patients with malignant ureteral obstruction (MUO).

MATERIAL AND METHODS: The medical records of patients treated for MUO in the Urology and Interventional Radiology Clinic, Konya Training and Research Hospital, were reviewed retrospectively. Patients with benign aetiology were excluded from the study. Reports of the procedures, ultrasonography findings, computed tomography (CT), angiography, and pyelography images and the follow-up records of patients with MUO were assessed. A total of 111 patients and 114 ureteral stenting treatments were included in the study; 63 (55.3%) were operated on using the antegrade ureteral stenting (AUS) method, whereas 51 (44.7%) were operated on using the retrograde ureteral stenting (RUS), method, and the characteristics of these groups were evaluated. The presence of hydroureteronephrosis and ureteral tortuosity were determined.

RESULTS: Overall success rates were found to be 95.2% using the AUS method and 47.1% using the RUS method. The technical success of the antegrade method was significantly higher in patients with or without tortuosity (respectively: p=0.005, Z shape p=0.001, pigtail shape p=0.035″). The technical success of the antegrade method was significantly higher in patients with hydroureteronephrosis (p=0.001).

CONCLUSION: The AUS technique should be the first choice for double-J stent placement in patients with MUO.

Introduction

Malignant ureteral obstruction (MUO) may be caused by intrinsic urological malignancies, such as prostate or bladder cancer, or other primary malignancies of the gynaecological or colorectal regions.[1] MUO can lead to urosepsis or renal failure and is usually associated with

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short life expectancy and significantly reduced quality of life.[2] Retrograde ureteral stenting (RUS), antegrade ureteral stenting (AUS), and percutaneous nephrostomy (PCN) are the main methods of urinary diversion, and each approach has various advantages and disadvantages.[3]

Studies to date have not been able to identify an optimal method of treatment in MUO cases. The RUS approach is known to have high failure rates when pelvic or retroperitoneal tumours are present; PCN results in the requirement for an external collection bag, which may worsen life quality, and many patients refuse to undergo such a procedure.[4] Therefore, it is apparent that the most effective treatment of MUO is not well defined, and available treatments may be considered controversial. Treatment choice usually depends on the experience of the clinician, the availability of the treatment procedure, and the urgency of the situation.[5,6]

There are two options in the placement of double-J stents (DJS): the antegrade and retrograde approaches. Currently, there is no concise protocol for the management of ureteral obstruction due to malignant aetiology.[7] Because the cystoscopic retrograde method often fails in MUO, the same patients are directed to DJS placement using the antegrade method; therefore, these patients may unnecessarily undergo two procedures. To authors' knowledge, none of the studies in the literature have compared the success of these two methods in the treatment of MUO with regard to ureter function. In addition, it is unclear in which patient groups the antegrade approach is more successful. Therefore, this study was performed to determine whether there is a difference between the normal population and patients with MUO in terms of DJS placement approach. The aim of the present study was to predict which of the methods, antegrade or retrograde, is preferable for patients who require stent placement due to MUO and to investigate whether hydroureteronephrosis and tortuosity can be used as predictive factors for treatment.

Materials and methods

The records of patients treated for the diagnosis of MUO in the Urology and Interventional Radiology Clinic, Konya Training and Research Hospital, between January 2015 and September 2018 were evaluated retrospectively. Patients with benign aetiology, such as urinary stones, benign ureteric stenosis, history of urological intervention, ureter injury, and ureter anomaly, were excluded from the study. Only patients with MUO were enrolled. Procedure reports, ultrasonography findings, computed tomography (CT), angiography, and pyelography images, and the follow-up records of patients with MUO were assessed and recorded. Patients were listed according to their treatment by AUS and RUS methods. Age, gender, right/left ureter stenosis, stenosis aetiology, and the preoperative and postoperative hydronephrosis degrees of patients were recorded. The increase in ureter diameter was defined as ureteronephrosis, whereas ureteronephrosis along with an increase in the width of pelvicalyceal structures was defined as hydroureteronephrosis. Tortuosity was evaluated in three classes according to form: normal, Z-shaped, or pigtail-shaped.[8] The presence of hydroureteronephrosis and ureteral tortuosity were classified and listed (Fig 1). These findings were evaluated with preoperative CT images (Fig 2). The accuracy of the findings in the medical records of patients undergoing AUS therapy was checked by re-evaluation of antegrade pyelography images (Fig 3). Failure to place the DJS was defined as a technical failure.

AUS method

AUS operations were performed by interventional radiologists with at least 2 years of experience. Before the treatment, each patient provided informed consent for the procedure. Routine surgical anti-biotherapy prophylaxis was performed with 1 g intravenous cefazolin in all patients. With the exception of several patients who requested otherwise, AUS procedures were performed under local anaesthesia. The standard 0.035″ hydrophilic guide and a 5 Fr angiography catheter combination was used to pass the occlusion in the AUS procedure.[9] The hydrophilic guidewire was then replaced by a stiff 0.035″ guide wire (Accoat guide wire super stiff 180 cm, SP Medical, Denmark), and the DJS (7–8 F, 24–28 cm; Geotek, Ankara, Turkey) was placed (Fig 5). In some patients, there were difficulties in passing the stenosis and/or placing the DJS using this standard combination. Thus, a combination of a 0.018″ hydrophilic-coated guide wire of 200 cm (V-18 Control Wire, Boston Scientific, USA) or 0.018″ crossing support catheter (seeker, Bard Peripheral Vascular, USA) was applied in these patients (Fig 4). In addition, for patients with severe ureteral tortuosity, a 7 F long sheath (45 cm destination; Terumo, USA) was used, and simple manoeuvres were performed to ease catheter passage. In two cases with extreme stenosis, gradual controlled angioplasty dilatation with a catheter balloon of 3–4 mm diameter and length of 40–200 mm (Mustang percutaneous transluminal angioplasty [pta] balloon dilatation catheter, Boston Scientific, USA) was performed to facilitate catheter passage. Last, the PCN treatment was performed in three patients in whom stents could not be placed despite all efforts.

RUS method

The RUS operations were also performed by urologists who had at least 2 years of experience. Before the treatment, each patient provided informed consent for treatment. One gram cefazolin was administered intravenously to each patient for prophylaxis before the operation. All patients were operated on under general or spinal anaesthesia in the lithotomy position, and 10 ml of 2% lidocaine gel was applied to the urethra of all patients. After observing the ureter inlet with semi-rigid ureterorenoscopy, a J-tipped, hydrophilic, 150 cm guidewire was placed. A 6–8 F polyurethane DJS of 22–26 cm (Geotek, Ankara, Turkey) was inserted along the guidewire. Direct urinary tract imaging was performed to confirm proper placement of the stent after the procedure.

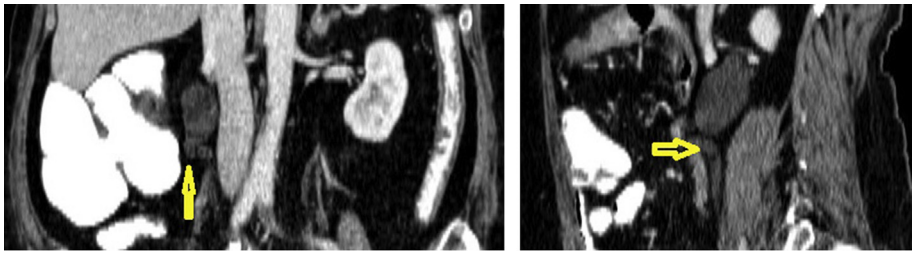

Figure 1 (a) CT multiplanar reformat coronal and (b) sagittal images taken before the DJS in a patient with gynaecological malignancy. Tortuosity (arrow) is present in the form of a pigtail.

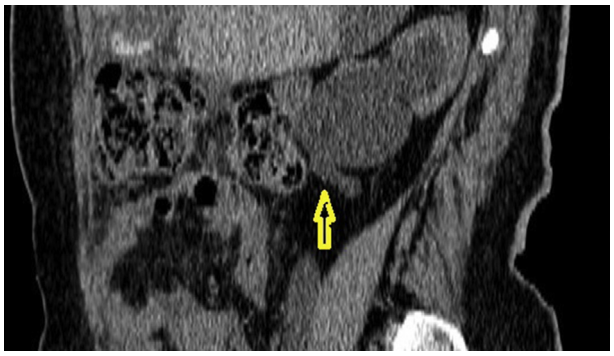

Figure 2 CT multiplanar reformat images, the posterior opening of the right proximal ureter, a sign of Z-shaped tortuosity (arrow) is seen.

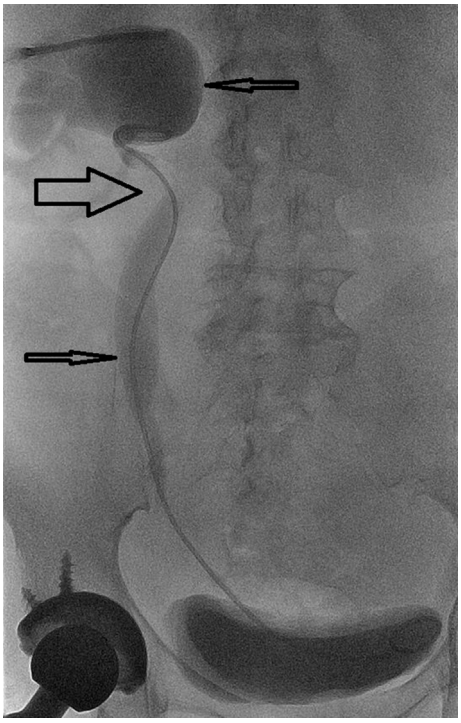

Figure 3 Same patient as Fig 2. A sign of hydroureteronephrosis (thin arrows) and Z-shaped tortuosity (thick arrow). DJS was placed with antegrade method in the patient with colon carcinoma.

This work was approved by the local ethics committee. Treatment methods were performed according to approved guidelines. Permission was obtained for the retrospective evaluation of patient files and images.

Statistical analysis

Research data were evaluated using SPSS version 22 software for Windows (SPSS, Chicago, IL, USA). Descriptive statistics were presented as mean±standard deviation (minimum–maximum), frequency distribution, and percentage. Pearson's chi-squared test and Fisher's exact test were used to compare categorical variables. The normality of distribution of continuous variables was analysed by using visual (histogram and probability graphs) and analytical methods (Kolmogorov–Smirnov/Shapiro–Wilk tests). The Mann–Whitney *U*-test was used for the comparison of continuous variables with non-normal distribution. For statistical comparison between two dependent groups, the Wilcoxon signed ranks test was used. Statistical significance level was accepted as $p<0.05$.

Results

A total of 111 patients and 114 ureteral stenting treatments were assessed in the current study; 63 (55.3%) of these patients underwent the AUS procedure, and the remaining 51 (44.7%) cases underwent the RUS procedure. Three patients had bilateral ureteric stenosis. Among the malignant aetiologies, colon malignancy was the most frequent underlying diagnosis in 39% of patients. Overall success rates were found to be 95.2% with AUS and 47.1% with RUS. The degree of hydronephrosis before and after the operation was decreased by an average of grade 1±0.9 (min: 0; max: 3) in patients operated on with AUS, whereas it was decreased by an average of 0.7±1 (min: 0; max: 3) in patients operated on with RUS. The distribution of AUS and RUS groups is basically similar and does not show statistically significant differences. The distribution of other descriptive and clinical features between the study groups is presented in Table 1.

Ureteral tortuosity was observed in 69 of 114 ureters (AUS: 35, RUS: 34) in total. In patients with Z-shaped and

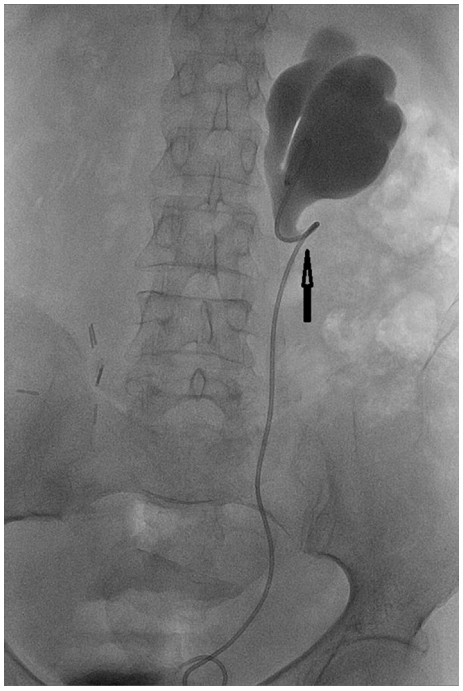

Figure 4 Ureter tortuosity in the form of a pigtail (arrow) in the image of the right-ureter stent and pyelography.

pigtail-shaped tortuosity, the technical success of the antegrade method was significantly higher than the retrograde method (Z shape p=0.001, pigtail shape p=0.035″). Furthermore, in the group without ureteral tortuosity, the technical success of the antegrade method was also superior compared to the retrograde method (p=0.005; Table 2).

A total of 90 patients—54 from the AUS group and 36 from the RUS group—had hydroureteronephrosis. The technical success of the AUS method was significantly higher in the presence of hydroureteronephrosis (p=0.001; Table 3). The technical success of the antegrade method in cases without hydroureteronephrosis was also high (p=0.080); however, the difference between groups was not statistically significant.

There were a total of 34 patients with intrinsic aetiology (bladder and ureter), and 80 patients with extrinsic aetiology (pelvic, gynaecological, prostate, and colon). The AUS approach was statistically better in patients with extrinsic aetiology in the presence of tortuosity. Furthermore, in the presence of hydroureteronephrosis, all MUO patients had higher AUS success compared to RUS (Table 4). When the aetiology of the patients was examined in detail, high technical success was achieved in stenting with the antegrade method in all patients with MUO. In patients with colon, pelvic, and gynaecological malignancies this difference in technical success was even higher (Table 5).

Discussion

This retrospective study summarises the view that the AUS technique may be a good alternative to the RUS technique in MUO patients, with an overall success rate of 95.2% versus 47.1%. The antegrade approach seems to be a good alternative in selected patients, especially after good evaluation of the ureter.

DJS placement and PCN are the main options in the treatment of MUO. The treatment approach is greatly influenced by the physician's experience and suggestions. Physicians often rely on their personal experience and their preferences for counselling their patients. Sometimes the clinician recommending the intervention and the clinician

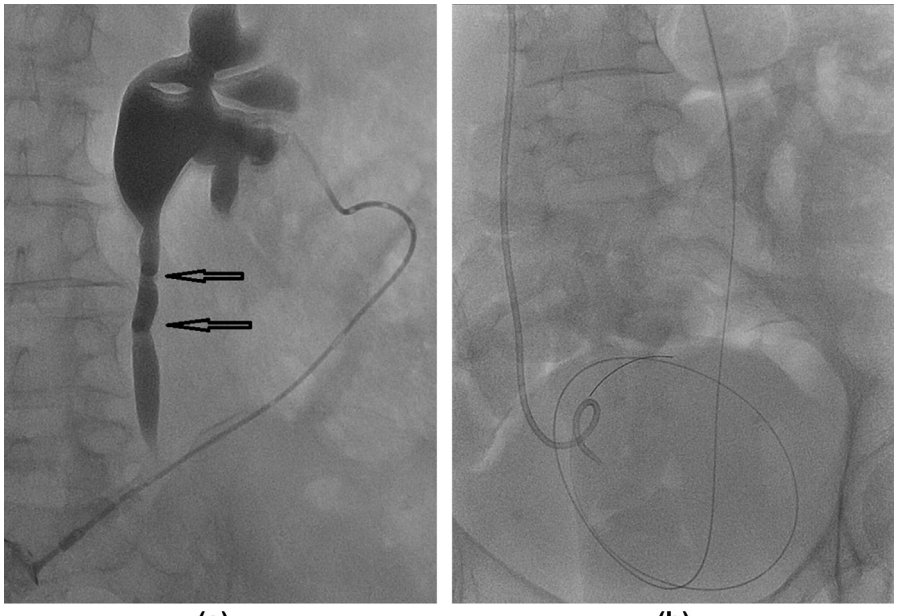

Figure 5 (a) Pigtail tortuosity (arrows) and hydroureteronephrosis in antegrade pyelography, obstruction due to gynaecological malignancy and distal ureter invasion. (b) The stenosis could not be passed with the standard guide; V18 was then performed.

Table 1
Distribution of descriptive and clinical findings in regard to groups.

	Total n=114 (%) (patient=111) (%)	AUS (n=63) (%) (patient=61) (%)	RUS (n=51) (%) (patient=50) (%)	p-Value
Age (years), mean±SD(min–max)	61±10.8 (37–90)	61.9±10.2 (42–80)	59.9±11.5 (37–90)	0.338[a]
Sex, n (%)				
Male	71 (64)	37 (61)	34 (68)	0.631[b]
Female	40 (36)	24 (39)	16 (32)	
Side, n (%)				
Right	66 (57.9)	33 (52.4)	33 (64.7)	0.185[b]
Left	48 (42.1)	30 (47.6)	18 (35.3)	
Aetiology, n (%)				
Pelvic and gynaecological	15 (13)	9 (15)	6 (12)	0.771[b]
Bladder and ureter	31 (28)	16 (26)	15 (30)	
Prostate	22 (20)	14 (23)	8 (16)	
Colon	43 (39)	22 (36)	21 (42)	
Preop hydronephrosis Grade, mean±SD	2.5±0.8	2.4±0.8	2.6±0.9	0.348[a]
Postop hydronephrosis Grade, mean±SD	1.6±1.1	1.3±0.8	1.9±1.3	0.016[a]

n, number of ureters; %, column percentage; SD, standard deviation; AUS: antegrade ureteral stenting; RUS: retrograde ureteral stenting; preop: before operation; postop: post-operation.
[a] Mann–Whitney U-test.
[b] Pearson's chi-squared test.

Table 2
Distribution of success status according to study groups in patients with and without ureteral tortuosity.

Tortuosity type	Group	Outcome		p-Value
		Unsuccessful	Successful	
		n (%)	n (%)	
None (n=45)	AUS	0	28 (100)	0.005[a]
	RUS	5 (29.4)	12 (70.6)	
Z shape (n=52)	AUS	3 (10.7)	25 (89.3)	0.001[b]
	RUS	16 (66.7)	8 (33.3)	
Pigtail shape (n=17)	AUS	0	7 (100)	0.035"[a]
	RUS	6 (60.0)	4 (40.0)	

n, number of ureters; %, row percentage; AUS, antegrade ureteral stenting; RUS, retrograde ureteral stenting.
[a] Fisher's exact test.
[b] Pearson's chi-squared test.

Table 3
Distribution of success status according to study groups with and without hydroureteronephrosis.

Hydroureteronephrosis	Group	Outcome		p-Value
		Unsuccessful	Successful	
		n (%)	n (%)	
Absent (n=24)	AUS	1 (11.1)	8 (88.9)	0.080[a]
	RUS	8 (53.3)	7 (46.7)	
Present (n=90)	AUS	2 (3.7)	52 (96.3)	0.001[b]
	RUS	19 (52.8)	17 (47.2)	

n, number of ureters; %, row percentage; AUS, antegrade ureteral stenting; RUS, retrograde ureteral stenting.
[a] Fisher's exact test.
[b] Pearson's chi-squared test.

performing the intervention may make different suggestions.[10] It is also important to consider the risks of complications from invasive procedures and the expectations of patients. Although there is debate concerning the risks and benefits of using urinary stent placement to relieve upper urinary tract obstructions, it is not clear which method should be the priority for which patient group.[11] There are two options for stent placement. The ureteral DJS can be placed by urologists through the transurethral retrograde route and by interventional radiologists through the percutaneous antegrade route. The decision for treatment approach also depends on the level of ureteral pathology and determination of the best way to access the stenosis.[12] In the current study, the AUS approach was found to be technically superior to the RUS approach in patients with extrinsic aetiology in the presence of tortuosity. The presence of tortuosity in this group of patients may be considered as a positive predictive factor for the use of the AUS procedure. Furthermore, in all patients (intrinsic/extrinsic), the presence of hydroureteronephrosis may be seen as an indication for preferring the AUS approach (Table 4).

Retrograde stenting has several advantages compared to the antegrade approach, especially in benign aetiologies. For example, it is easier to treat obstructive stones and strictures with RUS; however, it is known that RUS procedures may fail in up to 50% of patients with distal and extra-ureteral obstruction caused by malignancies.[4,7,12,13] Studies on this subject have mostly aimed to determine the causes of stent failure,[13–15] whereas the technical success of the procedures, which could affect the choice of treatment, were rarely evaluated in previous studies.

Some recent studies have reported that, in most cases of urinary bladder or prostate carcinoma, retrograde stenting is not possible due to tumour involvement of ureter orifices. They presented percutaneous nephrostomy as a better option in MUO[16–18]; however, the requirement for external drainage connected to the nephrostomy catheter decreases patient comfort and quality of life.[5,6] Many patients refuse such treatment. It is assumed that those researchers did not consider the AUS method in their studies and therefore suggested this procedure; however, in this group of patients, the AUS procedure, with higher technical success, should be preferred more frequently. In a study by Song *et al.* involving 75 patients with MUO, the retrograde cystoscopy method was used initially for ureteric stenting,

Table 4
Distribution of success according to tortuosity and hydroureteronephrosis variables in MUO patients with intrinsic and extrinsic aetiology.

Variable, (n)	Aetiology, n	Group	Outcome		*p*-Value
			Unsuccessful	Successful	
			n (%)	*n* (%)	
Tortuosity absent (*n*=45)	İntrinsic (*n*=13)	AUS	0	9 (100)	0.308[a]
		RUS	1 (25.0)	3 (75.0)	
	Extrinsic (*n*=32)	AUS	0	19 (100)	0.020[a]
		RUS	4 (30.8)	9 (69.2)	
Tortuosity present (*n*=69)	İntrinsic (*n*=21)	AUS	1 (11.1)	8 (88.9)	0.067[a]
		RUS	7 (58.3)	5 (41.7)	
	Extrinsic (*n*=48)	AUS	2 (7.7)	24 (92.3)	0.001[b]
		RUS	15 (68.2)	7 (31.8)	
Hydroureteronephrosis absent (*n*=24)	İntrinsic (*n*=7)	AUS	0	3 (100)	1.000[a]
		RUS	1 (25.0)	3 (75.0)	
	Extrinsic (*n*=17)	AUS	1 (16.7)	5 (83.3)	0.131[a]
		RUS	7 (63.6)	4 (36.4)	
Hydroureteronephrosis present (*n*=90)	İntrinsic (*n*=27)	AUS	1 (6.7)	14 (93.3)	0.008[a]
		RUS	7 (58.3)	5 (41.7)	
	Extrinsic (*n*=63)	AUS	1 (2.6)	38 (97.4)	0.001[a]
		RUS	12 (50.0)	12 (50.0)	

n, number of ureters; %, row percentage; AUS, antegrade ureteral stenting; RUS, retrograde ureteral stenting; MUO, malignant ureteral obstruction.
[a] Fisher's exact test.
[b] Pearson's chi-squared test.

Table 5
Distribution of the success of methods in different aetiologies of patients with MUO.

Aetiology, *n*	Group	Outcome		*p*-Value
		Unsuccessful	Successful	
		n (%)	*n* (%)	
Pelvic and gynaecological (*n*=15)	AUS	0	9 (100)	0.011[a]
	RUS	4 (66.7)	2 (33.3)	
Bladder and ureter (*n*=34)	AUS	1 (5.6)	17 (94.4)	0.006[b]
	RUS	8 (50.0)	8 (50.0)	
Prostate (*n*=22)	AUS	1 (7.1)	13 (92.9)	0.039[a]
	RUS	4 (50.0)	4 (50.0)	
Colon (*n*=43)	AUS	1 (4.5)	21 (95.5)	0.001[b]
	RUS	11 (52.4)	10 (47.6)	

n, number of ureters; %, row percentage; AUS, antegrade ureteral stenting; RUS, retrograde ureteral stenting; MUO, malignant ureteral obstruction.
[a] Fisher's exact test.
[b] Pearson's chi-squared test.

and 61 (81.3%) of the 75 cases were treated successfully with cystoscopy. In the remaining 14 cases, stent placement failed. The authors stated that in patients with failed treatments, the ureteral orifice could not be identified or ureteral stenosis did not allow stent passage.[13] Successful cystoscopic RUS placement for MUO treatment is a difficult procedure. Wang *et al.* reported technical failure in the RUS procedure in up to 34.7% of their patients. They suggested that hydronephrosis and the degree of bladder invasion might be responsible for the unfavourable retrospective analysis of this condition.[19] RUS procedure failure rates of 15%–34.6% were reported among highly experienced urologists in various publications.[14,19–21] In a prospective study by Yossepowıtch *et al.*, 100 patients with obstructive uropathy were classified according to extrinsic and intrinsic aetiology. Among these, 61% had intrinsic and 39% had extrinsic obstruction. Extrinsic causes included pelvic malignancies. Stent passage using standard operative manoeuvres failed in 27% of extrinsic patients and only 6% in patients with intrinsic obstruction (p=0.002). They reported a higher failure rate in stent placement in patients with MUO.[12] In these studies published in the literature, the authors evaluated only in terms of AUS or only RUS technique. In the present study, the technical success of both methods was compared in the patient group with MUO. One of the advantages of the present study is the aetiology and demographic features of both groups with MUO. The distribution of AUS and RUS groups in terms of their descriptive characteristics is fundamentally similar. The distribution of AUS and RUS groups did not show statistically significant differences in terms of aetiology, age, or preoperative hydronephrosis. This is important for the homogeneity of the present study.

In some cases, it may not be possible to pass through severe distal ureteral obstructions using the standard guidewires suggested for the procedure. Keeling *et al.* provided an alternative approach to severe ureteral obstructions, using an alternative combination of micro-guidewire and microcatheter.[22] In the present study, the success of RUS in patients with MUO was 47.1% and success of AUS was 95.2%. A very high technical success rate was achieved with the AUS method. The use of 200 cm long 0.018″ hydrophilic-coated guidewires, 0.018″ crossing support catheters, and 45 cm long sheath and balloon dilatations contributed significantly to this high success rate. Van Der Meer *et al.* included 130 patients with benign and malignant aetiologies in their retrospective study. Similar to the present study, they reported a 96% success rate with AUS. They concluded that AUS may be a good alternative to RUS when the percutaneous nephrostomy catheter is inserted or when the retrograde approach has failed.[23] The present study combines these two studies. The AUS method is a good alternative to the RUS method in MUO patients due to its high technical success due to the use of different technical materials.

In patients with MUO, the cystoscopic retrograde method often fails. The same patients are directed to stent placement using the antegrade method, causing the majority of these patients to undergo two procedures for the same indication unnecessarily. This will increase costs and the probability of complications. If it was possible to predict RUS failure, this may prevent the implementation of unnecessary procedures. Therefore, determining the initial approach to MUO cases (AUS versus RUS) is critical for efficient and safe treatment. In addition, to the authors' knowledge, no study has identified which patient groups will benefit most from the antegrade approach to DJS placement. Although the RUS approach is known to have lower technical success rates, it is preferred for general ureteral stenting as it is believed to be an easier method; however, the present study shows that AUS should be preferred to RUS, especially in a select group of patients. In patients with ureteric stenosis secondary to extrinsic aetiologies such as the colon, pelvic, and gynaecological malignancies, the AUS method may be preferred as the initial procedure (Table 5). Depending on the severity of ureter stenosis, hydroureteronephrosis and tortuosity may develop. This study aimed to recommend appropriate treatment strategies in regard to these factors. In the present study, the technical success of the AUS method was significantly higher in the presence of hydroureteronephrosis and tortuosity (p=0.001; Z shape p=0.001; pigtail shape p=0.035; Table 3). In the presence of these findings, the AUS method may be preferable as the first option. Thus, the patient will not be dependent on continuous nephrostomy therapy, which reduces quality of life. In addition, the possibility of a second operation and its financial burden can be avoided.

The relatively small population and the natural boundaries of a retrospective analysis are the main weaknesses of the present study. The findings only reflect the experience in this institution. The results may differ in different institutions and depending on different experts.

In conclusion, AUS method should be preferred to the RUS method initially, because of its high technical success in ureteral stent placement in MUO patients. In this patient group, the presence of hydroureteronephrosis and tortuosity may be used as predictive factors that may favour the use of the AUS method.

Conflicts of interest

The authors declare no conflict of interest.

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