Commentary

Metal ureteral stents in chronic obstructions

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In the October-December 2010 issue of this journal, Abdulrahman *et al.*[1] summarized their clinical experience with some of the available ureteral metal stents.

I gladly accepted to write this comment in order to clarify certain points which are confusing many if not all of our colleagues:

In today's nomenclature, "Stenting" is the use of a hollow device to create a pathway, support a structure, or opening of hollow organs that are partially or completely obstructed due to benign or malignant obstructive diseases. Under this description, also externally communicating urethral catheters or the double-J's which create a pathway should be called "stents", but they are not. The word "stent" cannot be found in a dictionary. It derives from the name of a British dentist, Charles Thomas Stent, lived in the 19th century, who used metallic scaffolds for immobilizing tissues. Scaffolding tubular devices to tutor occluded blood vessels were introduced in the early 1980s and were named "stents" which became an accepted term in the medical vocabulary. What we call today ureteral double-J stents are in reality "intraureteral catheters" made of various polymers. The newcomer to this list is the Resonance, which is a bare metal, non-expandable double-J which does not have a lumen. None of the double-Js are scaffolding devices because of their small caliber. They just create a pathway but do not create a scaffold in the ureter. For this, they need to be large in caliber and have a large lumen. Studies demonstrated that the lumen of most double-J stents occlude within a few weeks and urine drains around the stent. The way the Resonance drains the kidney is quite speculative. Its caliber is 6 Fr. For giving its double-J shape, it has a centrally positioned metal wire filling almost all its luminal space. Drainage is obtained through capillary drainage around the spiral outer wall.

Then, there is a myth of conventional polyurethane stents crushing under the pressure of tumor. Although there are many reports on conventional polyurethane stents occluding in malignancies, to the best of my knowledge no one could show a case where such a stent crushed under the pressure of a tumor. External malignant compression on an ureter can occlude urine drainage, but cannot crush a polyurethane stent. The reason for failure of the polyurethane ureteral stents in malignant cases is because their lumen occludes early by debris and the peristent space occludes by the compressing/strangling tumor. In two separate studies, metal coil and metal coil reinforced ureteral stents were compared with conventional ureteral stents withstanding compression.[2,3]

Unfortunately, these comparisons were done using unrealistic conditions. In these studies, the stents compared were put and compressed between two metal surfaces. This is far from what happens in real life. No tumor is metal hard, and the way a tumor develops by cell division cannot be simulated by approximating two metal surfaces for crushing a stent.

Another point of confusion is the term of "chronic obstruction" describing an obstruction necessitating long-term stenting. There should be a separation between benign and malignant obstructions. There are clear differences in the occlusion mechanisms between an intrinsic pathology causing a benign obstruction, a primary or infiltrating ureteral

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malignancy and the compression of an extraureteral tumor. These differences are the cause of differences in success rates when double-J stent is used for benign and also malignant obstructions.

Ureteral stenoses necessitating long-term stenting are caused by intrinsic malignant disease of the ureter, compression, or infiltration of malignancies of the abdominal organs or by iatrogenic reasons such as trauma during ureteroscopy or gynecological accidents. Ureteral anastomoses or ureteral reimplantation to the bladder or bowel made reservoirs or conduits, ureteral ischemia during renal transplantation are additional reasons for the development of ureteral stenoses. Because of a lack of a better alternative and its affordable price, for restoring the obstructed urinary flow, currently small-caliber double-J ureteral stents which were developed more than 30 years ago are used. They have to be changed every 3-6 months.

Patients with chronic obstructions need stenting for long months, or even for years. Such patients need long-term stenting with nonoccluding large-caliber devices. During the recent years, new approaches for ureteral stenting have been tried.[4] This brings the era of metal stents into urological practice. Theoretically, like in the vascular system, noncovered, large-caliber metal mesh stents (24-30 F) had to provide a relief also to ureteral obstructions. Several attempts to use large-caliber bare metal mesh wire vascular and biliary stents in the ureter failed. Tissue proliferation through their interstices causing restenosis limited their use. To prevent restenosis, drug-coated or covered vascular stents have been tried to be used as ureteric stents. Some of these stents had large migration rates (81.2% with the externally covered Passager compared to 22.2% with the internally covered Hemobahn endoprosthesis). The implanted Passager caused a "trumpet-like" ureteral narrowing above the proximal end of the stent indicating reactive tissue proliferation. With the Hemobahn stent hyperplastic tissue development at the end of the stent was reported in 27.7% of the cases.[5,6]

The function of the ureter completely differs from blood vessels. Blood vessels are almost inactive tubes allowing blood to flow forward. In contrast to this, the ureter has variable calibers all along its length and the flow of urine is obtained by its peristaltic function. This makes difficult to stent the ureters the way blood vessels are stented with vascular stents. Additionally, vascular stents are permanently implanted, where in the ureters most stents are for short- or long-term use, to be removed after a period of time.

Currently, three different metal ureteral devices which are approved for deobstructing the ureter are available. They are Memokath 051, the Resonance, and the Allium URS. Only the Memokath 051 and the most recent Allium URS can be called stents because of their large lumen. The Memokath has a nitinol made bare metal closed coiled body and a thermo-expandable bell-shaped end for anchoring. Its caliber is 10.5 F.[7] The Allium URS has a nitinol made skeleton fully covered with a strong proprietary polymer made thin membrane giving its tubular shape. It comes in two calibers of 24 and 30 F. These stents have a main body with high-radial-force and softer end segments to reduce the development of obstructing reactive proliferative tissue. The stent also have a feature to make its easy endoscopic removal. It can be inserted either antegradely or endoscopically. The Resonance coiled metal double-J has a 6 F caliber without a distinct lumen.

Like any device in medicine stents also are not devoid of problems. The Memokath 051 and the Resonance have their inherent problems of reactive tissue proliferation at the ends of the stent, encrustation, and stone formation[8] The nonsuitability of the Memokath 051 in benign ureteral obstructions were reported in the past.[9] There are very large outcome differences between the limited number of papers published on the Resonance stents. Modi *et al*. reported a 38% failure rate. The authors recommended "vigilant monitoring" of the patients with a Resonance stent. Comparing these results with Liatsikos *et al*., 100% success in malignancy patients and 56% failure in benign ureteral stricture patients in 8.5 months are somehow confusing.[8,10]

The problem with these reports is that the failures are reported, but the reasons of the failure are not analyzed in depth. Such reports should include more details on the pathology, length and place of the stricture, infection, the need for pre-dilation, etc. This additional information can give us more clues to understand the reason for the different outcomes. During the 24th Engineering and Urology Meeting in Chicago (2009), Clayman's group mentioning failures they had with the Resonance, checked the function of this stent in laboratory conditions. On the basis of this study, they reported that the Resonance may cause a clinically significant functional obstruction.[11]

Reports on the Allium URS are very few. It seems that their geometry allows stent wall apposition to the ureteral wall for allowing intraluminal flow. However, when positioned in the ureteral orifice its migration has been reported in a recent presentation during the 28th World Congress on Endourology held in Chicago (2010).

Hopefully, the organ specific new large-caliber ureteral stents will solve, if not all but most of the deficiencies of the current double-Js. However, their long-term efficacy will have to proven in large clinical studies.

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