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Modes of drainage of kidneys with bilateral malignant obstruction

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Abstract

Malignant ureteral obstruction (MUO) is an unpleasant finding resulting from a wide range of malignancies with limited survival prognosis. Its presentation and progression show that it can resist treatment with some stents, including single polymer ureteral stents. With most treatment failures, several treatments are available for the initial management and treatment of benign ureteral obstruction, including therapy with percutaneous nephrostomy (PCN), metallic stents, tandem stents, and other stents. Considering the variety of methods and the heterogeneous population of patients, evaluating the merit of each approach is challenging and needed. Due to the lack of significant studies in this field, these methods leave their performance up to the individual provider. This review aims to provide a framework for urologists to use for individual care and apply it appropriately to patients with MUO. Prospective clinical studies are needed to empower patients with MUO to receive evidence-based treatment and recommendations.

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Introduction

Renal function impairment, renal colic, and infection can all be brought on by malignant ureteral obstruction (MUO). It may be developed by retroperitoneal lymphadenopathy, metastases, intrinsic ureteral obstruction, or extrinsic compression from a primary tumor (1). Ovarian, cervical, colorectal, and breast cancer are the most frequent causes of MUO; genitourinary malignancies are less common. With a median survival of 6–8 months and a 1–year overall survival of fewer than 50% (2), the prognosis for these individuals is dismal. Although reconstruction through surgery has historically been used to treat MUO, the short lifespans of patients and the high risk of complications now need a less invasive approach. Retroperitoneal lymphadenopathy from advanced cancer is a different potential factor (3). Typically, slow-moving and vague, MUO is difficult to diagnose.

On the other hand, if left untreated, progressive obstruction can cause electrolyte depletion, uremia, and urinary tract infections (UTIs) (4). Decompression of the ureter is necessary to restore renal function when the MUO is discovered (5). The ideal treatment to address these occlusions is reconstruction through surgery. However, most of these patients are often ineligible for surgery, and the decision regarding this surgery is difficult because of the various risks of complications. Therefore, it is not easy to manage urological diseases because clinical challenges and moral conundrums related to the quality of life, disease prognosis, and fast symptom relief should be solved with minimal complications (6).

Key point

Ovarian, cervical, colorectal, and breast cancer are the most frequent causes of MUO. MUO may cause urosepsis or renal failure. Unblocking the ureter is necessary to restore renal function when the MUO is discovered.

Stents for malignant ureteral obstruction

Malignant ureteral obstruction may cause urosepsis or renal failure, making it more difficult for a doctor to treat the underlying malignancy (7). Regular polymeric double J stents (DJS), tandem stents, nephrostomy tubes, and more specialized products like solid metal stents and polyurethane stents reinforced with nickel-titanium are just a few of the ways to treat ureteral obstruction (8). When a stent cannot be placed in the ureter, or long-term stenting is required, an extra-anatomic stent (EAS) can bypass the ureteral obstruction.

A stent is placed through the skin in the kidney and tunnels under the skin into the bladder and creates extra-anatomical urine drainage (9).

We describe the most recent developments in observable risk factors that can be used to predict the failure of urinary drainage. These failures are frequently a symptom of the development of cancer and its natural course.

Low serum albumin, bilateral hydronephrosis, high C-reactive protein, and pleural effusion were indicators of drainage failure; comparative studies demonstrate that metal stents outperform polymeric DJS in preserving patency (10).

The physician should discuss with the patient any issues such as frequent replacement, need for external equipment (with nephrostomy tubes), or significant urinary symptoms in the case of internal DJS. In the case of MUO, this review will emphasize the present state of diversions.

Double J stents

This stent is one of the most widely used stents and is called this name because of its J-shaped end (11). DJS, made of silicone, polyurethane, or other polymers, must be replaced every three to six months since it is prone to encrustation, blockage, migration, and fracture. In addition, one of the main issues with DJS is the encrustation of stone formation on the stent's surface. In the setting of MUO, polymeric stents have been demonstrated to be less effective at long-term drainage than metal stents (12).

Metallic stents

A metal stent is another easy solution for internal ureteral stenting without problems with frequent replacements. Metal stents, which allow stent replacement every 12 months, are acceptable options for long-term decompression (13). Metallic stents are now a practical option for MUO long-term treatment. Forty-seven patients with chronic ureteral blockage were the subject of a retrospective study by Kadlec et al (14) that looked at their outcomes over a 5-year follow-up period. They found that the average length of stenting for benign and malignant obstruction was 22 months and seven months, respectively. The average time spent stenting was eight months. UTI associated with stents was the most frequent justification for early replacement. They have reported comparable outcomes for their 74 patients who were given metallic stents for MUO and non-urological malignancies. The typical time for the function was 6.2 months. Their insertion success rate was 86.9%, with 91.2% of patients achieving urinary system patency. Obstacles in the abdominal ureter, irregular thickening of the ureteral wall with aberrant enhancement and infiltration, and lymphatic metastases around the ureter were risk factors for stent failure. The probability of stent failure is higher in urological cancers than in non-urological tumors. Although stents, minor complications such as stent migration, flank pain, severe hematuria, heartburn, and urinary frequency have occurred, no significant complications have been described. Only after these individuals had failed a regular polymeric DJS placed in the Metallic stent, according to the scientists' theory, a longer delay to receive a metal stent may promote cancer progression and create a more challenging patient population for stenting. In another research, patients with advanced cancer and MUO saw similar positive outcomes with the Resonance stent, with a mean time to failure of 7.4 months (15). Due to different patient groups, sample sizes, and causes, these studies cannot be directly compared. However, a general process suggests that metal stents last longer, eliminating the need for frequent replacement. Metal stents are well tolerated and cause only minor discomfort in the lower urinary tract. Although each metal stent is more expensive to purchase than a conventional polymer stent, if it can reduce the number of surgeries, it results in overall cost savings.

PCN tube

A popular method used to decompress MUO is percutaneous nephrostomy (PCN). Interventional radiologists or urologists can execute the minimally invasive PCN tube insertion operation while the patient is under local anesthetic (16). It works well to relieve discomfort and ureteric blockage. However, an external drainage bag and tube may be cumbersome, restrict physical activity, and adversely affect the patient's quality of life. PCN has problems such as sleep quality, impaired social functioning, and poor body image (17). Pain, dislocation, obstruction, infection, and frequent tube replacement are minor complications of the PCN tube in addition to the standard 3-month replacement (18). However, its advantages include local anesthesia during PCN installation, which may be preferable for patients unable to tolerate general anesthesia. Also, there are no risks such as displacement, infection, and bleeding that may require re-incision of the PCN. Tumor location often influences whether to install a PCN in pelvic malignancies, such as when bladder obstruction brought on by cervical, colorectal, or prostate cancer is present (19). When deciding on a procedure, inform the patient and their caregivers that PCN will provide more acceptable anesthesia if tube replacement is required. Patients in a prospective trial who underwent percutaneous nephroureteral stent implantation and decompression for MUO completed a quality-of-life assessment. Patients with ureteral stents reported significantly more frequent urination and dysuria at 30 and 90 days (18). The model that Gunawan and colleagues decided to verify. Two hundred eleven patients received PCN, and metastatic disease affected 45% of them. The median overall survival was 5.5 months.

Still, the four groups have notable differences in terms of survival ranging from 17.6 months (without risk factors) to 1.7 months (four factors). Their studies failed to show that MUO had a trivial overall survival rate following PCN. Despite years of progress in oncology, urology, and palliative medicine treatment, MUO still has a low prognosis (20).

Tandem stents

The procedure of tandem ureteral stenting (TUS) refers to placing two twin and parallel ureteral stents in one ureter. The first-ever article on tandem stenting for MUO was published a decade ago, and since then, only a few retrospective papers have been published. By forming a gap between the two stents, TUS is expected to withstand blockages more effectively. Overall flow across TUS implanted in pig model ureters increased compared to single polymer ureteral stents in in-vitro renal research. The increase in total flow was higher by five times, which indicates that the gap formed by tandem stents is a reliable approach to keeping the flow in a blocked ureter. Lower ureteral peristalsis, flow obstruction along the stent, and tumor invasion through side holes are the factors in single ureteral stent failure. As a relatively new treatment, TUS has emerged as a reliable choice for MUO patients (21). The gap between the two stents, which also lets urine downward despite the blockage, is considered the critical advantage of tandem stents' operation. A recent study compared tandem to single stenting showed that tandem stents achieved the same success rate in MUO treatment with notably higher durability of stent patency. In general, survival rates were the same. Still, given the patient population, decreasing the number of stent replacement operations and readmissions can be a success (22).

These results confirmed the idea that creating a gap between tandem stents opposes MUO and gives a higher duration, longer survival, and unobstructed ureter to patients who expect a low survival rate (three to five months) (23). Because of inadequate data on quality of life, tandem stents can create more urine symptoms. Tandem ureteral stents are a reliable alternative when one ureteral stent cannot let urine drain. The operation of placing several ureteral stents is simple and is similar to one ureteral stent. Thus, it is considered an easy operation for almost all urologists. The available but limited data show an excellent clinical performance of tandem lateral stents for malignant and benign ureteral obstruction. Studies have indicated that tandem ureteral stents can last more than three months, making them a more efficient method from a financial viewpoint compared to other urinary obstruction alternatives (24). This means that the new stenting devices can improve quality of life and lower the need for maintenance.

Extra-anatomic stent

As the most prevalent urinary tract condition after kidney transplantation, urinary stenosis is mainly treated through surgery to remove the obstruction. If not possible, and if the stent cannot be in the urethra, an extra-anatomical stent (EAS) is employed to bypass a completely blocked urethra. To place the stent through the skin in the kidney, a nephrostomy device is used to place the stent in the bladder through the tunnels in the skin. This process forms analogous urine drainage. Desgrandchamps et al, employed a subcutaneous nephrovesical bypassin a kidney transplant patient suffering ureteral stenosis. After eight months, no complication was reported (25). Burgos et al managed to use diversion in three kidney transplant patients following a failed open operation in high-risk surgical patients suffering low graft function (26).

Azhar et al employed Detour EAS in eight transplant patients suffering from ureteral stenosis. The surgical operation was a success for four patients, and the rest underwent the operation because of high stenosis and/or high-risk surgery. Regarding technical complications, the stent was dislodged in two patients while repaired after three days. Two patients also suffered recurrent infections, and one had failed graft. The remaining cases showed good graft function and no complication after 19.4 months (27).

A deviation was employed in five kidney transplant patients by Yazdani et al with 11 months follow-up on average. One patient demonstrated asymptomatic bacteriuria before surgery and did not report tubal blockage or infection (28). EAS causes minimal invasive effects, and as an efficient and acceptable method, it is used for the long-term management of kidney transplantation. The best candidates are those with a history of failed stents and nephrostomies. Installing stents close to tumors is not recommended as this may trigger tumor seeding along the stent. There are rare signs of stored bladder or stent blockages. Infection, encrustation, blockage, or skin issues are other consequences. Skin erosion was observed in one case, and local tumor growth and bladder fistula were seen in two other cases that needed stent removal. Kim et al (29) argued that EAS is a less invasive technique as a permanent or temporary treatment for internal urine drainage. Their results were based on a study of more than 100 patients. The results indicated that EAS was a reliable alternative for a nephrostomy tube that needs tube change annually. To implant an EAS, patients must be under general anesthesia, and the tubes can be 50 cm in length and 8fr in width. The EAS must be replaced between six and twelve months, which is still less frequent than other choices. Recent studies have reported six cases needing bilateral EAS implantation, and the success rate of insertion in MUO was 100%. A bigger study on 13 patients said about four had a significant complication. After 30 days, three patients needed stent revision because of urinary leakage. After three months, another patient reported leakage, which was repaired effectively. One patient had an EAS dislodged, which intensified a laparotomy by injuring the sigmoid. Eventually, the patient was lost six weeks after surgery because of an intestinal damage problem. These findings indicate the nature of the treatment and the necessity of being more cautious in the installation revision or revision procedures (29).

Stent-related factors

Several important issues must be taken into account by urologists when making decisions regarding a long-term plan for MUO patients. Stent-related characteristics like the diameter of sent and side holes need to be comprehended for better management. In addition, urologists must be aware of a range of factors related to each patient. In the case of straightforward tube models, there is a direct association between the tube radius and the fluid flow rate. Logically, the urine flow pattern in the kidney must be the same as that of the stented ureter. A study by Kim et al, concluded, however, the contrary (29). Research works have indicated that excessive lumina flow is essential for urine drainage in a stented ureter, and smaller stents can leave a bigger space between them and the ureteral wall to facilitate flow. The authors found no data regarding the association between stent size and patency duration. In the same way, adding extra side holes to the stent can increase ureteral flow by adding more drainage pathways. Kim et al (29) examined this theory in an in vitro setting using stents with 0, 11, 23, and 47 side holes. They found no association between the flow rate and the number of side holes. They argued that most ureteral flow in the stented models depends on the added stent flow and the terminal flow, while the side holes' contribution is trivial. Still, these findings may not accurately reflect in vivo environments.

Conclusion

Malignant ureteral obstructionis an unpleasant discovery of widespread malignant disease with a variety of etiology and often has a dismal prognosis. Although urologists and oncologists agree that the initial installation of a stent is the proper first-line treatment, several obstructions- and malignancy-related variables might cause the stent to be inserted incorrectly or fail altogether. Tandem stents, metal stents, or PCN tubes have become the mainstay of treatment due to the high failure rate of single stents. Given the variety of treatment options, it is crucial to plan with other healthcare professionals and the patient and family to customize the care to meet their needs and preserve the quality of life.

Authors' contribution

Conceptualization: Esrafil Mansouri, Fereshtesadat Fakhredini, Samaneh Karimi.
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Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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