Complications of Camey-Le Duck ureteral reimplantation technique in modified ureterosigmoidostomy (Mainz pouch II) urinary diversion

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Objective: to analyze complications and clinical outcome of Camey-Le Duck ureteral reimplantation technique in modified Mainz pouch II urinary diversion. Patients and methods: this retrospective study included a total of 110 patients (101 male and 9 female, mean age 59.2 years, SD=10.2), who had underwent a modified Mainz pouch II urinary diversion with Camey-Le Duck ureteral reimplantation technique, following total cystectomy, during the period 1995-2014. The mean follow-up, available for 90 (82%) patients period was 19 (1-74) months. Early and late postoperative complications were analyzed. Results: early complications developed in 22 (20%) patients as follow: unilateral ureterohydronephrosis in 8 (7%) patients, bilateral ureterohydronephrosis in one (1%) - two RU (renouretal units), urinary leakage in 8 (7%), and pyelonephritis in 5 (5%) patients. Late complications developed in 28 (25%) patients: pyelonephritis in 17 (15%), and ureteral reimplantation site stenosis in 11 (10%) patients with 12 RU. Balloon dilatation procedure was applied in all 12 RU, with additional metallic Strecker stent insertion in 5 RU. At 24-month follow-up, all patients with metallic Strecker stent had normal results of serum biochemistry, blood gas analysis and renal ultrasound. In the rest of six patients with 7RU, balloon dilatation has failed and restenosis of ureteral reimplantation site with consequent ipsilateral hydronephrosis was verified. In these patients, permanent percutaneous nephrostomy catheter was applied. Conclusion: Camey-Le Duck ureteral reimplantation technique following Mainz pouch II urinary diversion is simple, reliable and durable. It enables well upper urinary tract protection and is associated with relatively low major complication rates.

Key words: Camey-Le Duck technique, ureteral reimplantation,

INTRODUCTION

Numerous surgical techniques for urinary diversion following radical cystectomy have been described up to date. It encompasses a wide range of incontinent and continent procedures. It is undoubtedly that development of techniques that have included the use of intestinal segments for urinary tract recoupment had made substantial support to the evolution of urinary diversion procedures. Regardless to differences in respect to the type of the procedure, preservation of the renal function remains the common ultimate goal.

The first form of continent urinary diversion was ureterosigmoidostomy, introduced by Simon at the end of the 19th century. Due to high surgical and metabolic complication rates, primary enthusiasm with the technique and its modifications was lost at the beginning of the 20th century. By the Coffey’s new ureterointestinal anastomosis technique in 1910th, ureterosigmoidostomy has become popular again. In the middle of the 20th century, several reports have clearly demonstrated that hyperchloremic metabolic acidosis is unavoidable complication of ureterosigmoidostomy and the technique had been abandoned1-4.

Along with further achievements of urinary diversion techniques, related primarily to the low-pressure urinary reservoir creation based on the principle of bowel detubularization, as well as the introduction of clean intermittent self-catheterization, the modern era of continent urinary diversion has begun5-7.

A major modification of ureterosigmoidostomy, sigma rectum pouch (Mainz pouch II) technique, was initially proposed by Fisch and Hohenfellner in 1991. A Mainz pouch II technique involves a creation of low-pressure sigmoidorectum high capacity pouch by the detubularization of the rectosigmoid, bringing together old and modern concept of urinary diversion to reduce ureterosigmoidostomy-associated complications such as hyperchloremic metabolic acidosis, pyelonephritis, incontinence and uretero-colonic anastomotic stricture8-10.
Objective: to analyze complications and clinical outcome of Camey-Le Duck ureteral reimplantation technique in modified Mainz pouch II urinary diversion.

PATIENTS AND METHODS

During the period 1995-2014 a total of 110 patients (101 male and 9 female, mean age 59.2 years, SD=10.2) underwent modified sigma rectum pouch (Mainz pouch II) urinary diversion. For the purpose of this retrospective study, the medical records and radiographic studies of all patients were reviewed.

In 108 patients the indication was bladder cancer and in two functional bladder loss. All patients have been assessed preoperatively by the standardized diagnostic protocol as proposed by Fisch et al. It included complete laboratory blood and urine analysis, physical examination (including digital rectal and pelvic examination), abdominal echography, plain urotract x-ray, excretory urography, urethroscopy, chest x-ray, transurethral bladder tumor biopsy (for bladder cancer), pelvic CT (or NMR) scan, irigography and rectoscopy. The competence of anal sphincter was assessed by asking the patient to hold a water enema of 300-400 ml for 4 hours during daytime and at night. Disease confined to the bladder, local advanced disease with prostatic stromal and/or urethral invasion, without nodal involvement were considered indications for this urinary diversion for patients with bladder cancer. Incontinent anal sphincter, sigma diverticulosis, intestinal polyps, insufficient renal function (serum creatinin >1.5mg/ml) were considered contraindications for the procedure. The operative procedure have been performed according to original technique with modifications as follows:

- ureteral implantation into the pouch by Camey-Le Duc technique;
- ureteral stents fixation to the pouch mucosa with plain catgut sutures;
- ureteral stents fixation to the gluteal skin exteriorly.

Through the midline abdominal transperitoneal incision, abdominal cavity is exposed. Radical cystoprotatectomy with bilateral pelvic lymph node dissection or anterior pelvic exenteration in females were performed. In order to create urinary reservoir, 12 centimeters of sigmoid colon and 8 centimeters of rectum are exposed and opened by diathermy knife along its antimesenteric border. A posterior pouch wall was created by joining lateral limbs using 3-0 Vicryl two-layer running sutures. The ureters are mobilized and are brought retroperitoneal into the pouch through the posterior wall. Afterward, ureters were reimplanted into the pouch by Camey Le Duck technique, laying on the specially created bearing. 8F ureteric stents are placed, anchored to the mucosa of the posterior wall of the pouch and then were brought out through the rectal tube. The pouch is completed by the creation of the anterior wall and is then anchored to the anterior longitudinal ligament of the sacral promontory. To prevent migration of the ureteral stents, they are sutured to the perineal skin. Postoperatively, abdominal cavity drains were exteriorized after cessation of fluid drainage while ureteral stents on 10th day. Postoperative follow-up included serum biochemistry, blood gas analysis and renal ultrasound at second and every 3 months for the first and second year and thereafter biannually. In patients with hydronephrosis of moderate to severe degree, percutaneous nephrostomy was applied in order to prevent deteriorization of renal function and to enable approach for a full radiological workup.

In order to correct hyperchloremic metabolic acidosis, sodium bicarbonate (from 3 to 10 g daily, depending on the degree of acidosis) was given orally for the arterial pH below 7.35 or base excess of 2.0 mmol/l. The mean follow-up, available for 90 (82%) patients period was 19 (1-74) months.

RESULTS

The average operation time for the standard sigma rectum pouch (Mainz pouch II) procedure was 5,0 (ranged 1-74) months. The mean hospital stay was 17 (15 to 43) days. Ureteral stents were removed between 10th and 12th postoperative day. Perioperative lethality was nil.

In connection with the ureteral reimplantation, early postoperative complications have been verified in 22 (20%) patients and late in 28 (25%) patients.

In the early complications (<30 days) are unilateral ureterohydronephrosis in 8(7%) patients, bilateral uretero-hydronephrosis in one (1%) - two RU, urinary leakage in 8(7%) and unilateral acute pyelonephritis in 5 (5%) patients.

Of 8 patients with unilateral hydronephrosis, in 6 patients it was caused by ureteral stent obstruction. In four of them it was resolved by the ultrasound-guided mild correction of the intrarenal position of the stent and stent rinsing, while two patients had underwent percutaneous nephrostomy for the next four weeks. In two patients, hydronephrosis was due to immediate postoperative ureteral stent prolapse. In the second patient percutaneous nephrostomy was applied due to severe hydronephrosis and had been removed after four weeks. During the early follow-up, both patients had normal postoperative course and hydronephrosis was withdrawn.

Bilateral ureterohydronephrosis appeared in one patient during the immediate postoperative course, due to ureteral stent obstruction and had withdrawn after stent rinsing. There was no hydronephrosis in patients with urinary leakage (n=8). Leakage was moderate (<500ml daily) and was ceased after prolonged drainage by abdominal drains. Of five patients with acute unilateral pyelonephritis, in one patient is was associated with moderate hydronephrosis and percutaneous nephrostomy was applied. Other four patients pyelonephritis had been successfully treated by conservative treatment.

In the late complications (>30 days) are pyelonephritis in 17(15%) patients and ureteral reimplantation site stenosis in 11(10%) patients. Unilateral pyelonephritis was verified in 14 while bilateral in 3 patients (6RU). Of these, in 8 patients (10RU) pyelonephritis occurred due to ureteral obstruction and because of progressive hydronephrosis they were treated by temporary percutaneous nephrostomy. Patients have been released from nephrostomy tube after 4-6 weeks. In the rest of 9 patients (10RU), pyelonephritis was not obstructive and was treated conservatively.
In a total of 11 patients (12RU) stenosis at the ureteral implantation site have been verified as a late complication. In all, percutaneous nephrostomy was applied in order to prevent deteriorization of renal function and to enable further diagnostic and therapeutic approach for a full uro-radiological workup. Radiological diagnostics which consisted of MSCT urography and antegrade pyeloureterography was performed to determine the extent of the stenosis. Therapeutic procedures that have been performed by experienced radiologist have included balloon dilatation of the stenosis of the ureteral implantation site in antegrade manner, with or without additional implantation of metallic Strecker stent.

Balloon dilatation procedure was performed through the percutaneous nephrostomy approach under the fluoroscopic guidance.

First of all, a guide wire is placed through the nephrostomy approach into the pyelocaliceal system and was then placed into the ureter to the level of the ureterosigmoid anastomotic site.

A guide wire is easily pushed through the stenotic segment. Afterwards, a special Albright balloon dilatation catheter is slipped over the guide wire until it reaches the stenosis (Figure 1a). Next, the catheter is passed through the stenosis and placed so that the balloon is at the level of stenosis. Then, the balloon is filled with contrast medium, which facilitates visualization and further manipulations (Figure 1b).

The balloon is filled to the full capacity and was 2 to 3 minutes left in the place in order to dilate the stenotic segment. A balloon filling procedure was repeated 3 to 4 times. Thereafter, the balloon dilatation catheter is extracted and the guide wire was left in place. Afterwards, 10-12 F ureteral catheter is pulled over the guide wire until it passes stenosis (Figure 2).

Next, a guide wire is extracted and ureteral catheter is then anchored to the access point and was left in place for 4 to 6 weeks.

If the metallic stent is placed, following the extraction of the balloon dilatation catheter, a special radiopaque balloon catheter that carries metallic stent around the balloon have been introduced. It advances through the ureter until the balloon is placed into the stenotic segment. After positioning the balloon, it has been filled with contrast medium in order to extend the metallic stent. Thereafter, a balloon is emptied and the metallic stent was left in place. A balloon catheter is extracted and percutaneous nephrostomy has been slipped over the guidewire into
the renal pyelocaliceal system in order to enable post procedural diagnostics and follow up (Figure 3). The guidewire is then extracted.

Whether balloon dilatation or metallic stent insertion is performed, a percutaneous nephrostomy was removed after 3-4 weeks. Previously, successful dilatation of the ureterosigmoid anastomosis was confirmed by antegrade pyeloureterography and additional clamping of percutaneous nephrostomy for the next few days to rule out the occurrence of hydronephrosis.

There were 10 patients with unilateral and 1 with bilateral stenosis at the ureteral reimplantation site. Of these, five patients with unilateral stenosis underwent the implantation of metallic Strecker stent. In the rest of six patients with 7RU balloon dilatation of the ureterosigmoid stenosis was applied (Figure 4, Figure 5a,b).

During the follow up period of 24 months, all patients (n=5) with metallic Strecker stent had normal results of serum biochemistry, blood gas analysis and renal ultrasound.

However, in the rest of six patients with 7RU who underwent balloon dilatation of the ureterosigmoid stenosis, hydronephrosis of moderate to severe degree has been verified. After placing percutaneous nephrostomy, in all of these six patients, pyeloureterography showed a failure of balloon dilatation and the occurrence of ureterosigmoid anastomotic site restenosis. Patients have been treated by permanent percutaneous nephrostomy tube.

**DISCUSSION**

In spite of numerous continent urinary diversion procedures that have been invented, there is still lack of ideal technique for all patients and indications. However, as aforementioned, preservation of renal function remains the common ultimate goal of any urinary diversion. It could be obtained if the ureteral reimplantation into the bowel segments does not produce or facilitate the occurrence of reflux, obstruction and urinary tract infection.

In our series, the incidence of unilateral acute pyelonephritis as early complication of Mainz pouch II modified procedure is 5%, while as late was 15%. Previously reported series showed that the incidence of late pyelonephritis varying from 0%-16%

Nevertheless, it has been argued that this incidence depends on the type of the ureteral reimplantation technique as well as the age of the patient. In reported series of 67 patients with Mainz pouch II urinary diversion and Camey-Le Duc ureteral reimplantation, Ignjatovic et al quoted 18% incidence of pyelonephritis. In a large series, Bastian and co-workers suggested that comparing to elderly, younger patients more often have pyelonephritis. Authors consider that in elderly patients upper urinary tract is well protected. In the same series, the lowest incidence of pyelonephritis was associated with Le Duc ureteral implantation technique. Soulie and co-workers presented 12.3% incidence of pyelonephritis in series of elderly pa-
Complications of Camey-Le Duck ureteral reimplantation technique in modified ureterosigmoidostomy (Mainz pouch II) urinary diversion

patients with mean age 79.3 years, who had undergone ileal orthotopic neobladder or external urinary diversion.

We verified prolonged urinary leakage in 8 (7%) patients. Since we didn't notice major complications associated with, the leakage was probably due to weak anastomosis during the pouch creation or ureteral reimplantation. In the absence of upper urinary tract dilation, this complication could be managed by prolonged drainage. Our experience is consistent with the findings of similar series 13,14,22.

In respect of ureteral reimplantation site stenosis as a late complication in our series, we verified 11 (10%) patients with 12 RU with consequent hydronephrosis of moderate to severe degree. In all patients it occurred during the first 12 months after surgery. It has been reported by several authors 18,23 that ureteral anastomotic stricture formation usually occurs soon after surgery (up to 8 months) if direct implantation was performed. However, with antireflux implantation technique, strictures of the submucosal tunnel arises during the first two years post-operatively 18,19.

Aly and co-workers cited 10.7% incidence of ureterointestinal stenosis following direct anastomosis 14. Bastian and co-workers reported 6% incidence comparing three different techniques (Goodwin-Hohenfellner, Abol-Enein and Le-Duc) of ureteral reimplantation in Mainz pouch II urinary diversion. They concluded that regarding upper urinary tract dilatation, Le Duc technique is superior to others, but without statistical significance. Moreover, they claimed that the type of the ureterosigmoid anastomotic technique does not affect the period of occurrence of stenosis.

Although the reported incidence of anastomotic stricture formation varies between 2.9% and 19%, it has been proposed by several authors that regardless the bowel segment and type of anastomosis, direct anastomosis is associated with long term ureterointestinal stricture formation in 3%-7%, while antirefluxing in 7-15% 8,9,11,14,19,24,25.

We consider that our experience shows that Camey-Le Duc ureteral reimplantation technique is simple, reproducible and relatively safe. Some authors state that with regard to upper urinary tract protection, Mainz pouch II diversion is comparable to other urinary diversion procedures 13,14,19,21,25,26,27. Since the ureteral reimplantation in the false sigmoid segment may produce ureteral kinking, pouch fixation to the anterior longitudinal ligament of the sacral promontory enables additional upper urinary tract protection due to straight ureteral route 28.

As proposed by Le Duck and coworkers, stenosis of ureterosigmoid anastomosis by Camey-Le Duc technique occurs within two years after surgery 9,19. Some authors 29-32 suggest that for early postoperative stenosis, uro-radiological interventional procedures including balloon dilatation, cold knife incision or metallic stent insertion could be acceptable and successful therapeutic options. Fisch and coworkers consider ureteral neo-implantation as the best treatment option for late stenosis 29. In our series, ureteral neo-implantation has not been performed due to early presentation of all ureterosigmoid stenosis. However, by our experience, balloon dilatation of the stenosis of the ureteral implantation site failed in all of six patients with 7 RU. Our findings are consistent with previously reported results from several large series, which indicate generally unsuccessful outcome following balloon dilatation of ureterointestinal strictures without additional metallic stent insertion 16,33,34. In general, the rate of restenosis is quite high. Unlike the balloon dilatation alone, metallic Strecker stent insertion at the ureterosigmoid anastomotic site was associated with excellent results in all patients, without hydronephrosis or deterioration of renal function at 24 month follow-up. Similar results have been published regarding the use of metallic stents for the treatment of uretero-enteric anastomotic strictures 35,36.

**CONCLUSION**

Camey-Le Duck ureteral reimplantation procedure following Mainz pouch II urinary diversion represents excellent technique in terms of simplicity, feasibility and durability. It is comparable to other reimplantation techniques in respect of morbidity, enabling well upper urinary tract protection. The incidence of ureterosigmoid stenosis following Camey-Le Duck procedure is relatively low. If stenosis occurs early after surgery, it could be successfully treated by balloon dilatation with additional metallic Strecker stent insertion. However, for the late ureterosigmoid stenosis open surgery and ureteral neo-implantation are inevitable.
SUMMARY

Cilj rada: da analizira komplikacije i klinički ishot Casey-Le Duck tehnike ureteralne reimplantacije kod modifikovane Mainz pouch II u uromanske derivacije.

Pacijenti i metode: ova retrospektivna studija uključila je ukupno 110 pacijenata (101 muškarac i 9 žena, prošte 40% 28 godine, SD=10,2) koji su podvrgnuti modificovanoj Mainz pouch II uromanske derivaciji sa Casey-Le Duck tehnikon reimplantacije uretera, nakon totalne cistektomije, tokom perioda 1995-2014. Srednje vreme praćenja, dostupno za 90 (82%) pacijenata iznosilo je 19(1-74) meseci. Analizirane su rane i kasne postoperativne komplikacije.

Results: rane komplikacije nastale su kod 22(20%) pacijenata i to: unilateralna hidronefroza kod 8(7%) pacijenata, bilateralna ureterohidronefroza kod jednog (1%)- dve RU (renoureteralne jedinice), ekstrakavazacija urina kod 8 (7%), i pijelonefritis kod 5(5%) pacijenata. Kasne komplikacije nastale su kod 28(25%) pacijenata i to: pijelonefritis kod 17(15%), i stenoza na mestu reimplantacije uretera kod 11(10%) pacijenata sa 12 RU. Balon dilatacija primenjena je kod svih 12 RU, uz dodatnu inserciju metalnog Strecker stenta kod 5 RU. Na 24-mesečnom praćenju, svi pacijenti sa metalnim Strecker stentom imali su u pride našao ne raznih seminar skalk, analnih analiza kvrti i ultrazvuka bubrega. Kod preostalih šest pacijenata sa 7 RU, balon dilatacija nije uspela i verifikovana je restenoza na mestu ureteralne reimplantacije, sa posledinom ipsilateralnom hidronefrozom. Kod ovih pacijenata primenjen je trajni perkutani nefrostomski kateter.


 REFERENCES

1. Simon J. Ectropia vesicae (absence of the anterior walls of the bladder and pubis abdominali pariitis); operation for directing the orifices of the ureters into the rectum; temporary success; subsequent death; autopsy. Lancet 1852; ii: 568.


