https://doi.org/10.23873/2074-0506-2024-16-3-337-344

Treatment of recurrent ureteral stricture after kidney transplantation with nitinol stent

A.V. Shabunin[1,2], G.M. Chechenin[1,2], P.A. Drozdov✉[1,2],
I.V. Nesterenko[1], S.A. Astapovich[1], E.A. Lidzhieva[2]

[1]City Clinical Hospital n.a. S.P. Botkin,
5 2-nd Botkinskiy Dr., Moscow 125284 Russia;
[2]Russian Medical Academy of Continuous Professional Education,
2/1 Bldg. 1 Barrikadnaya St., Moscow 125993 Russia

✉Corresponding author: Pavel A. Drozdov, Dr. Sci. (Med.), Head of the Department of Organ and/or Tissue Transplantation, City Clinical Hospital n.a. S.P. Botkin; Associate Professor of the Department of Surgery, Russian Medical Academy of Continuous Professional Education, dc.drozdov@gmail.com

Abstract

Introduction. *Urological complications make up a significant percentage in the structure of kidney graft loss and patient death in the early and long-term period after transplantation. The most common urological complication in the long-term period is ureter or anastomotic stricture, which, according to various authors, occurs in 0.9–34%. However, now there is no consensus in the treatment for recurrent strictures.*

Case Report. *We have presented a clinical case of successful treatment for the stricture of the ureterovesical anastomosis after kidney transplant from a brain-dead donor. During the first year after kidney transplantation, after two reconstructive surgeries and repeated placement of plastic stents, the patient was diagnosed with recurrent stricture of the ureterovesical anastomosis, and therefore a coated nitinol ureteral stent was implanted.*

Conclusion. *This clinical case report demonstrates the feasibility of effectively using a nitinol stent in the treatment of recurrent strictures of the ureterovesical anastomosis after kidney transplantation. In some cases, this technique can be considered as an alternative to repeated surgical interventions. Further studies are needed to determine a more precise treatment algorithm*

Keywords: kidney transplantation, ureterovesical anastomotic stricture, covered nitinol stent

Conflict of interest The authors declare no conflict of interest

Financing The study was performed without external funding

For citation: Shabunin AV, Chechenin GM, Drozdov PA, Nesterenko IV, Astapovich SA, Lidzhieva EA. Treatment of recurrent ureteral stricture after kidney transplantation with nitinol stent. *Transplantologiya. The Russian Journal of Transplantation.* 2024;16(3):337–344. (In Russ.). https://doi.org/10.23873/2074-0506-2024-16-3-337-344

CTS, computed tomography scan

USE, ultrasound examination

PCS, pyelocaliceal system

Introduction

The occurrence of urological complications after kidney transplantation has decreased significantly in recent years. The routine use of ureteral stents during the formation of the ureterovesical anastomosis and the use of modern suture material made it possible to minimize the risk of complications from the ureter of the transplanted kidney. Nevertheless, given the high risk of graft loss and the need for repeated interventions, this problem is still relevant.

The incidence of stricture development in the graft ureter is in the range of 0.9–34%, according to various authors [1, 2]. Late strictures that

occur more than 3 months after transplantation are associated with poor vascularization of the ureter and related to the presence of the following risk factors: donor age over 65 years, long cold ischemia time, multiple renal arteries, delayed renal graft function [3, 4]. To date, the optimal surgical tactics for correcting ureteral strictures of a transplanted kidney have not been yet defined. In the surgical clinic of the City Clinical Hospital n.a. S.P. Botkin, when this complication develops, preference is given to open reconstructive interventions both for the first recurrence and for recurrence after the reconstructive intervention. Meanwhile, in the clinical case described below, we faced a persistent recurrence of the stricture, which required a change in treatment tactics in this patient.

Case Report

Patient R., born in 1961, underwent an allogeneic cadaveric kidney transplantation on May 29, 2021, for the end-stage chronic renal disease as a result of diabetic nephropathy. The postoperative period was uneventful with the primary graft function; on the 14th postoperative day the internal ureteral stent was removed, the patient was discharged from hospital with a blood creatinine of 160 μmol/L.

The patient was re-admitted to the Hospital Department in July 2021 with symptoms of graft pyelonephritis. Ultrasound imaging (USI) examination showed moderate ureteropyelocalicoectasia (pelvis 9 mm, calyces 4–6 mm, ureter 5–6 mm). A clinical urinalysis revealed leukocyturia and bacteriuria; according to the results of urine bacterial culture, it was multidrug-resistant *Kl. pneumonia* in titer 10^8. The administered antibacterial therapy with meropenem at a dose of 1000 mg intravenously twice a day and tigecycline 50 mg intravenously twice a day, the urinary infection was stopped, urine culture was negative, and the patient was discharged home with a blood creatinine of 169 μmol/L.

The next hospitalization was at the end of August 2021 for an increased blood creatinine level to 273 μmol/L identified during an outpatient examination. According to ultrasound imaging, there was a marked dilatation of the pyelocalyceal system (PCS) (pelvis 25 mm, calyces 20–22 mm, ureter up to 6 mm) (Fig. 1). Clinical urinalysis dated August 29, 2021 was without any specific findings.

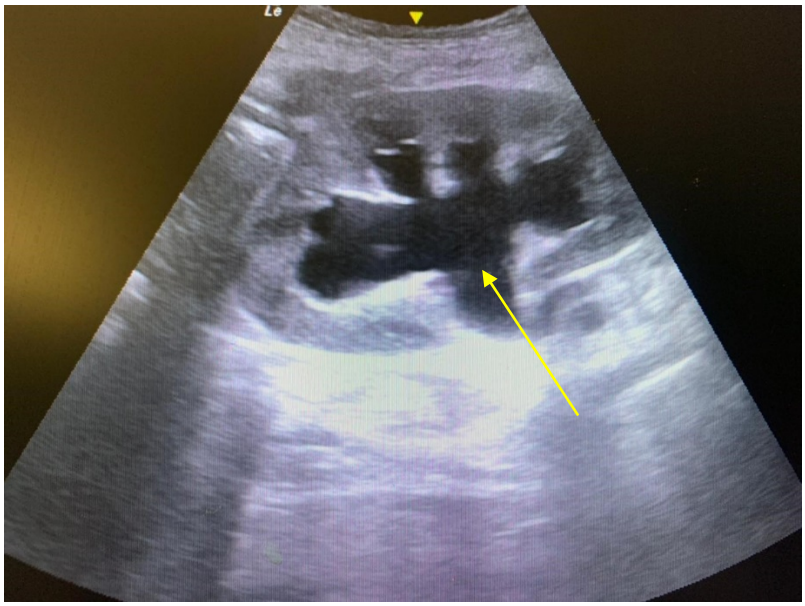

Fig. 1. Ultrasonogram of the renal graft. Marked pyelocaliceal dilatation (yellow arrow)

On September 30, 2121, puncture nephrostomy of the renal graft was performed; at fistulography, there was a block at the level of the ureter middle third. A decision was made to install an antegrade plastic ureteral stent, which was performed on October 1, 2021. (Fig. 2). The graft dysfunction resolved, the patient was discharged from hospital on the 5th day having a blood creatinine level of 176 μmol/L.

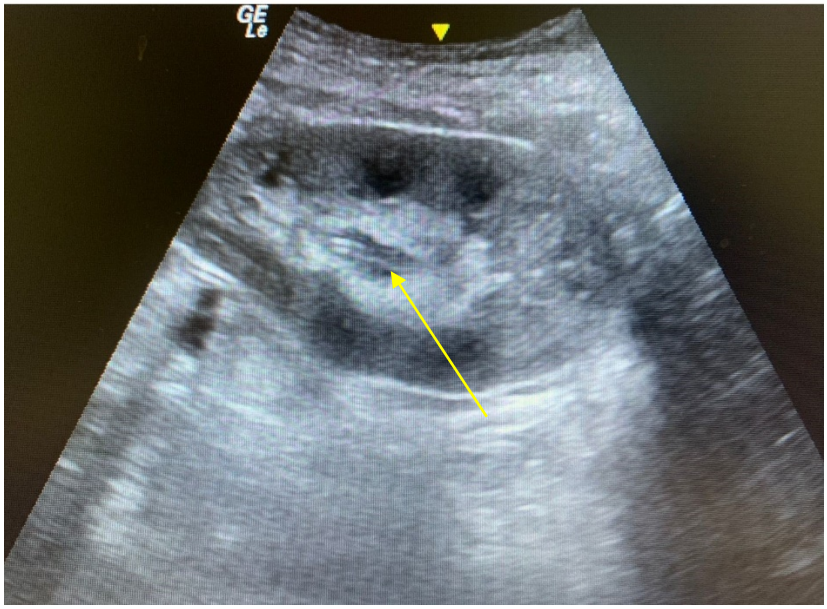

Fig. 2. Ultrasonogram of the renal graft after ureteral stent implantation (the stent is located in the renal pelvis) (yellow arrow)

Then, on November 19, 2021, the ureteral stent was cystoscopically removed as planned. At the time of the procedure, the graft function was satisfactory. The results of a clinical urinalysis showed mild leukocyturia, moderate bacteriuria. A urine culture was taken for microflora on November 20, 2021, and *Kl. Pneumonia* in titer 10^4 resistant to main antibacterial drugs was detected 3 days later. Antibacterial therapy was administered according to the following scheme: meropenem 1000 mg intravenously twice a day, and tigecycline 50 mg intravenously twice a day. The control ultrasound examination on November 22, 2021 revealed a recurrence of the graft PCS dilatation to the values seen at the previous hospital admission, and therefore nephrostomy was performed again. Due to the minimally invasive treatment with a ureteral stent being ineffective, a decision was made to perform reconstructive surgery. On November 29, 2021, a surgical revision of the neoureterocystoanastomosis was performed, during which the anastomotic area compression by surrounding dense scar-necrotic

tissue was revealed. The graft ureter was resected within a satisfactory blood-perfusion area and reimplanted into the bladder with the placement of an internal ureteral stent. The postoperative period was uneventful. The stent was removed as planned 4 weeks later, on December 27, 2021. The nephrostomy was removed after another 2 weeks and a series of fractional clampings. During control ultrasound examination after the nephrostomy removal, a moderate dilatation of the pelvis still remained.

Repeated hospital admission was in June 2022 for the renal graft dysfunction (blood creatinine level 412 μmol/L); ultrasound showed a pronounced PCS dilatation; a recurrent ureteral stricture was diagnosed (Fig. 3); and on June 09, 2022, percutaneous nephrostomy was performed; during fistulography the contrast did not enter the ureter from the pelvis (Fig. 4).

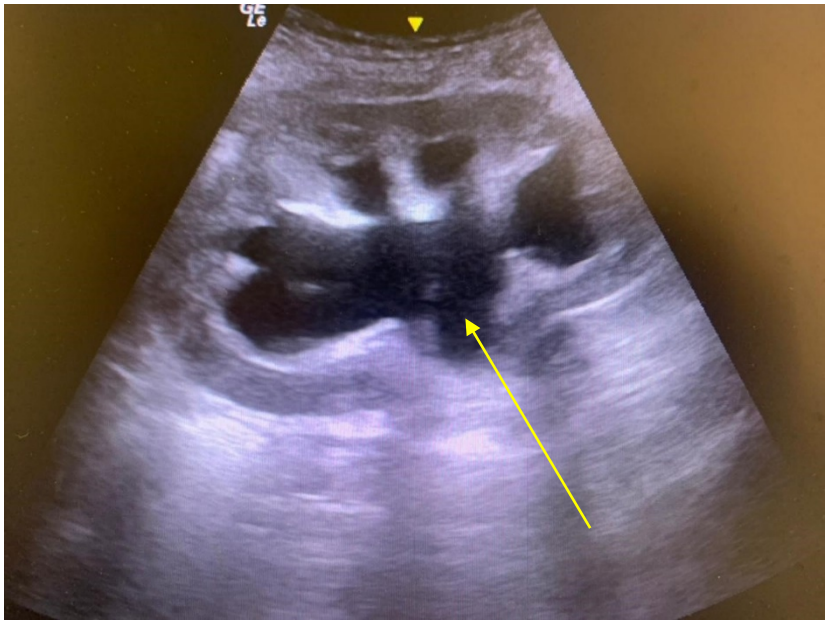

Fig. 3. Ultrasonogram of the renal graft 6 months after reconstructive surgery. Pyelocaliceal dilatation (yellow arrow)

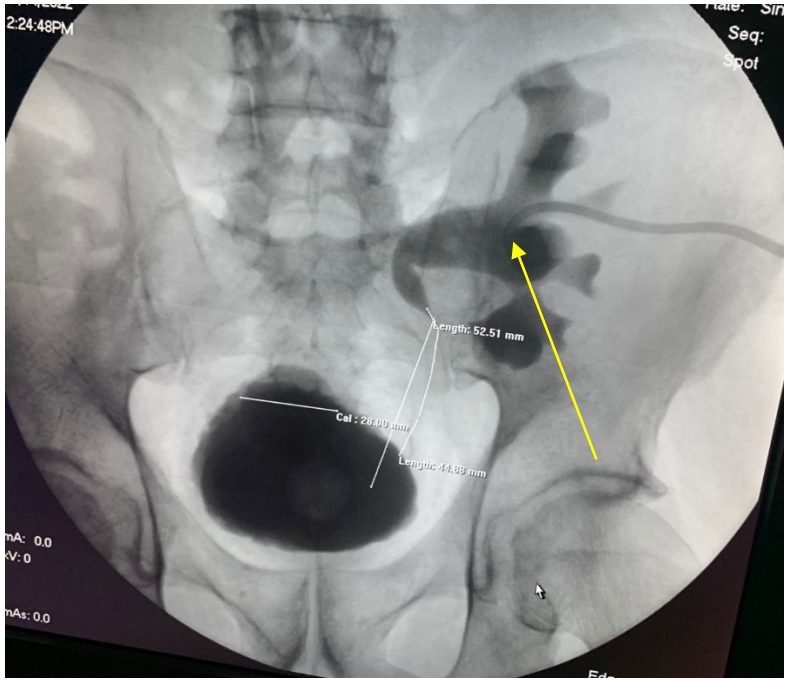

Fig. 4. Fistulogram. Recurrent stricture of the ureterovesical anastomosis (yellow arrow)

On June 15, 2022, an antegrade plastic ureteral stent was placed, and the nephrostomy was removed. After 5 weeks, on July 19, 2022, the stent was removed. A control ultrasound examination revealed pronounced ureterocalicopyelectasia (Fig. 5), which required repeat nephrostomy on July 26, 2022. A decision was made to perform repeated reconstructive surgery.

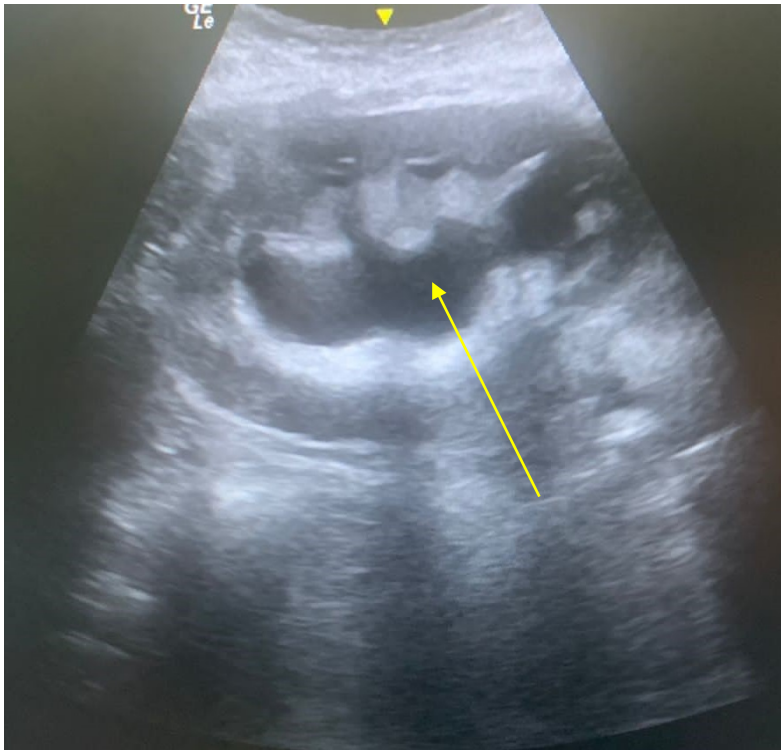

Fig. 5. Ultrasonogram of the renal graft, July 19, 2022. Pyelocaliceal dilatation (yellow arrow)

On July 28, 2022, a surgical revision of the ureterovesical anastomosis was performed. An extended (up to 3.5 cm) stricture of the graft ureter was detected. The ureter was resected within healthy tissue and reimplanted with the placement of an internal plastic stent. After 3 weeks of exposure, the stent was removed on August 18, 2022. Fractional clamping of the nephrostomy drainage again led to an increase in the blood creatinine level and the graft PCS dilatation, which was regarded as a recurrent stricture. The surgical treatment being ineffective, a decision was made to install a self-expanding endoprosthesis in the graft ureter for an indefinite period.

On September 05, 2022, antegrade placement of a coated nitinol Hilzo Covered Ureteral Stent 7 mm x 100 mm (BCM Co., Ltd, Korea). The nephrostomy was removed simultaneously. The postoperative course was uneventful, urodynamics were restored, and the graft function

returned to normal. The patient was discharged for outpatient follow-up having a blood creatinine level of 153 μmol/L.

During follow-up for a year, the graft function was satisfactory (the blood creatinine level was 160 μmol/L); no episodes of urinary infection were observed. According to the results of an ultrasound examination dated December 20, 2023, there was a slight PCS dilatation; according to a computed tomography (CT) of the abdominal and pelvic organs, the stent location was adequate (Fig. 6).

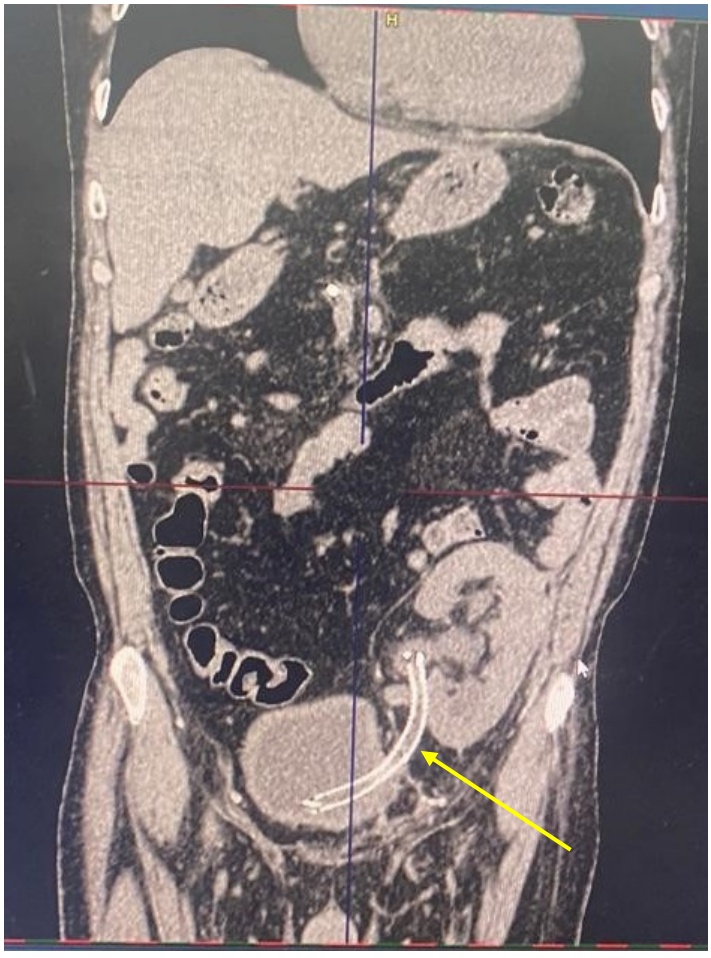

Fig. 6. Abdominal computed tomography scan (native). Stent in the ureter of the kidney graft (yellow arrow)

On January 16, 2024, the patient was hospitalized for the complaints of pain on urination and a feeling of incomplete bladder emptying. The graft function was satisfactory (blood creatinine level was 142 μmol/L). Clinical urinalysis revealed bacteriuria and moderate leukocyturia. Due to the detected increase *in Kl. Pneumonia* with a titer of 10^5 in urine culture on January 17, 2024, an intravenous antibacterial therapy was started with meropenem at a dose of 1000 mg twice a day and tigecycline 50 mg twicw a day. According to the results of the ultrasound examination, there was a moderate dilation of the renal graft pelvis. A computed tomography scan of the abdominal cavity and pelvis was performed, which revealed a complete distal migration of nitinol stent. On January 19, 2024, cystoscopy was performed; the stent was removed without technical difficulties. In the postoperative period, there were neither dysfunctions nor dilation of the renal graft PCS. Urine culture for bacterial microflora on January 21, 2024 was negative. The patient was discharged on the 7th day.

At the time of follow-up visit on March 9, 2024, the graft function was satisfactory; no signs of urinary infection or recurrence of ureteral stricture were detected.

Discussion

The development of ureteral stricture of a kidney graft is a complication that negatively affects the kidney transplantation results [4]. To date, a number of methods have been proposed for the treatment of this complication, including both reconstructive interventions and minimally invasive technologies consisting of long-term stenting of the ureter with a plastic double-J stent [4–8]. However, the priority algorithm for treating ureteral stricture of a transplanted kidney has not been defined to date. In our opinion, long-term ureteral stenting should hardly be considered as the

optimal method of definitive treatment due to the relatively low efficacy and a high risk of developing urinary infection with the presence of multidrug-resistant flora, which is especially dangerous for immunocompromised patients. In our practice, we most often give preference to reconstructive interventions with reimplantation of the ureter into the bladder or with the formation of an anastomosis with the native ureter. We should note that such interventions require preventive drainage of the graft urinary tract and control of the infectious process. Based on world literature data and our own experience, we consider this approach to be the most optimal option for this category of patients.

The presented Case Report is so far the only one in our practice where the stricture persistently recurred, and we did not find the technical feasibility to perform another reconstructive surgery. We should note that we did not consider the reconstruction with using the native ureter due to the previous ipsilateral nephroureterectomy for renal cell carcinoma 3 years before transplantation. In this regard, we decided to implant a coated nitinol stent as the only possible intervention to preserve a functioning graft. At the time of its placement, we considered maintaining the stent exposure for an indefinitely long period, since we had already had experience of unsuccessful interval treatment with a plastic stent. It is worth to note that during the year of an active follow-up of the patient, no episodes of clinically significant urinary infection or graft dysfunction were recorded.

During the patient's last hospitalization, we detected a complete distal migration of the stent into the bladder, and no recurrence of the stricture was noted. This phenomenon is most likely due to the self-expanding property of the coated nitinol endoprosthesis (stent), which created a wide “framework” for the scarred wall of the ureter, preventing stenosis of its lumen.

Thus, the placement of a coated nitinol self-expanding stent was an effective treatment option in a kidney transplant recipient with recurrent graft ureteral stricture and repeated reconstructive and minimally invasive interventions using plastic stents.

Conclusion

This Case Report has demonstrated the possibility of an effective use of nitinol stent in the treatment of recurrent strictures of the ureterovesical anastomosis after kidney transplantation. In some cases, this technique can be considered as an alternative to repeated surgical interventions.

References

1. Minkovich M, Famure O, Li Y, Ghane-kar A, Selzner M, Kim SJ, et al. Ureteral strictures post-kidney transplantation: Trends, impact on patient outcomes, and clinical management. *Can Urol Assoc J.* 2021;15(10):E524–E530. PMID: 33750520 https://doi.org/10.5489/cuaj.7003

2. Black AJ, Harriman D, Nguan C. Contemporary risk factors for ureteral stricture following renal transplantation. *Can Urol Assoc J.* 2022;16(6):E321–E327. PMID: 35099386 https://doi.org/10.5489/cuaj.7648

3. Zhang J, Xue W, Tian P, Zheng J, Ding C, Li Y, et al. Effect of ureteral stricture in transplant kidney and choice of treatment on long-term graft survival. *Int Urol Nephrol.* 2023;55(9):2193-2203. PMID: 37308613 https://doi.org/10.1007/s11255-023-03669-z

4. Saydulaev DA, Miloserdov IA, Gautier SV. Prevention and surgical treatment of urological complications in kidney transplant recipient. *Russian Journal of Transplantology and Artificial Organs.* 2019;21(3):166–173. (In Russ). https://doi.org/10.15825/1995-1191-2019-3-166-173

5. Shabunin AV, Drozdov PA, Eremin DA, Nesterenko IV, Makeev DA, Zhuravel OS, et al. "Early" removal of the internal ureteral stent after kidney transplantation. *Transplantologiya. The Russian Journal of Transplantation.* 2020;12(4):278–285. (In Russ). https://doi.org/10.23873/2074-0506-2020-12-4-278-285

6. Yang KK, Moinzadeh A, Sorcini A. Minimally-invasive ureteral reconstruction for ureteral complications of kidney transplants. *Urology.* 2019;126:227–231. PMID: 30654141 https://doi.org/10.1016/j.urology.2019.01.002

7. Pike TW, Pandanaboyana S, Hope-Johnson T, Hostert L, Ahmad N. Ureteric reconstruction for the management of transplant ureteric stricture: a decade of experience from a single centre. *Transpl Int.* 2015;28(5):529–34. PMID: 25557065 https://doi.org/10.1111/tri.12508

8. Reisler J, Gorman B, Sonstein J, Cicalese L. Long-term management of post-transplant ureteral stricture with surgical reconstruction: a case series and literature review. *Open Journal of Urology.* 2022;12(9):478–491. https://doi.org/10.4236/oju.2022.129047

Information about authors

Aleksey V. Shabunin, Academician of the Russian Academy of Sciences, Prof., Dr. Sci. (Med.), Head Physician of the City Clinical Hospital n.a. S.P. Botkin; Head of the Department of Surgery, Russian Medical Academy of Continuous Professional Education, https://orcid.org/0000-0002-0522-0681, shabunin-botkin@mail.ru

35%, concept and design of the study, approval of the final version of the manuscript

Grigory M. Chechenin, Cand. Sci. (Med.), Surgeon of the Department of Liver and Pancreas Surgery, City Clinical Hospital n.a. S.P. Botkin; Associate Professor of Surgery Department, Russian

Medical Academy of Continuous Professional Education, https://orcid.org/0000-0002-4883-2389, grigorii67@gmail.com

20%, developing the concept of ureterovesical anastomosis stenting

Pavel A. Drozdov, Dr. Sci. (Med.), Head of the Department of Organ and/or Tissue Transplantation, City Clinical Hospital n.a. S.P. Botkin; Associate Professor of the Department of Surgery, Russian Medical Academy of Continuous Professional Education, https://orcid.org/0000-0001-8016-1610, dc.drozdov@gmail.com

15%, organization of the treatment process in the Transplant Department, concept and design of the study, writing and editing the manuscript

Igor V. Nesterenko, Prof., Dr. Sci. (Med.), Surgeon of the Department of Organ and/or Tissue Transplantation, City Clinical Hospital n.a. S.P. Botkin, http://orcid.org/0000-0002-3995-0324, nesterenko62@bk.ru

15%, making surgical interventions for kidney transplantation and stricture correction of the ureterovesical anastomosis

Sergey A. Astapovich, Resident Doctor at a Surgical Clinic, City Clinical Hospital n.a. S.P. Botkin, https://orcid.org/0000-0001-7774-1892, astsergej99@gmail.com

10%, treatment of patients during their stay in hospital, writing the text

Elza A. Lidzhieva, Resident Doctor at Surgery Department, Russian Medical Academy of Continuous Professional Education, https://orcid.org/0000-0003-1120-5450, lidjieva99@mail.ru

5%, writing the text, collection and statistical analysis of data

The article was received on February 12, 2024;
approved after reviewing on April 22, 2024;
accepted for publication on June 26, 2024