Ureteral Metal Stents: 10-Year Experience With Malignant Ureteral Obstruction Treatment

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Purpose: Ureteral patency in malignant ureteral obstruction cases is a therapeutic challenge. We report our long-term experience with palliative treatment for extrinsic malignant ureteral obstruction with percutaneous placement of metal mesh stents.

Materials and Methods: From January 1996 to December 2005, 90 patients with a mean age of 59 years (range 35 to 80) with ureteral obstruction due to extrinsic ureteral compression and/or encasement by primary or metastatic tumors, or retroperitoneal lymphadenopathy underwent implantation of self-expandable metal mesh stents. A total of 119 ureters were managed. Followup included urinalysis, blood biochemistry tests and transabdominal ultrasound or intravenous urography.

Results: The technical success rate of percutaneous antegrade insertion of ureteral self-expandable metal mesh stents was 100%. Renal biochemistry normalized and hydronephrosis gradually resolved 1 to 2 weeks after stent insertion. Median followup was 15 months (range 8 to 38). Hyperplastic reaction and/or encrustation, or tumor ingrowth developed in 45 stents. Secondary intervention, such as repeat balloon dilation and coaxial stenting, was done to improve patency. Migration was observed in 13 metal stents. The primary and secondary patency rates during followup were 51.2% and 62.1%, respectively. A double pigtail or external-internal stent was inserted in 45 cases in which secondary interventions did not ensure patency.

Conclusions: Internal drainage of extrinsic malignant ureteral obstruction with metal mesh stents provides long-term decompression of the upper urinary tract in select cases. Certain problems limit the application of metal mesh stents in the ureter. Further studies are warranted to identify independent predictors of ureteral patency after the application of metal stents for malignant obstruction.

Key Words: ureter, ureteral neoplasms, ureteral obstruction, stents, palliative care

EXTRINSIC malignant ureteral obstruction may compromise ureteral patency and lead to renal failure.1,2 Malignant unilateral or bilateral ureteral strictures are secondary to extrinsic compression due to locoregional primary tumors, remote metastatic disease or direct tumor infiltration. Encasement by retroperitoneal lymphadenopathy is another possible cause.1–4 Malignant obstruction of the upper urinary tract is established gradually and usually clinically subtle. Detecting malignant ureteral obstruction usually requires im-
mediate ureteral decompression to restore renal function.1,5 Urological management of the condition is challenging since clinical issues and ethical dilemmas related to disease prognosis, quality of life and prompt symptom palliation with minimal complications must be addressed.6

Contemporary management options are external drainage with percutaneous nephrostomy, internal drainage with double pigtail stent insertion or ureteral dilation with a balloon catheter.5,7 Nevertheless, most of these patients have recurrent urinary infections, tube dislocation, stent migration, discomfort due to bladder irritation or routine care of the nephrostomy tube, causing deteriorating quality of life.2,3,7

Several research teams have proposed MSs to ameliorate obstructive urinary tract pathology, such as benign prostatic hyperplasia, urethral stenosis, uretero-ileal anastomotic stricture, benign and malignant ureteral obstruction,5 and even kidney transplantation ureteral stenosis.8 Considering our promising initial experience and reports by others5 we have used vascular MSs as palliative treatment for extrinsic malignant ureteral obstruction for more than a decade. We present our long-term experience with these endoprosthesis in the ureter in terms of clinical efficacy, focusing on certain technical issues and limitations of MS use. The current MS literature is also reviewed.

MATERIALS AND METHODS

Between January 1996 and December 2005, 34 males and 56 females with a mean age of 59 years (range 35 to 80) who had unilateral or bilateral extrinsic malignant ureteral obstruction underwent percutaneous placement of MSs. Ureteral obstruction was secondary to tumors associated with pelvic or retroperitoneal metastasis in all cases. Upper tract obstruction was related to compromised renal function, hydronephrosis and/or urinary tract infection. Diagnostic imaging of obstruction was done by transabdominal ultrasound, computerized tomography or intravenous urography. A team of senior urologists and interventional radiologists evaluated all patients. The protocol was approved by the institutional review board and all patients provided informed consent before the procedure.

Insertion Technique

MSs were placed percutaneously under fluoroscopic guidance through a nephrostomy tract in all cases. Antibiotic prophylaxis was administered 24 hours before intervention. The insertion procedure was performed with the patient under conscious sedation and placed on the fluoroscopy table in an oblique supine position with the respective lumbar fossa exposed for percutaneous nephrostomy. The standard intervention for percutaneous nephrostomy was performed. Combined ultrasound and fluoroscopic guidance was used. Antegrade pyelography was done through the nephrostomy tract to identify the obstructed ureteral segment and evaluate its morphology, site and length. When there was coexisting urinary tract infection or an over dilated upper urinary tract, the patient was left on external nephrostomy drainage for 1 to 2 weeks, respectively. Proper antibiotic therapy was administered in upper urinary tract infection cases for 1 week. Otherwise self-expandable MSs were implanted at the same session.

After obtaining percutaneous nephrostomy access a 7Fr long sheath was placed in the dilated ureter to facilitate the insertion of a hydrophilic guidewire through the stricture. Stricture traversal was attempted by an appropriate combination of a 0.035-inch straight or curved hydrophilic guidewire and a straight or angled 4Fr glide catheter. Meticulous, gentle interventional maneuvers were necessary to prevent ureteral rupture and contrast extravasation, which may blur the fluoroscopic field and promote periureteral fibrosis. After successfully traversing the stricture the hydrophilic guidewire was forwarded into the bladder and exchanged for a rigid 0.035-inch Amplatz guidewire to strengthen the ureteral course and secure luminal passage during balloon dilation and ureteral stent placement. Initially the obstruction was dilated with 6 to 7 mm wide conventional angioplasty balloons. Balloon length was chosen according to baseline lesion length up to 8 cm. When lesions were longer than 8 cm, overlapping balloon inflation was performed. Inflation pressure was increased until balloon waisting was abolished and ureteral continuity was established. Typical inflation pressure was 12 atm (range 8 to 16) (part A of figure). After lesion dilation standard vascular self-expandable MSs with an 8 mm nominal diameter and a length range of 3 to 12 cm were applied. Repeat high pressure balloon dilation (post-dilation pressure up to 30 atm) was necessary in cases of resistant stricture and suboptimal stent expansion. Stent length was chosen to bypass the proximal and distal ends of obstruction at least 3 to 4 cm on each side. When the distal stent end was positioned intravesically, stents protruded 0.5 to 1 cm from the ureteral orifice. Two or more MSs overlapping by at least 2 to 3 cm were placed in sequence as needed to bridge longer obstructed ureteral segments. The current study was an off label application and stent brands were chosen according to commercial availability.

Patient Followup

After the intervention was complete the patient had an external capped nephrostomy tube for 48 hours to 1 week to allow the evaluation of ureteral patency by antegrade nephrotomogram and assess any periprocedural complications or early stent obstruction. The nephrostomy tube was removed immediately after ureteral patency was confirmed by nephrotomogram. Patients were scheduled for followup 1, 3, 6 and 12 months after stent implantation and yearly thereafter. Urine culture, blood biochemistry tests and transabdominal ultrasound or intravenous urography were performed to promptly detect any recurrent stricture. Computerized tomography was done as needed. All patients received specific instructions to present to our institution in case of symptomatic such as ipsilateral flank pain, fever, dysuria, hematuria or vomiting. If recalcitrant stenosis due to encrustation and/or hyperplastic reaction occurred, repeat balloon dilation and coaxial overlapping stenting were done once. If the latter maneuver failed, internal drainage was achieved with
percutaneous or retrograde placement of a double pigtail or external-internal stent. Alternatively external urinary diversion was done with a nephrostomy tube.

Technical success was defined as successful traversal and stenting of the ureteral stricture. Clinical success was defined as an unobstructed stent and a patent ureter at post-procedural nephrostomy with nondeteriorating renal function. Specifically if imaging revealed unobstructed drainage and biochemical values were not increasing, we considered the intervention successful. Primary patency was defined as successful abolishment of stricture after stent implantation without additional intervention. Secondary patency also included repeat balloon dilation with or without coaxial stent placement.

RESULTS

Bilateral ureteral obstruction was present in 29 patients, resulting in a total of 119 ureters managed by MS implantation. Patients with bilateral ureteral obstruction presented in renal failure. The remaining patients had a single ureteral obstruction with symptoms of deteriorating renal function and/or urinary tract infection. Mean ureteral obstruction length was 5.6 cm (range 1.4 to 15). Of the 119 lesions 85 (more than two-thirds) were in the distal segment of the ureter, ie below the level of the common iliac vessels (table 1). Table 2 lists the primary malignant diseases. Table 3 lists the implanted MS types.

Single session stent placement was done in 102 ureters. In the remaining cases an external nephrostomy tube was inserted and stent placement was delayed for 1 to 2 weeks due to infection or an over dilated upper urinary tract. The technical success rate of percutaneous antegrade placement of ureteral MSs was 100% (all 119 cases). Balloon post-dilation of stents was done in 95 ureters (79.8%). Procedure duration was between 30 and 60 minutes per ureter depending on obstruction length and severity. Serum creatinine decreased to normal and hydronephrosis gradually resolved 1 to 2 weeks after stent insertion.

A total of 41 patients experienced mild flank pain and discomfort a few days in duration after stent placement, probably because of the expanding force of the endoprostheses. Five patients reported irritative bladder symptoms with self-limited hematuria due to excessive protrusion of the distal stent end into the bladder. Another 3 patients had recurrent urinary tract infection.

### Table 1. MSs for malignant ureteral obstruction after 10-year experience

<table>
<thead>
<tr>
<th>Ureteral lesion site:</th>
<th>No. Ureters (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal</td>
<td>85 (71.4)</td>
</tr>
<tr>
<td>Mid</td>
<td>26 (21.8)</td>
</tr>
<tr>
<td>Upper</td>
<td>8 (6.7)</td>
</tr>
<tr>
<td>Stented:</td>
<td></td>
</tr>
<tr>
<td>Restenosis</td>
<td>45 (37.8)</td>
</tr>
<tr>
<td>Double-J® stent needed</td>
<td>45</td>
</tr>
</tbody>
</table>

### Table 2. Primary sites of malignant diseases causing malignant ureteral obstruction

<table>
<thead>
<tr>
<th>Primary Ca</th>
<th>Site</th>
<th>No. Obstructed Ureters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Ovary</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Uterus</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Prostate</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Bladder</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Breast</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Table 3. Stents used by stent type

<table>
<thead>
<tr>
<th>Stent</th>
<th>No. Implanted Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallstent™</td>
<td>42</td>
</tr>
<tr>
<td>AccuFlex™</td>
<td>10</td>
</tr>
<tr>
<td>Sinus-Flex (Optimed, Ettlingen, Germany)</td>
<td>8</td>
</tr>
<tr>
<td>Protege™</td>
<td>11</td>
</tr>
<tr>
<td>Luminex™</td>
<td>5</td>
</tr>
<tr>
<td>Passager (Boston Scientific, Natick, Massachusetts)</td>
<td>14</td>
</tr>
</tbody>
</table>

tract infections, possibly due to vesicoureteral reflux through the stent. No allergic reaction to the stent material was recorded.

Median followup was 15 months (range 8 to 38). Early hyperplastic reaction and edema with or without the sign of a proximal trumpet-like configuration was noted in almost all cases on nephrotomography before removing the safety nephrostomy tube. Within 1 month an excessive obstructive hyperplastic reaction jeopardizing ureteral patency was observed in 17 stented ureters. These cases were managed by repeat balloon dilation and coaxial stenting. Hyperplastic reaction or encrustation resulting in significantly decreased ureteral patency was noted in 22 and 6 stented ureters, respectively, between 1 and 3 months after implantation (part B of figure). Management was done by balloon dilation and coaxial MS insertion. In 13 stented ureters (10.9%) the prostheses migrated into the bladder, jeopardizing ureteral patency, and causing obstruction and ipsilateral lumbar pain. Mean time to migration was 1.5 months (range 2 weeks to 3 months). Floating stents were removed from the bladder by cystoscopy and noncovered MSs were placed. No stone formation, and/or extraluminal or intraluminal encrustation was evident in any removed covered stent. There was no evidence of tissue ingrowth through the stent lumen of covered stents.

The overall primary patency rate was 51.2% during followup. Although secondary interventions were done in 45 stented ureters during followup, the endoprostheses failed to alleviate the obstruction. The latter cases were managed by double pigtail or external-internal stent insertion (part C of figure). The secondary patency rate was 62.1% during followup.

DISCUSSION

PS use is one of the most common urological practices. Although these stents have several indications, their use to relieve malignant etiology ureteral obstruction is controversial. Extrinsically malignant ureteral obstruction managed by PSs is associated with a high failure rate and significant morbidity. Two double pigtail ureteral stents have been used for ureteral obstruction in failed single stent cases with various success rates. A new double lumen, double pigtail stent was also evaluated in a pig model with promising results. Nephrostomy tubes are associated with a high success rate but the impact on the already aggregated quality of life of these patients is significant.

MSs have been used to manage benign disease such as benign prostate hyperplasia, urethral stricture and detrusor-sphincter dyssynergia as well as for palliative treatment in patients with ureteral obstruction associated with end stage malignant disease. In the latter cases the success rate was reported to be high and the method proved to be useful in cases of PS failure.

Long-term experience with MSs for ureteral stricture was reported by several groups. We treated ureteroileal anastomotic strictures with MS implantation and the cumulative secondary patency rate 1 and 4 years after intervention was 83.3% and 56.7%, respectively. Implantation of the Memokath™ 051 thermo-expandable ureteral metal stent in 28 malignant and 27 benign cases resulted in improved urinary drainage in all except 3. Reinserter was done in 14 cases and mean followup was 16 months. Self-expandable MSs have been implanted for benign ureteral strictures in 13 patients with a mean followup of 92 months. Three stents remained patent with the insertion of double pigtail PSs, while encrustation in 2 cases forced stent removal. Pyonephrosis resulted in the extraction of 2 stents.

Generally MS use is limited by hyperplastic reaction and/or tumor ingrowth through the stent struts, encrustation, migration and infection. In the current study hyperplastic reaction and tumor ingrowth were observed in 39 cases overall, representing the most common complication that jeopardized ureteral patency. In cases of excessive hyperplastic reaction repeat balloon dilation and coaxial stenting may be done. Mild urothelial hyperplasia with or without a trumpet-like configuration around the proximal stent edge is common and does not compromise ureteral patency significantly. Regression is usually expected 4 to 6 weeks after stent insertion. By that time the stent is ultimately embraced by the ureteral wall.

Encrustation influences long-term MS use. The phenomenon was observed in small areas of stents that were not covered by endothelium due to inadequate embrace of the stent by the ureteral wall. Moreover, resistance to encrustation was proposed to be associated with resistance to bacterial and subsequent biofilm formation. Encrustation resulting in ureteral occlusion in 6 cases was managed by balloon dilation and coaxial stent placement.

A total of 13 stents migrated toward the bladder. Migration is a major problem for covered MSs, which were introduced to limit the ingrowth of hyperplastic tissue through stent struts, but using the latter stent type in the ureter resulted in a high migration rate and an unfavorable outcome. All
migrated stents were removed by cystoscopy and self-expandable MSs were inserted. All stents that migrated during our experience were covered MSs. Although it was not uncommon to have difficulty negotiating the stricture, all cases were eventually stented. Clinical success was observed in all cases in the first 2 weeks after implantation. Nevertheless, hyperplastic reaction, tumor ingrowth, encrustation and migration compromised ureteral patency and additional interventions were necessary. In some cases additional interventions failed to preserve ureteral patency and double pigtail or external-internal stents were inserted. The MS in these cases made the exchange of stents easier. Thus, the secondary stricture patency rate was 62.1% during the 15-month mean followup. Although further balloon dilation and coaxial stent insertion as well as polymeric stent insertion were deemed necessary to maintain ureteral patency in a significant portion of cases, our results represent the long-term outcome of ureteral metal stenting. Further studies are warranted to identify independent predictors of ureteral patency after applying metal stents for malignant obstruction.

Using drug eluting stents in the cardiovascular system and their experimental implantation in the pig ureter proved to limit the hyperplastic reaction. Thus, clinical application of these stents in the ureter could improve the outcome of metal stenting. Further evaluation of metal stents with drug eluting stents should be expected.

CONCLUSIONS

Internal drainage of extrinsic malignant ureteral obstruction with MSs provided long-term decompression of the upper urinary tract in select cases. Certain problems limit MS application in the ureter. Further studies are warranted to identify independent predictors of ureteral patency after applying metal stents for malignant obstruction.

REFERENCES


EDITORIAL COMMENTS

These authors present their long-term experience with nontraditional treatment for malignant ureteral obstruction. Expandable MSs have been used in the ureter for conditions such as uretero-intestinal anastomotic, post-renal transplant, and benign and malignant ureteral strictures. These studies have mixed results. The current study is unique due to the large number of patients and the long-term followup. Expandable MSs are a possible solution for long-term internal drainage in the extrinsically compressed ureter. Although the authors report 100% success for traversing the stricture and placing the stent, ultimately the stents frequently failed to provide long-term decompression. Failure was secondary to obstructive hyperplastic reaction and encrustation, and often required additional intervention. Primary and secondary patency rates were only 51.2% and 61%, respectively.

Potential factors that would affect the success rate, such as stricture length and site, and primary
disease process with or without treatment, could not be addressed in this study due to multiple confounding variables. Future research to identify what types of stricture would be amenable to this treatment may establish a subset of patients that could potentially benefit from metal stents. Other options, such as drug eluting stents and Resonance® metallic stents, may provide an avenue of further research or comparison. However, currently the authors indicate that expandable MSs cannot be recommended for malignant ureteral obstruction. Unfortunately we are left with the same persistent management dilemma in this patient subset.

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REFERENCES


These authors present important long-term followup on the safety and efficacy of metallic stents in extrinsic ureteral compression cases. It would be useful to identify prognostic factors that may impact the success of metal stenting, such as ureteral stricture site and length, primary malignancy type and the response to systemic therapy. It may also be beneficial to consider functional studies during followup, such as diuretic renography, to evaluate success in addition to the biochemical and imaging modalities reported.

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REPLY BY AUTHORS

We had the opportunity to include our experience with a large number of patients treated with MSs for ureteral obstruction due to malignant disease. Although MSs represent an interesting perspective for management of these cases, our long-term experience revealed significant problems which relegate this modality to select cases. The 10-year distribution of cases and results is associated with significant changes in materials and equipment as well as experience gained. Moreover, the cases included a wide variety of malignant diseases and the impact of tumor origin on the outcome of MSs placement could not be evaluated. In addition, the location of the lesion and stent insertion varied. These parameters prevented the performance of statistical analysis which would have provided additional integrity to the investigation.

Despite these limitations, our results provide valuable knowledge to a field that is under evaluated. MSs initially provided promising results but eventually their efficacy proved to be limited (references 5 and 13 in article). These stents are constantly evolving especially the drug eluting stents in interventional cardiology, and continuous evaluation of newly introduced MSs in short-term and long-term clinical trials should provide new therapeutic options (reference 15 in article). Since patients with malignant ureteral obstruction usually have a limited life expectancy and quality of life is invaluable, the need for a minimally invasive intervention providing a permanent solution to ureteral obstruction renders continued investigation of ureteral MSs imperative (reference 16 in article).

REFERENCE