Comparative evaluation of the results of various surgical interventions for ureteral strictures.

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Abstract

Introduction

Ureteral stricture is an abnormal narrowing of the ureter lumen that prevents the normal passage of urine. This condition can lead to numerous complications, therefore, effective treatment of this disease is of paramount importance. Several surgical procedures can be offered to patient including endoscopic, laparoscopic and open treatment. This study aimed to compare different procedures and analyze their effectiveness.

Methods and results

This retrospective analysis included 29 patients. The etiology of disease, treatment type, complications and long-term results were analyzed. We consider the use of computed multispiral urography (29), as well as magnetic resonance imaging (11) as the preferred methods in the diagnosis of stricture. Pyelonephritis was the most common complication in the early postoperative period in 10 (30%) patients. Analysis of the study shows that in 12 patients out of 16 studied, the late postoperative period proceeded favorably and all of them were able-bodied. Conclusion

As can be seen from the above, the problem of treating ureteral strictures is relevant in urological practice. Our experience in the treatment of patients with this pathology is consistent with the literature data.

Keywords: ureteral stricture, kidney transplantation, urology, appendicoureteroplasty, ureterocystanastomosis.

Introduction

Ureteral stricture is an abnormal narrowing of the lumen of the ureter, completely or partially disrupting its patency and leading to the development of ureterohydronephrosis [1, 2]. Complications of this disease are secondary urinary tract infection, stone formation, and chronic renal failure [1, 2]. According to various authors, the causes of ureteral stricture can be: ischemia, trauma (including iatrogenic), inflammatory diseases (including tuberculosis), periureteral fibrosis, endometriosis, damage to the ureter due to prolonged exposure to a foreign body (calculus, stent, etc.), as well as congenital developmental anomalies [1, 2]. More than 80% of cases of stricture are formed because of iatrogenic damage to the ureter [3]. These injuries include burns associated with radiation therapy [4,5].

Patients with ureteral strictures usually seek help when there is a complication such as ureterohydronephrosis, which is an indication for surgical treatment. In addition, in patients with severe concomitant diseases (diseases of the cardiovascular system, decompensated diabetes mellitus, etc.), the operation of choice is the installation of a ureteral stent or various types of nephrostomies to preserve kidney function [8, 9].

The variety of surgical interventions for ureteral strictures can be divided into open, endoscopic, or laparoscopic surgical interventions [8, 9]. To be noted, the choice of the option of reconstructive intervention is determined by the structural and functional state of the ureters and kidneys, the extent and level of stenosis. The basic principle of all operations is the formation of a hermetic anastomosis and maintaining the blood supply to the organ. The use of absorbable suture material in this case increases the effectiveness of the intervention [8].

As it can be seen, the polyetiology of ureteral stricture, as well as the variety of comorbidities and surgical interventions, determines the relevance of the problem. In our opinion, it would be appropriate to determine the choice of surgical intervention, taking into account modern highly informative diagnostic methods, as well as the capabilities of each clinic to perform complex reconstructive interventions. Aim of the study was a comparative evaluation of short- and long-term results of various surgical interventions to treat long ureteral strictures.

Methods and results:

The work is based on a retrospective analysis of 29 case histories of patients with ureteral stricture treated at the National Research Oncology Center, Nur-Sultan, in the period of 2012-2021. The age of the patients ranged from 18 to 70 years, there were 10 men and 19 women. The main number of patients 21 (73%) were of working age and only 8 (27%) were older than 61 years. This disease was more common in women (19) and somewhat less common in men, although no statistically significant difference was observed.

Table 1 represent etiology of diseases in the study group, diagnostic procedures performed to confirm a diagnosis, and all-cause outcome. One patient (female) had strictures on both sides due to unknown cause and underwent different surgeries on both ureters.

Characteristics	Total	Female	Male
		50,72	
Age	48,82(12,55)	8,93)	48,82(12,55)
Etiology	29	19	10
Cervical cancer	3	3	0
Bladder cancer	2	1	1
Congenital	3	2	1
Iatrogenic	5	5	0
Urolithiasis	9	2	7
Post-radiation	2	2	0
Idiopathic	5	4	1
Diagnostic procedure			
Antegrade urography	20	13	7
СТ	29	19	10
Pelvic MRI	11	8	3
Excretory urography	29	19	10
US	29	19	10
PET-CT	5	4	1
Outcome (all-cause)			
Dead	3	2	1
Alive	26	17	9

Table 1. Characteristics of patients.

The diagnosis of ureteral stricture was verified with a comprehensive examination, including laboratory testing.

We consider the use of computed multispiral urography (29) magnetic resonance imaging (11) as the preferred methods in the diagnosis of stricture. Antegrade urography through the nephrostomy (8) and retrograde pyeloureterography (12) had less diagnostic value than computed multislice urography, but in difficult cases their intraoperative use is undeniable. This is confirmed by the literature data [6,7].

Preoperative ultrasound (29) made it possible to assess the state of the parenchyma of the kidneys and the pyelocaliceal system of the organ, and in case of dilatation, the ureter. Excretory urography has been used to study renal function and evaluate the ureter of a healthy kidney, and sometimes to determine the extent of a stricture in an affected ureter (29). Patients with oncologic pathology underwent PET-CT (5) to establish metastases and the advisability of surgical intervention.

Table 2. Surgical interventions and complications of the early postoperative period. AIO – acute intestinal obstruction, UCA – ureterocystanastomosis.

Procedure	Number of patients	Diagnosis	Complications
UCA Psoas Hitch	8	Lower-third ureter	1 – pyelonephritits
		stricture	
UCA	5	Lower-third ureter	4 – pyelonephritits
		stricture	
Laparoscopic UCA	7	Lower-third ureter	2 – pyelonephritis
		stricture	
Ileoureteroplasty	8	Lower- and middle-	3 – pyelonephritis
		thirds ureter stricture	
Appendicureteroplasty	2	Lower- and middle-	1 – urosepsis
		thirds ureter stricture	2 - AIO

As Table 2 shows, pyelonephritis was the most common complication in the early postoperatie period in 10 (30%) patients. Moreover, this complication occurred in patients with strictures of the middle third and lower third of the ureter. Along with this, we have not established a significant difference between the methods of surgical intervention to correct the stricture. In patients (2) after appendicoureteroplasty, acute dynamic intestinal obstruction was observed and one of them had urosepsis. All complications were corrected with conservative therapy without repeated interventions.

Procedure	Number of patients	Diagnosis	Complications
UCA Psoas Hitch	5	Lower-third ureter stricture	no
UCA	3	Lower-third ureter stricture	no
Laparoscopic UCA	5	Lower-third ureter stricture	2 – dull backpain 1 – urine leakage
Ileoureteroplasty	2	Lower- and middle-thirds ureter stricture	no
Appendicureteroplasty	1	Lower- and middle-thirds ureter stricture	no

Table 3. Surgical interventions and long-term complications.

All patients, depending on the method of correction of ureteral stricture, can be divided into 2 groups. The first group - 10 patients who underwent intestinal ureteroplasty. All patients in this group had long ureteral strictures, which limited the possibility of plastic surgery with the own tissues of the ureter and bladder. A second group consisted of 20 patients, who underwent a plastics with own tissues of the ureter and bladder.

The long-term results after various methods of surgical correction of ureteral stricture were studied in 16 (55%) patients over a period of 1.5 to 10 years (Table 3). The condition of patients was determined by direct telephone interview. Three patients died because of oncologic condition progression. Another patient didn't have any complications related to surgery, but his kidney function deteriorated despite the surgical treatment, so he underwent nephrectomy two

month later. After laparoscopic UCA, 2 out of 5 patients had intermittent dull pain in the lumbar region and one of them had intermittent urine leakage during exercise from a formed fistula in the area where the drainage tube was standing. Patients after ileoureteroplasty (2) and appendicoureteroplasty had no complaints and have fully returned to normal life. Analysis of the study shows that in 12 patients out of 16 studied, the late postoperative period proceeded favorably and all of them were able-bodied. The reported deaths were not related to the previous interventions. Only in one observation there was a urinary fistula functioning during exercise. This patient refused surgical treatment due to adaptation to the urinary fistula. As for the kidney function, patients GFR was measured before and after the surgery and compared. For the group that underwent open ureterocystanastomosis, mean initial GFR was 83,14 ml/min (SD 30,54), and after the surgery it was 87,75 ml/min (SD 37,64). For the group who underwent laparoscopic surgery, mean initial GFR was 92,67 ml/min (SD 49,81), after the surgery – 130 ml/min (SD 54,06), and for the group that underwent ileo- or appenducoureteroplasty mean initial GFR was 78,11 ml/min (SD 32,72), after the surgery – 85,1 ml/min (SD 27,91).

Discussion

To date, according to the literature, surgical interventions have been used to treat various ureteral defects, the variety of which indicates the ambiguity of determining the optimal options for their use. The reason for this is the degree and localization of the ureteral lesion. Non-extended lesions of the proximal or middle ureter are usually treatable by end-to-end anastomosis, after resection of the damaged part of the ureter [8, 9]. With such lesions of the distal ureter, the formation of ureteroneocystostomosis using the Boari flap or Psoas Hitch is most appropriate [8, 9]. For extended ureteral defects, interventions such as transureteroureterostomy, kidney autotransplantation, or ureteral replacement are considered the most appropriate. Replacement of extended defects of the ureter remains a huge problem for urological surgeons, which is usually the only salvation of kidney function after traditional methods have failed or been excluded [8, 9].

The polyvalence of the etiology of ureteral stricture, and iatrogenic and radiation damage to the organ indicates its vulnerability during surgical and therapeutic manipulations. The largest number of ureteral strictures resulting from urolithiasis also indicates the vulnerability of the mucous layer of the ureter with frequent traumatization by uroliths. Therefore, in our opinion, the ureter should be perceived as an organ that is less tolerant to traumatic effects. When carrying out various options for correcting the stricture of the ureter, the following tactics established by the literature data were followed:

- for damage of the upper third, uretero-ureterostomy, transuretero-ureterostomy, ureterocalicostomy are advisable;
- for damage of the middle third uretero-ureterostomy, transuretero-ureterostomy or Boari flap;
- for damage of the lower third direct reimplantation, Boari flap or Psoas Hitch.

According to the literature data, ureterocystanastomosis is indicated for patients with strictures of the distal ureter up to 5 cm long. If the defect of the lower and middle thirds of the ureter is longer, when ureterocystanastomosis is not possible, the Boari flap is an alternative [9]. The surgery involves replacing the defect of the ureter with a tubularized flap from the wall of the bladder. The combination of this technique with the simultaneous bringing down of the kidney makes it possible to compensate for ureteral defects up to 10–15 cm long [10]. In the case of extended ureteral strictures, as well as in case of ineffectiveness of previous interventions, various options for intestinal plastics of the ureter are performed. Most often, an ileal flap is used for replacement [8, 9]. Endoscopic correction of ureteral strictures is a minimally invasive method of treatment that allows restoring the patency of the ureter without unnecessary trauma to the surrounding anatomical structures, prevents secondary stone

formation, and in some cases helps to establish the specific nature of inflammation by additional biopsy. However, this method of assistance is not applicable for total lesions [10].

There are studies comparing laparoscopic and open surgeries for this condition. In the first retrospective, comparative study between open and various laparoscopic procedures, Simmons et al. concluded less estimated blood loss, shorter length of hospital stay in the laparoscopic group but similar patency and complication rates [12]. In another comparative analysis, De Cicco et al. suggested similar recurrence ratio between the two groups with success rates reaching >90% [13].

It should be noted that when replacing a defect in the ureter, the replaced organ (or part of it) must have peristalsis and have a good blood supply. Besides,

the replaced organ should not lead to urinary reflux and the formation of stones or strictures [8]. Various types of surgeries have been proposed to replace ureteral defects, including the use of free vascular pedicle grafts, as well as grafts made of artificial materials. To date, small bowel ureteroplasty and appendicoureteroplasty have received the greatest popularity among these techniques [8, 9].

Talking about kidney function, GFR as a primary characteristic was measured. When comparing different surgical interventions, laparoscopic ureterocystanastomosis increased GFR more significantly than other types of interventions. Although, for better statistical analysis more patients are required for future research.

Our study was consistent with literature data. The limitations of study are small number of patients and impossibility to perform a statistical analysis. This can be a beginning of a bigger multicentral study with more patients and deeper analysis.

Conclusions

Our comparative assessment of the results of various surgical interventions, taking into account modern highly informative diagnostic methods for ureteral stricture, led to several conclusions. Our study showed that the long-term results of correction of ureteral stricture by various surgical methods in 15 patients were considered good and in 1 patient satisfactory.

As can be seen from the above, the problem of treating ureteral strictures is relevant in urological practice. Our experience in the treatment of patients with this pathology is consistent with the literature data. But, along with this, they push us to develop ways to improve long-term outcomes.

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