



Kidney auto-transplantation due to upper and middle ureter defect after ureteroscopy injury

Autotransplantacija bubrega zbog defekta gornjeg i srednjeg uretera nakon povrede pri ureteroskopiji

Mirko D Jovanović*, Predrag Marić*, Vladimir Bančević*[†], Radovan Milošević*[†],
Ivica Nikolić*, Dejan Simić*, Aleksandar Spasić*, Novak Milović*[†]

Military Medical Academy, *Urology Clinic, Belgrade, Serbia; Univeristy of Defence,
[†]Faculty of Medicine of the Military Medical Academy, Belgrade, Serbia

Abstract

Introduction. Surgery complications during and after ureteroscopic procedures are rare, mostly temporary and require no special additional procedures. However, major complications, nevertheless their small incidence (less than 1–2%), can be very serious and they include ureter perforation and avulsion. **Case report.** We represented a patient with complicated ureter iatrogenic stenosis developed after ureteroscopic procedure of stone removal. After several hospitalizations, septic condition with retroperitoneal abscess and an attempt of endoscopic and open surgical solution, the kidney auto-transplantation was successfully done. **Conclusion.** There are a small number of complications with ureteroscopic procedures, but when ureter avulsion or perforation occurs, and when the mission is to preserve pair organs, kidney auto-transplantation has the advantage over other methods of ureter reconstruction.

Key words:

ureteroscopy; iatrogenic disease; ureteral obstruction; kidney; transplantation, autologous; treatment outcome.

Apstrakt

Uvod. Hirurške komplikacije tokom i nakon ureteroskopskih procedura su retke, uglavnom su prolazne i ne zahtevaju posebne dodatne procedure. Međutim, velike komplikacije i pored male incidence (manje od 1–2%), mogu biti veoma ozbiljne i tu spadaju perforacija i avulzija uretera. **Prikaz slučaja.** U radu je prikazan bolesnik sa komplikovanom iatrogenom stenozom uretera koja se razvila nakon ureteroskopske procedure razbijanja kamena. Nakon brojnih hospitalizacija, pojave septičnog stanja sa retroperitonealnim apscesom i pokušaja endoskopskog i otvorenog hirurškog rešavanja, uspešno je urađena autotransplantacija bubrega. **Zaključak.** Ureteroskopske procedure imaju mali broj komplikacija, ali u slučaju avulzije ili perforacije uretera, u cilju očuvanja parnih organa, autotransplantacija bubrega je u prednosti u odnosu na druge metode rekonstrukcije uretera.

Ključne reči:

ureteroskopija; jatrogena bolest; ureter, opstrukcija; bubreg; transplantacija, autologna; lečenje, ishod.

Introduction

Surgical complications during and after ureteroscopic procedures are rare, mostly of temporary character and do not require special additional procedures¹. Most of them belong to a minor complications such as bleeding, mucosal laceration, and kidney colic, and all are successfully treated conservatively or endoscopically².

However, major complications, nevertheless their small incidence (less than 1–2%), can be very serious and cause significant morbidity. They include ureter perforation and avulsion³. All these complications are early and arise in the course of the surgical procedure or immediately after it (in

the first 24 hours). The complications are dealt with endoscopy or open surgery^{4,5}. Some of the most often late complications, that can arise from several weeks to several months after the primary treatment, are ureter stenoses⁶, that occur in 0–0.2% cases^{7,8}.

Ureteral stenoses lead to urin excretion obstruction and can be non-complicated or complicated by urinary infection, kidney insufficiency and kidney dysfunction. Complicated ureter stenoses require urinary tract decompression by placing “double J” ureteral stent or percutaneous nephrostomy catheter. With some patients there is a necessity for ureteral “double J” stent constant replacement on a three months basis. The consequence of these interventions is the stent bacte-

rial colonization, which can lead even to urosepsis. Other possible complications are hematuria, stent migration, and incrustation⁹. Carrying fixed percutaneous nephrostomy tube makes everyday patient's activities harder, and some of the complications are hematuria, urinary infection, the catheter dislodgement. Due to all abovementioned problems, these are only temporary solutions until ensuring conditions for a permanent surgical solution.

The ways to permanently solve a complicated ureter stenosis are surgical, and the approach can be open or laparoscopic. As methods of surgical solutions for ureter stenosis, besides ureter reconstruction, the literature gives 4 most frequent ways: ureter interposition by ileum segment, Boari flap, psoas hitch and kidney auto-transplantation¹⁰. Using appendix for lower ureter parts reconstruction is also surgically feasible¹¹.

In the report we represented a patient with complicated iatrogenic ureter stenosis developed after ureteroscopic procedure of stone removal. After a number of hospitalizations, developed septic condition with retroperitoneal abscess and an attempt of endoscopic and open surgical solution, the kidney auto-transplantation was successfully carried out.

Case report

A patient of age 43 developed a chronic obstructive left kidney illness due to complicated left ureter stenosis that had occurred after ureteroscopic removal of the ureter stone and multiple successive endoscopic and open surgical procedures in attempt to solve the complications.

In January 2013 at the Urological Department of another institution, the patient was subjected to an ultrasound examination, due to left-sided kidney colic, when the left si-

de hydronephrosis was verified. The laboratory results showed normal values of erythrocyte sedimentation, blood cells count, serum biochemistry and urin sediments. Urin culture was sterile. Intravenous pielo-ureterography was carried out and showed the left kidney exclusion and a shadow of mineral intensity, size of about 8 mm at the lower edge of the 3rd lumbar vertebrae on the left (Figure 1).

Kidney function was normal estimated glomerular filtration rate (eGFR > 60%) and patient had no other diseases. His general condition was good (Karnofsky score > 90%) and besides periodical left flank pain with propagations to the left groin, the patient had no other disorders. At another institution the patient was subjected to an endoscopic ureterolithotripsy on the left side. At the course of the surgery, the left ureter proximal part was perforated together with complete transection of the ureter wall, which was a Grade III-b complication according to the Clavien-Dindo surgical complication classification system¹². An open ureterolithotomy and urethroraphy were immediately carried out and a JJ stent was placed (Figure 2).

The early postoperative course was complicated by arise of febrile state with clinical image of paralytic ileus and the patient was transported to a higher rank institution for further treatment. At the multisliced computed tomography (MSCT) an abscess retroperitoneal collection was identified at the left side that encompasses m. psoas and iliacus and the whole iliac cave, its size was 15×14×9 cm. The patient was operated on February 8th 2014 at a tertiary rank institution where a retroperitoneum exploration with abscess drainage and ureterolysis were done, together with placement of percutaneous nephrostomy catheter (PNS) into the left kidney. The postoperative course was good and the patient was sent off for home treatment and after a month the JJ stent was



Fig. 1 – Intravenous pielo-ureterography with exclusion of the left kidney and a shadow of mineral intensity, size of about 8 mm at the lower edge of the 3rd lumbar vertebrae.



Fig. 2 – Control kidney-ureter-bladder (KUB) radiography after an open surgical revision by lumbotomy, ureterolithotomy, ureteroraphy and JJ stent placement, at the same institution.

extracted, and PNS was dislodged three days before that. Six days after displacing JJ stent due to the septic condition, the patient was hospitalized again. The hydronephrosis was verified on the left side and the PNS was placed again. During the PNS placement, the pus contain was evacuated, and after an antibiotic therapy, the patient's general condition was being stabilized.

A month after that, at the anterograde urography control, a total stenosis of the upper part of ureter was verified (2–3 cm below the ureteropyelic union), and the ureter wasn't fulfilled with contrast below the stenosis (Figure 3).

The patient was then sent to the Urology Clinic of the Military Medical Academy in Belgrade for further treatment. Because of the total high ureter stenosis verification and still completely functional left kidney (daily diuresis over PNS about 1500 mL urine *per day*), all possible methods of the surgical treatment were discussed and it was decided to do the auto-transplantation of the left kidney.

Because of the complete stenosis of the upper left ureter, the left kidney auto-transplantation was carried out at the Urology Clinic of the Military Medical Academy in Belgrade on June 28th, 2013. Intraoperatively there were identified a number of growths around the kidney and pylon, and the ureter virtually couldn't be distally identified out of the ureteropyelic union, and upper and middle ureter were transformed into a fibrous stripe.

The left kidney was placed in the right iliac cave by the "end to end" arterial anastomosis with internal iliac artery and "end to side" renal vein anastomosis with external iliac vein. The ureter was implanted into the bladder by a modified Lich Gregoir method with two parallel incisions¹³. The surgery lasted 230 minutes, and during that time the patient was given no blood. He was released from the hospital on the 15th postoperative day, in an afebrile condition with normal creatinine and

urea values. Control *iv* pyeloureterography showed both kidneys concentrate well and urine excretion on time and there was no pielocaliceal system dilatation (Figure 4).

In this case the kidney auto-transplantation proved itself a safe alternative method in solving complex ureteral stenosis with the defect of 2/3 of the ureter.

Discussion

A kidney auto-transplantation was for the first time described in the literature in 1963 when Hardy and Erslan¹⁴ carried out a kidney reimplantation in the ipsilateral iliac cave of the same patient in case of an upper ureter injury. Since then this complex method has being used, but not so often and in several centers only, for surgical treatments of ureter injuries, kidney artery aneurysm, renovascular hypertension and kidney malignant tumors¹⁵.

Endoscopic or ureteroscopic stone removal (Ureteroscopic Lithotripsy – URSL), with different energy sources, in a number of cases represents a method of choice for active treatment of stone in the upper ureter part¹⁶. Due to a fast technology development of ureteroscopy in the last few years, active treatment of ureter stone has also been significantly improved, intervention successfulness rate has been increased, and at the same time complications percentage has been lowered¹⁷. The existing literature finds "stone free rate" even up to 99%, with complications rate from 9–11%, out of which ureter injuries (perforation and avulsion) occur in 1–4%^{2,3}. Ureter perforation is a complication which, depending on a ureter wall injury degree, can also be solved endoscopically by placing ureteral "double J" stent, but in cases of ureter wall transection for more than 50%, an open surgical revision is mainly necessary¹⁸. Scars and ure-



Fig. 3 – Control anterograde urography verifies a total stenosis of the upper ureter (2–3 cm below the ureteropyelic union).



Fig. 4 – Control intravenous pyeloureterography showed both kidneys concentrate well and urine excretion on time and there was no pielocaliceal system dilatation.

ter stenoses arise as late complications of ureter wall perforation.

Our patient suffered a total ureter stenosis as a result of ureteroscopic lithotripsy and ureter perforation late complication. After the first reoperation when the ureterolitotomy, ureterography and a JJ stent placement had been carried out, a retroperitoneal abscess has arisen because of an infection, which as an outer ("extrinsic") factor additionally has contributed to a high complicated ureter stenosis and a total defect of the upper and middle part of the ureter.

The upper ureter stenoses of a different etiology make a great challenge for urologists. Although there are a great number of options for their surgical treatment, there is no consensus about an optimal method. Generally, each patient's characteristics and the surgeon's experience mainly determine a treatment plan. Methods of surgical treatment of a complicated ureter stenosis or ureter defect are: ureteroureterostomy, transureterostomy, nephropexy, ureterocalicostomy, Bladder flap, psoas hitch, colonic segment interposition, kidney auto-transplantation and as a final option – nephrectomy¹⁹. Although the other kidney function in our patient was preserved, nephrectomy was rejected as a possibility because of the patient's age and a risk of arising calculosis on the other kidney. Preserving pair organs function makes a treatment option if there is no malignant disease, particularly with younger patients²⁰.

We considered all surgical possibilities for the urinary path reconstruction in our patient. Due to non-existence of the whole upper and middle part of the ureter, it was not possible to carry out above mentioned methods of ureter reconstruction or ureterocystoneostomy with Bladder flap or psoas hitch method. Colonic segment interposition as a possibility was rejected because of the expected surgical and late complications – urinary infection, electrolyte disbalance, anastomosis stenosis and kidney insufficiency²¹. In cases with complex ureter stenosis, when ureterocystoneostomy is not feasible, kidney auto-transplantation must be considered as an option²². Because of a great experience our clinic as a whole and its transplantation team had in the kidney transplantations area, and having in mind other methods of endoscopic and open surgical treatment had already been unsuccessfully carried out at another institution, the decision was made to do the left kidney auto-transplantation into the contralateral iliac cave.

According to some authors, in 40% patients that have been subjected to auto-transplantation, postoperative complications arise, which is why the kidney must be removed²³. In relation to

other surgical methods in treating complicated ureter stenosis, kidney auto-transplantation is rarely necessary and it should be an option only when other methods are impossible or contraindicated. Although earlier studies have shown a high percentage of perioperative kidney loss, recent series have shown excellent results made by experienced transplantation teams^{24,25}.

The principle of an auto-transplantation itself is a nephrectomy in the first act, an open or a laparoscopic one, where it is necessary to preserve kidney vein and artery at maximal length. After the nephrectomy, the kidney is being rinsed with the chilled electrolyte solution and placed in chopped up ice as a part of preparations for auto-transplantation ("bench preparation"). With the laparoscopic nephrectomy, the most frequent is Gibson's incision, and the auto-transplantation through the same cut is possible²⁶. The kidney is typically placed in the contralateral iliac cave because of the best vascular orientation, but in this procedure the contralateral ureter can be compromised²⁷.

In this case, a part of ureter 2–3 cm long beneath the ureteropyelic union was preserved and that was enough for non-tension anastomosis of ureter and bladder. In cases where there is a total defect of the ureter upper part or in patients with nephrolithiasis history, pyelovesicostomy is recommended²⁸, with previous stone removal.

Conclusion

Ureteroscopic procedures have a small number of complications, but in cases of ureter avulsion or perforation, the kidney loss is also a possibility. The solution of those cases requires a clear attitude and experience.

Kidney auto-transplantation should be considered in patients with extensive ureter defect where urinal diversion is not a method of choice. The success of this surgical procedure, besides strict selection and a choice of a patient, requires also experienced and well-trained transplantation team and previous patient's angiographic evaluation. It could be applied in other cases also, and most frequently in the surgical treatment of renovascular hypertension, renal artery aneurysm, kidney malignomas. If an injury or ureter stenosis happens, and with a failure of a primary ureter reconstruction, it has an advantage over colonic segment interposition due to a less late complications rate. With younger patients, where pair organs preservation is important, kidney auto-transplantation has an advantage over other ureter reconstruction methods.

R E F E R E N C E S

1. *Biester R, Gillenwater JY.* Complications following ureteroscopy. *J Urol* 1986; 136(2): 380–2.
2. *Geavlete P, Georgescu D, Niță G, Mirculescu V, Cauni V.* Complications of 2735 retrograde semirigid ureteroscopy procedures: A single-center experience. *J. Endourol* 2006; 20(3): 179–85.
3. *Johnson BD, Pearle MS.* Complications of ureteroscopy. *Urol Clin North Am* 2004; 31(1): 157–71.
4. *Gupta V, Sadasukhi TC, Sharma KK, Yadav RG, Mathur R, Tomar V, et al.* Complete Ureteral Avulsion. *Sci World J* 2005; 5: 125–7.
5. *Alapont JM, Broseta E, Oliver F, Pontones JL, Boronat F, Jimenez-Cruz JF.* Ureteral avulsion as a complication of ureteroscopy. *Int Braz J Urol* 2003; 29(1): 18–23.
6. *Hafez KS, Wolf SJ.* Update on minimally invasive management of ureteral strictures. *J Endourol* 2003; 17(7): 453–64.

7. *Abmed S, El-Abda SA, Sulimana GM, Abo Farhaa OM, Ramadana RA, El-Tatanyia HH, et al.* The development of ureteric strictures after ureteroscopic treatment for ureteric calculi: A long-term study at two academic centres. *Arab J Urol* 2014; 12(2): 168–72.
8. *Burks FN, Santucci RA.* Management of iatrogenic ureteral injury. *Ther Adv Urol* 2014; 6(3): 115–24.
9. *Chew BH, Durdevani M, Denstedt JD.* New developments in ureteral stent design, materials and coatings. *Expert Rev Med Devices* 2006; 3(3): 395–403.
10. *Benson MC, Ring KS, Olsson CA.* Ureteral reconstruction and bypass: Experience with ileal interposition, the Boari flap-psoas hitch and renal autotransplantation. *J Urol* 1990; 143(1): 20–3.
11. *Milović N, Janjić P, Bancević V, Kupresanin S.* Uretero-appendix-cystoneostomy as a technique for the reconstruction of the lower part of the ureter. *Vojnosanit Pregl* 2005; 62(12): 932–3. (Serbian)
12. *Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al.* The Clavien-Dindo classification of surgical complications: Five-year experience. *Ann Surg* 2009; 250(2): 187–96.
13. *Gregoir W.* The surgical treatment of congenital vesico-ureteral reflux. *Acta Chir Belg* 1964; 63: 431–9. (French)
14. *Hardy JD, Eraslan S.* Autotransplantation of the kidney for high ureteral injury. *J Urol* 1963; 90: 563–74.
15. *Wotkowiץ C, Libertino JA.* Renal autotransplantation. *BJU Int* 2004; 93(3): 253–7.
16. *Tiselius HG, Ackermann D, Alken P, Buck C, Conort P, Gallucci M.* Guidelines on urolithiasis. *Eur Urol* 2001; 40(4): 362–71.
17. *Matlaga BR, Jansen JP, Meckley LM, Byrne TW, Lingeman JE.* Treatment of ureteral and renal stones: A systematic review and meta-analysis of randomized, controlled trials. *J Urol* 2012; 188(1): 130–7.
18. *Schoenthaler M, Buchholz N, Farin E, Ather H, Bach C, Bach T, et al.* The Post-Ureteroscopic Lesion Scale (PULS): A multicenter video-based evaluation of inter-rater reliability. *World J Urol* 2014; 32(4): 1033–40.
19. *Knight RB, Hudak SJ, Morey AF.* Strategies for open reconstruction of upper ureteral strictures. *Urol Clin North Am* 2013; 40(3): 351–61.
20. *Milović N, Bancević V, Teodorović G.* Ureterorenoscopy laser lithotripsy treatment of stones impacted in the left ureter 10 years after right kidney autotransplantation. *Vojnosanit Pregl* 2014; 71(10): 972–4.
21. *Chung BI, Hamawy KJ, Zinman LN, Libertino JA.* The use of bowel for ureteral replacement for complex ureteral reconstruction: Long-term results. *J Urol* 2006; 175(1): 179–83.
22. *Soto JS, Phillips M, Cernigliaro J, Haley W.* Renal Autotransplantation for Iatrogenic High-Grade Ureteric Stricture. *Case Rep Urol* 2012; 2012: 259527.
23. *Wotkowiץ C, Libertino JA.* Renal autotransplantation. *BJU Int* 2004; 93(3): 253–7.
24. *Webster J, Lemoine J, Seigne J, Lockhart J, Bowers V.* Renal autotransplantation for managing a short upper ureter or after ex vivo complex renovascular reconstruction. *BJU Int* 2005; 96(6): 871–4.
25. *Lutter I, Molcan T, Pechan J, Daniel J, Wagenhoffer R, Weibl P.* Renal autotransplantation in irreversible ureteral injury. *Bratisl Lek Listy* 2002; 103(11): 437–9.
26. *Meng MV, Freise CE, Stoller ML.* Expanded experience with laparoscopic nephrectomy and autotransplantation for severe ureteral injury. *J Urol* 2003; 169(4): 1363–7.
27. *Marshall VF, Whitsell J, McGovern JH, Miscall BG.* The practicality of renal autotransplantation in humans. *JAMA* 1966; 196(13): 1154–6.
28. *Flechner SM, Noble M, Tiong HY, Coffman KL, Wee A.* Renal autotransplantation and modified pyelovesicostomy for intractable metabolic stone disease. *JUrol* 2011; 186(5): 1910–5.

Received on July 28, 2015.
Accepted on April 26, 2016.
Online First May, 2016.