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Intraureteral metallic endoprosthesis in the treatment of ureteral strictures

George Daskalopoulos [a,*], Adam Hatzidakis [b], Theodosis Triantafyllou [a], Dimitrios Delakas [a], Ploutarchos Anezinis [a], Maria Metaxari [a], Angelos Cranidis [a]

[a] *Department of Urology, General University Hospital of Heraklion, 71110 Heraklion, Crete, Greece*
[b] *Department of Radiology, General University Hospital, Heraklion, Greece*

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Abstract

Objective: We report our experience on intraureteral metallic stents placement for the treatment of malignant and benign ureteral strictures. *Methods:* Eight patients (six men and two women) with inoperable malignant or benign ureteral strictures, underwent insertion of metallic stents through percutaneous tracts. Six lesions (three malignant, three benign) involved ureterointestinal anastomoses after cystectomy for bladder cancer and ureteroileal urinary diversion or bladder substitution, and two malignant lesions involved the midureter. Self-expandable stents were used in seven cases and a balloon-expandable stent in the remaining one case. One stent was sufficient in seven ureters, and in one ureter, two overlapping stents were placed. *Results:* Metallic stents were inserted without technical difficulties in all obstructed ureters and patency was achieved in all patients. Ultrasonography revealed resolution of pre-existing hydronephrosis. The duration of follow-up was 6–17 months (mean, 9 months). One ureter was occluded 8 months after stent placement because of ingrowth of tumor and granulation tissue. The other ureters showed no signs of obstruction during follow-up. No major complications directly attributable to the metallic stent occurred. *Conclusions:* Our results suggest that insertion of a metallic stent in the ureter is feasible and safe for the treatment of benign or malignant ureteral strictures. However, more work needs to be done to establish the use of these stents for the treatment of ureteral obstruction.

Keywords: Metallic stent; Ureteral obstruction; Malignancy

1. Introduction

The management of ureteric obstruction caused by recurrent benign disease or extrinsic compression by tumor can become a complex problem. The surgical approach to this problem has been replaced by less invasive techniques with significantly lower morbidity and mortality rates. Long-term double-J stenting or percutaneous nephrostomy are the only viable options if open diversion is to be avoided. Neither method is entirely satisfactory. Percutaneous nephrostomy will correct the immediate biochemical abnormality [1], but is impractical for long-term diversion and is associated with complications, such as hemorrhage and infection in approximately 4–5% of the patients [2]. Internal double-J stent placement is clearly a more acceptable method of relieving the obstruction, as home care is easier, infection reduced and accidental removal unlikely. However, double-J stents must be changed at regular intervals because they are known to have limited life spans due to occlusive encrustation, migration and fracture [3–5]. Furthermore, there are situations where it is difficult or impossible to insert a retrograde stent (e.g. an obstruction close to the vesicoureteric junction, stenosis at the ureteroileal junction of an ileal conduit). Improvement in stent design and materials have reduced the need for frequent changes, but there is a clear need for a stent which can be left in situ for prolonged periods without the inevitable morbidity of a double-J stent. This is particularly relevant to patients with malignancy, where frequent hospitalization should be avoided.

* Corresponding author. Tel.: +30-81-39233840; fax: +30-81-542066.

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Considerable technological progress has recently been made in the development of metallic stents that were initially intended for the vascular [6] and biliary systems [7,8] and the results have been encouraging. Such stents have also been successfully used for various urinary tract procedures, such as, urethral strictures [9,10] and bladder outflow obstruction due to benign prostatic hyperplasia [11,12]. Therefore, the use of a metallic stent in the ureter has been a logical development. However, experience with use of such stents for the treatment of benign or malignant ureteral strictures is limited. Furthermore, in the literature there have only been a few reports on the use of metallic stents for ureteroileal anastomotic strictures and to a limited number of patients [13–15].

In the present study, we report our experience with placement of intraureteral metallic stents for the treatment of malignant and benign ureteral strictures. The majority of our patients had malignant or benign ureterointestinal anastomotic strictures.

2. Methods and patients

Between February 1998 and August 1999 eight patients (six men, two women) with inoperable benign or malignant ureteral strictures, underwent insertion of metallic endoprostheses through percutaneous tracts. All patients signed an investigational consent form approved by the institutional review board before participating in this study. Inoperability was due to increased cardiovascular risk of surgery, patient refusal to have open surgery, or for reasons related to metastasis of the primary tumor. The mean age of the patients was 64.5 years (range, 61–76 years).

All patients selected for metallic stent insertion presented with obstructive renal failure due to either bilateral ureteral obstruction or obstruction of a single remaining or single functioning kidney. Obstruction was diagnosed and documented with ultrasonography and computerized tomography. A percutaneous nephrostomy under ultrasound guidance was performed in all patients as an immediate procedure, before the placement of the metallic stent. In three patients the obstruction was bilateral; all were stented unilaterally, the side where the kidney had the thicker cortex being selected.

Ureteral stricture occurred at ureterointestinal anastomotic sites in five patients following radical cystectomy and ileal loop diversion for the treatment of invasive bladder carcinoma (Fig. 1), at ureterointestinal anastomosis in one patient following radical cystectomy

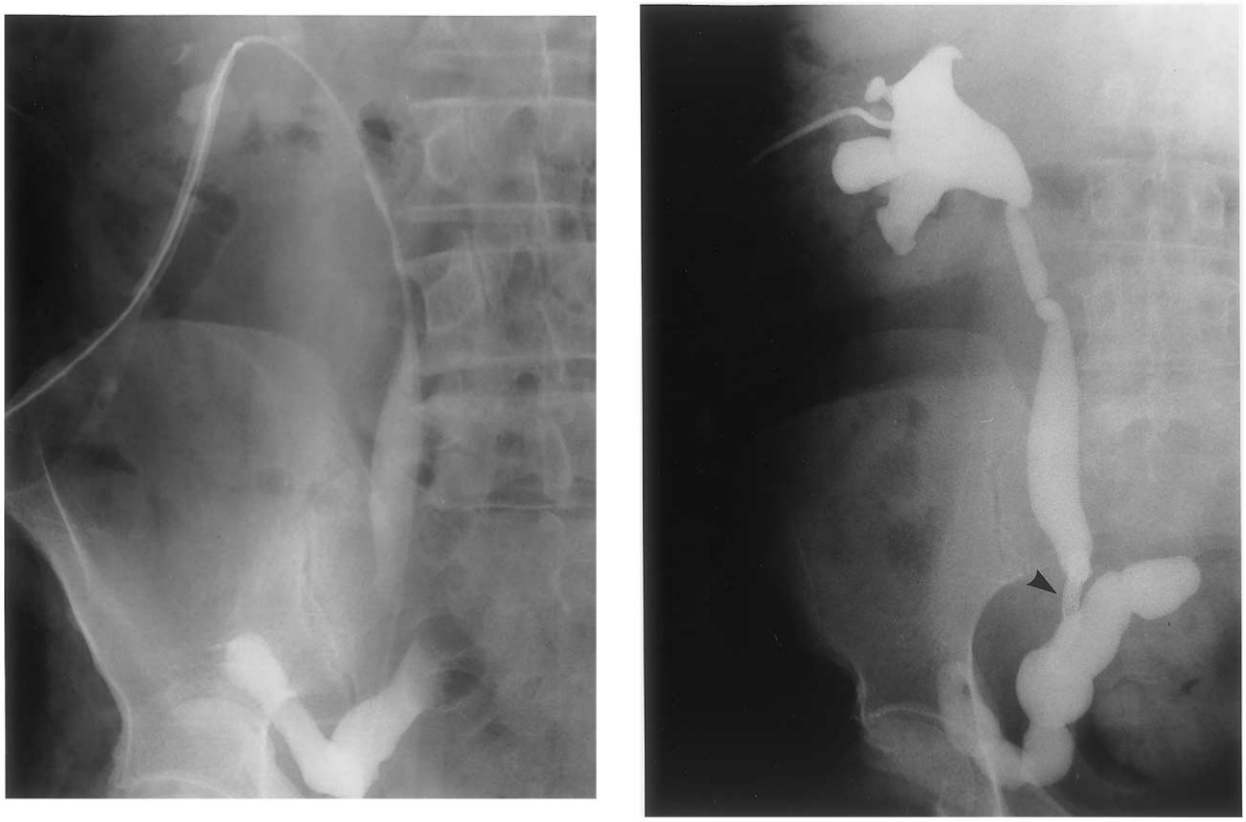

Fig. 1. (a) Right nephrostomography shows a severe stricture at right ureteroileal anastomosis in a patient with ileal loop diversion. (b) Nephrostomography obtained 24 h after a 6-mm × 2-cm Strecker stent (arrow) placement reveals patency of anastomosis.

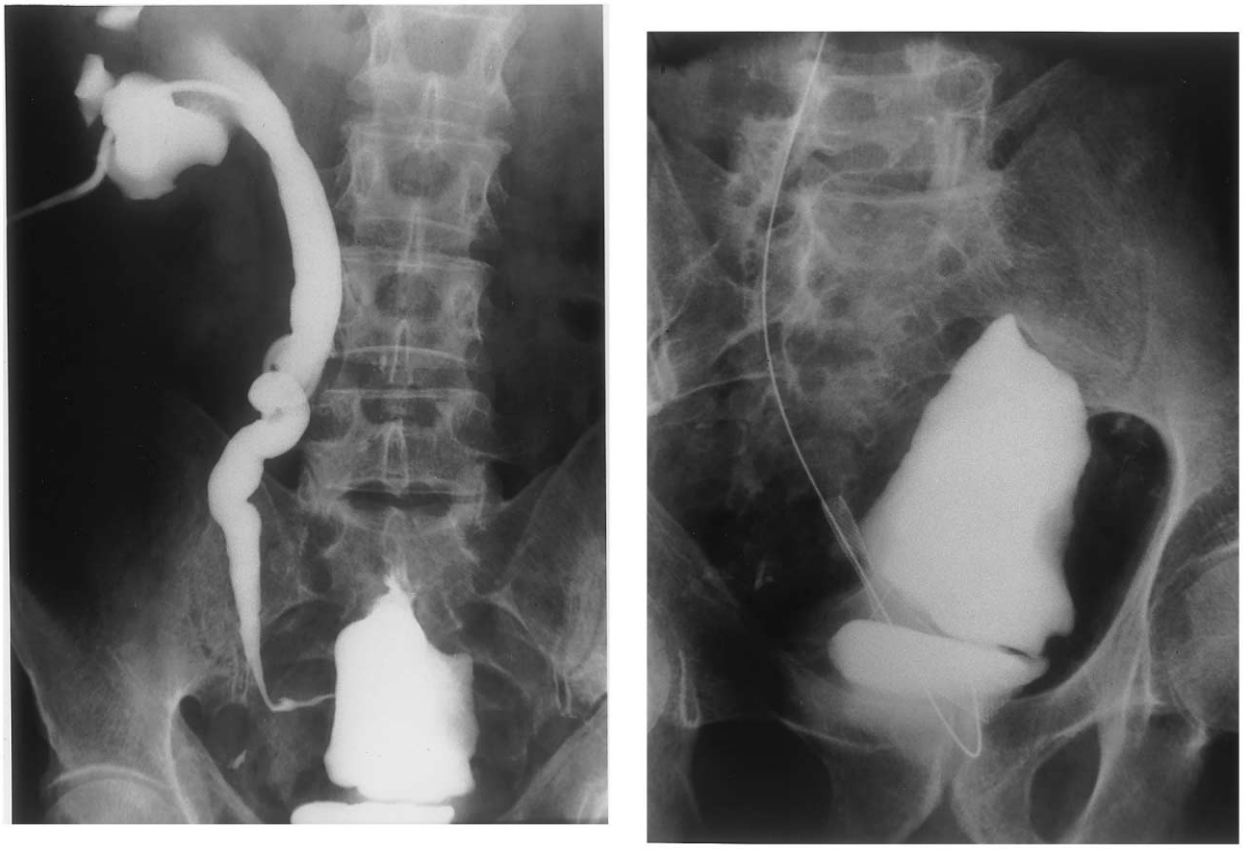

Fig. 2. (a) Nephrostomography demonstrating a stricture at the level of the right ureterointestinal anastomosis extending to the distal ureter in a patient with orthotopic ileal neobladder replacement. (b) Patency of the stented ureter has been achieved. Partial migration of the distal end of a 10-mm × 6-cm Wallstent into the lumen of the orthotopic ileal neobladder with its proximal part still in the distal ureter.

with otrhotopic ileal neobladder replacement (Fig. 2) and in the midureter caused by malignant retroperitoneal tumor in two patients (Fig. 3) (Table 1). Of the six cases of urinary diversion, three were patients in whom tumor recurrence had occurred at the ureterointestinal anastomosis and three had developed a benign anastomotic stricture. The time between diversion and stricture formation ranged from 10 to 23 months (average, 13).

2.1. Technique

All stents were placed using a percutaneous approach under local anesthesia with fluoroscopic guidance in all patients. Two types of metallic stents were used in this study; the self-expandable Wallstents and the balloon-expandable Strecker stents (both from Boston Scientific, Watertown, MA, USA). The exact length and morphology of the ureteric strictures was determined using antergrade pyelography which was carried out in the same session as stent implantation (Figs 1a, 2a and 3a).

Entry into the collecting system was through the previous established percutaneous nephrostomy. A 0.035 in. hydrophilic guidewire (Terumo, Leuven, Belgium) was inserted and manipulated across the stenotic part of the ureter. After placement of the guidewire the stenosis was dilated using a 6 mm-diameter balloon catheter, thus creating enough space for the final placement of the metallic stent. The stent was then inserted over the guidewire in a proper length so that it exceeded both ends of obstruction. In the cases of urinary diversion the lower part of the metallic stent always protruded in the ileal conduit or neobladder bypassing the stricture by approximately 1 cm. In the two patients with midureter stricture the stents were placed in a way that the ends exceeded the stenotic segment at least 1–2 cm at each side. At the end of the procedure, Wallstents needed a post-insertion balloon dilatation in most of the cases to ensure that they were fully expanded and that there was no free space between the stent and the ureteral wall. After stent placement, a new percutaneous nephrostomy catheter was left in place in order to assess the patency and the adequate function of the stent. Injection of contrast material through the nephrostomy tube was performed in each patient 24–48 h following stent placement. The tube was not removed if contrast material did not flow easily from the kidney through the stent into the bladder. Prior to removal, the tube was clamped to assess the effect of a functional

stent. If the patency of ureteral lumen was confirmed at nephrostomography the percutaneous nephrostomy tube was then removed (Fig. 1b). Prophylactic antibiotic therapy was administered routinely to all patients.

Because of the risk of occlusion of the Wallstents by temporary edema and urothelial hyperplastic reaction [16,17], a 6 F double-J catheter was placed through the Wallstent in two patients, and retained for approximately 4 weeks (Fig. 3c).

3. Results

Follow-up examinations consisted of renal ultrasonography 1, 3 and 6 months after placement of the stent, as well as every 3 months thereafter. Excretory urogram (IVP) was also obtained at 1 and 6 months of follow-up. Clinical follow-up consisted of evaluation of urine output and blood urea nitrogen and creatinine levels, urinalysis and urine culture. Serum creatinine levels were measured 1, 3 and 7 days postoperatively, then at monthly intervals for the first 3 months and every 3 months thereafter. The duration of follow-up was 6–17 months (mean, 9 months).

The metallic stents were inserted without technical difficulties in all obstructed ureters and secured a patent ureteral lumen in each of the eight patients. A total of nine unilateral metallic stents were inserted. Self-expandable stents (Wallstent) were used in seven cases and a balloon-expandable Strecker stent was used in one case (Table 1). The metallic stents that were used were 2–8 cm long and 6–10 mm in diameter. One stent was sufficient in seven ureters, but in one ureter where a long stricture had to be stented, two stents were placed in sequence with an overlap of at least 5 cm (Fig. 3b).

Ultrasonography revealed resolution of pre-existing hydronephrosis. Serum creatinine levels returned to normal (six patients) or decreased significantly (two patients) within a week after the metallic stents were inserted. One ureter was occluded 8 months after stent placement in a malignant anastomotic stricture, because of ingrowth of tumor and granulation tissue. The remaining seven ureters remained patent during follow-up with no need for any additional manipulations to maintain patency. One patient died of metastatic disease 10 months after metallic stent placement without signs of urinary obstruction.

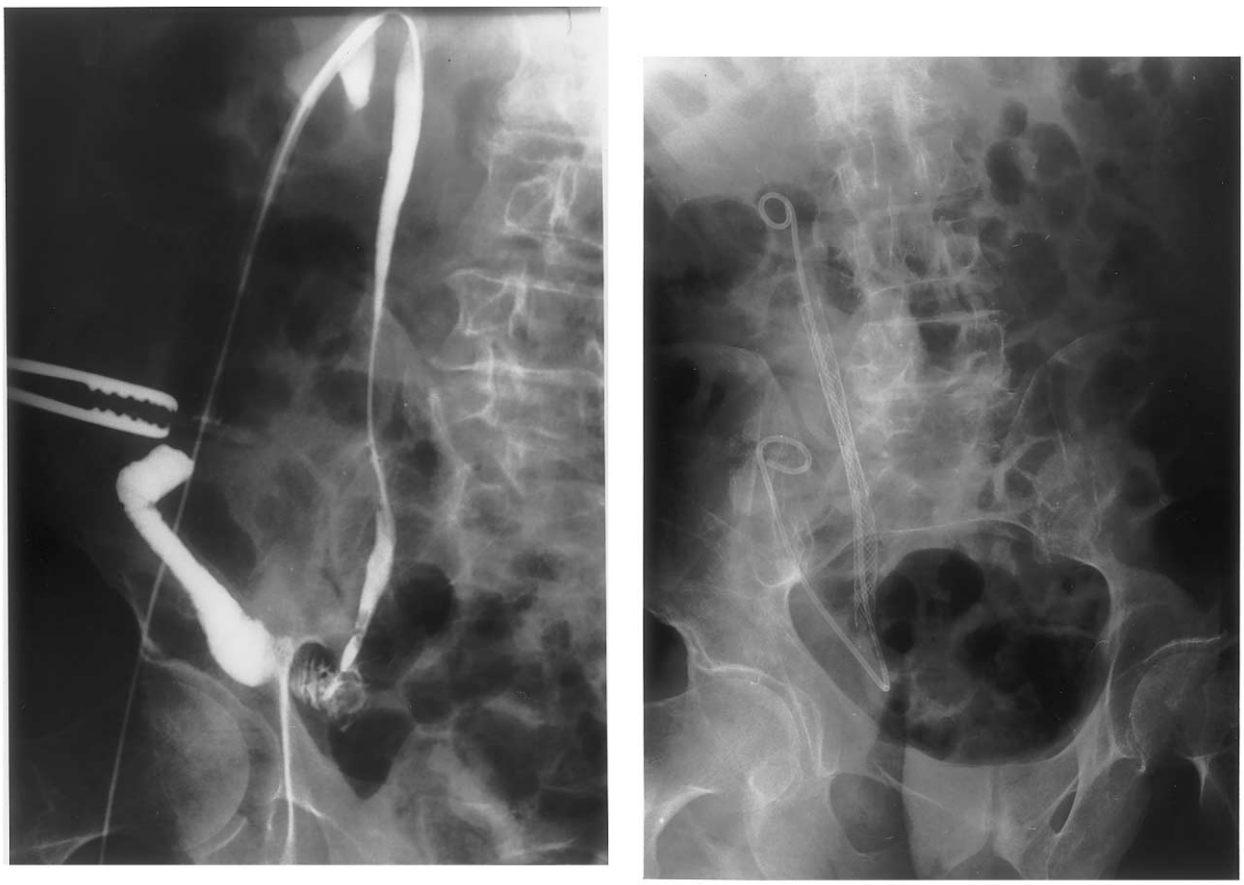

Fig. 3. (a) Right nephrostomography showing a long stricture of the middle portion of the ureter in a patient with ileal loop diversion. (b) Two 10-mm × 8-cm Wallstents were placed in sequence with an overlap of at least 5 cm. A 6 F double-J catheter was placed through the Wallstents and retained for approximately 4 weeks.

Table 1
Patients characteristics and the results of ureteric stenting[a]

Patient number	Age (years)	Sex	Site of stricture	Side	Stent inserted	Number of stents	Follow-up (months)	Complications related to stent
1	62	M	UIA	L	Wallstent	1	8	Hematuria
2	61	F	UIA	L	Wallstent	1	10	-
3	76	M	UIA	L	Wallstent	1	8	Occlusion
4	62	M	UIA and LU	R	Wallstent	2	9	Hematuria
5	63	M	UIA	R	Strecker	1	17	-
6	61	M	UIA and LU	R	Wallstent	1	6	Migration towards the neobladder
7	68	F	MU	R	Wallstent	1	8	-
8	63	M	MU	L	Wallstent	1	7	Flank pain

[a] M, male; F, female; UIA, ureterointestinal anastomosis; MU, middle ureter; LU, lower ureter; L, left; R, right.

In one case, the lower end of a Wallstent had accidentally migrated through the ureteric orifice into the lumen of the orthotopic ileal neobladder with his proximal part still in the distal ureter, as seen at subsequent cystoscopy, without causing further problems (Fig. 2b). No other complication regarding the technique was noted.

No major complications directly attributable to the metallic stent occurred. Minor complications included macroscopic hematuria in two patients which resolved spontaneously and mild flank pain in one patient obviously due to the presence of the metallic stent, which resolved a few days after insertion (Table 1). There were no allergic reactions to the stent or urinary tract infection in any patient.

4. Discussion

A ureteral stricture caused by benign or malignant disease in patients who are not able to undergo surgery for any reason constitutes a therapeutic dilemma. Current therapeutic approaches to these strictures include surgery, percutaneous nephrostomy or transvesical as well as antegrade placement of double-J stents.

Surgical urinary diversion often results in high morbidity and mortality rates [18]. Percutaneous nephrostomy and placement of a double-J stent are the methods of choice although they often do not meet expectations [2–5,19]. The use of double-J stents is associated with a number of complications, including migration, encrustation, irritation of the trigone and ureteric hyperplasia, edema and fibrosis [3–5,19] and it is recommended that they must be routinely changed every 3–6 months. On the other hand, the alternatively performed percutaneous nephrostomy is uncomfortable for the patient and is followed by serious complications including hemorrhage, urinary infection and adverse effects on the patients social and psychological well-being [2,20,21]. Therefore, it is desirable to spare patients the discomfort of a permanent nephrostomy tube or frequent exchange of double-J catheters.

Over the past few years, expandable metallic stents have received widespread attention for their role in the treatment of a variety of occlusive diseases, principally those of the vascular [6] and biliary systems [7,8]. The acceptance into practice of metallic stents in these systems makes the concept of analogous usage in the urinary tract both obvious and attractive. Recently, such stents have been successfully used to treat ureteral strictures [9,10] and bladder outflow obstruction due to benign prostatic hyperplasia [11,12]. The concept of metallic stents in the ureter was an extension of their use in the lower urinary tract. Implantation of metallic stents for the treatment of malignant ureteral obstruction is associated with promising results [16,17,22–24] whereas the efficacy of these stents in the treatment of benign ureteral strictures is still controversial [14,25,26].

The commonest reported clinical indication for the use of metallic stents is in the relief of advanced malignant disease [16,17,23,24]. Lugmayr and Pauer [23] used self-expandable metallic stents to treat 30 malignant ureteral obstructions in 23 patients. They reported an excellent primary patency rate of 83% at 30 weeks although 11 obstructions recurred. In 1993 Flueckiger et al. [17] reported on the use of 7-mm Wallstents to bypass malignant ureteral obstruction in 10 patients (13 ureters). Six patients showed no signs of obstruction for 3–14 months of follow-up (average, 5.8). The authors recommended the use of metallic stents alone or in combination with double-J stents to bypass malignant ureteral strictures and avoid the use of external drainage. van Sonnenberg also recommended the use of metallic stents to bypass ureteral obstruction as a safe and technically easy procedure [24]; in three of the nine malignant strictures treated with 10-mm Wallstents, the stents failed to function properly and double-J stents had to be placed through the metallic stents. In our series, metallic stents were inserted without technical difficulties in all five obstructed by malignancy ureters

and secured a patent ureteral lumen in each patient. One ureter was occluded 8 months after metallic stent placement in a patient with malignant ureteroileal anastomotic stricture, because of tumor ingrowth; the remaining four ureters obstructed by malignancy remained patent during follow-up with no need for any additional manipulations to maintain patency. As no major complications occurred, and hydronephrosis could be prevented in most of the patients with malignant ureteral strictures, we conclude that the implantation of a metallic stent is a safe and effective method for the tumor-associated ureteral obstruction.

In the literature there have been only scattered and conflicting reports on the use of metallic stents in patients with benign ureteral strictures [14,15,25,26]. In a recent study, Pauer et al. treated 13 patients with benign ureteral strictures with implantation of metallic stents [26]. In this study, primary patency (ureters patent since implantation) was achieved in seven patients and assisted patency (additional intervention) was noted in five. The authors concluded that with careful patient selection implantation of self-expanding metallic stents seems safe and effective for otherwise untreatable patients with benign ureteral strictures but further clinical experience with long-term results and experimental studies are needed. Five patients with a variety of benign lesions in whom previous treatment with transluminal balloon dilatation provided poor results, underwent placement of 8–10 mm Wallstents in a study by Reinberg et al. [15]. Their results were promising at 6–13 months with no major complications. The authors suggested that the Wallstent is an adequate alternative treatment for severe ureteral strictures refractory to endosurgical therapy. In contrast, the experience with metallic stents in benign strictures has been reported by Pollack et al. to be less satisfactory [14]. Their results indicated that poor patency rates can be expected with benign ureteroenteric anastomotic lesions. Only one of six metallic stents placed across benign strictures remained patent at 11-month follow-up; the remaining five stents became occluded because of a hyperplastic response. All three benign ureteral strictures in our study were located at ureterointestinal anastomoses. All stents placed across benign ureterointestinal anastomotic strictures did remain patent during follow-up. Given the small number of benign obstructions in our series and the short period of follow-up it is difficult for us to draw definitive conclusions in this group. Therefore, the use of metallic stents in benign ureteral strictures is still debatable. Additional studies and long-term results are needed to make definitive conclusions about whether this procedure will benefit patients with benign ureteral obstruction.

The majority of patients in this study had strictures at ureterointestinal anastomoses; three patients had benign and three had malignant stricture. The incidence of ureterointestinal strictures following urinary diversion ranges from 4 to 8% of the patients [27]. Management usually involved open surgery with reimplantation of the ureter. Various endoscopic techniques have been described as alternatives to open surgery such as, balloon dilatation, percutaneous intraureteral electrocautery incision and treatment with semirigid fascial dilators [27–29]. The success rates are highly variable. In the literature there have been only a few reports of using metallic stents to treat patients with ureterointestinal anastomotic strictures [13–15,25]. In 1990 Gort et al. first reported the treatment of a stenotic left ureteroileal anastomosis by antegrade placement of a metallic stent in a 66-year-old man [13]. The anastomosis remained patent for 6 months. In 1995 Pollak et al. concluded that the use of metallic stents in benign ureteroenteric strictures is ineffective in providing long-term relief with only one of six stents placed remaining patent at 11 months [14]. In a recent study, Kulkarni and Bellamy treated successfully two patients with benign strictures at ureteroileal anastomosis using a new metallic ureteric stent, the Memokath 051; both had been treated with repeated double-J stents insertions, because these stents frequently became encrusted and obstructed [25]. In all our patients the metallic stents were easy to place in antegrade fashion through the percutaneous nephrostomy tract and patency was achieved in all cases; only one ureter was occluded 8 months after stent placement in a malignant ureteroileal anastomotic stricture. Thus, the use of metallic stents seems an effective alternative treatment for ureterointestinal anastomotic strictures. Further and longer follow-up of more patients will validate our observations.

The limitations of using metallic stents in the treatment of ureteric obstruction are related to the phenomenon of a hyperplastic urothelial reaction and the resulting narrowing of the stent lumen, as seen in the urethra and bile ducts [7,10]. Flueckiger et al. believed that reactions causing constriction of the ureteral lumen during the first 2 weeks after metallic stent placement are caused by reactive swelling of the urothelium and not hyperplasia [17]. However, van Sonnenberg et al. investigated the phenomenon of mucosal hyperplasia with percutaneous intraluminal ultrasound and concluded that intraluminal debris may be the major culprit, with mucosal edema and hyperplasia being considered mild [24]. Nevertheless, re-obstruction by urothelial hyperplasia is a common problem which does not necessarily occur in all patients nor is it a persistent phenomenon. This urothelial hyperplasia can regress after 4–6 weeks, when the stent is then reported to be incorporated into the wall of the ureter [16,23]. Temporary placement of a double-J stent ensures drainage during the critical first month, after which the stent can

usually be removed [17,23]. Lugmayr and Pauer reported that they could prevent the temporary obstruction secondary to mucosal hyperplasia by routine additional implantation of a double-J stent left in place for 4 weeks [23]. Flueckiger et al. have reported similar experience [17]. In this study, after 1–2 weeks the lumens of the stents appeared compromised by intimal hyperplasia in four patients; this temporary obstruction was alleviated with double-J stents. In our series, a 6 F double-J stent was inserted through the lumen of the metallic stent in two patients and kept in place for 4 weeks to prevent obstruction by urothelial hyperplastic reaction. We did not observe any major complications directly attributable to the metallic stent in any of the present patients. In one patient with ileal orthotopic neobladder replacement the lower end of a Wallstent had accidentally migrated through the ureteric orifice into the lumen of the neobladder, without causing further problems.

In conclusion, the permanent stenting of a ureter which is obstructed by benign disease or malignancy is a contentious issue. Although the number of cases in our series is small for definitive conclusions to be made, our results provide evidence that insertion of a metallic stent in the ureter through percutaneous approach is feasible and safe for the treatment of benign or malignant ureteral strictures. The technique for insertion is relatively simple and the general concept of metallic stents use in the ureter seems attractive. Our experience does indicate that good patency rates can be expected with malignant ureteral strictures. Whether this procedure will benefit patients with benign ureteral strictures remains to be seen in larger series over a longer observation period.

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