

**Intestinal plastics in the treatment of iatrogenic injuries of ureters
in oncologic patients**

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Introduction.

Over the past decade, the frequency of injuries of upper urinary tracts (UUT) increased significantly. This is due to the expansion of indications for surgical treatment of malignant neoplasms of lower pelvis, widespread adoption in practice endourological, laparoscopic surgeries and frequent use of large-fractional radiotherapy [1, 2, 3, 4, 5].

Currently radiation therapy, as an independent method or in combination with operational, is used in most oncologic patients. In the treatment of cervical cancer radiotherapy is used for more than 90 % of patients [6].

Despite the widespread adoption of modern equipment for radiotherapy performance, improving the method of radiation, the number of patients with radiation complications remains high [7]. The incidence of urological complications in patients after radiotherapy is 50 %, the most serious of which are urinary fistula and stricture of ureter [8].

Restoring the patency of urinary tract may be performed by a large number of techniques whose effectiveness does not always satisfy the surgeon. However, in cases of extended defects of ureter as a result of influence of radiation therapy, the development of post radiation fibrosis, when the replacement of damaged ureter by urinary tract is inefficient and sometimes impossible, it is advisable to use organ replacing operations [9].

The use of ileo-uretero-plastics gained popularity in reconstructive urology after when in 1909 Shoemaker was the first who described intestinal plastics of ureter

and later Goodwin et al. popularized it in the treatment of urinary stone disease, neuromuscular dysplasia of ureters, ureteral obstruction due to tuberculosis, etc. [10, 11, 12, 13]. Recently, the implementation of new methods of treatments – laparoscopic, endoscopic, the increase of cancer morbidity and expansion of indications for surgical and combined treatment resulted in increase in the number of iatrogenic injuries of UUT that is one of reasons for increasing the number of nephrectomies in Ukraine. Determining the treatment strategy and finding ways to restore the integrity of urinary tract injuries during extended injuries of ureter, in patients with oncological pathology, is one of the urgent problems of plastic urology.

There are still not fully studied peculiarities of urodynamics and kidney function in patients with intestinal plastics of ureters.

Objective: to study the efficiency of the use of intestinal plastics of ureters in the treatment of long-term iatrogenic injuries of ureters in oncologic patients.

Materials and methods

18 patients (29 ureters) were subjected to clinical analysis with iatrogenic ureteral injuries. They were examined and had surgical treatment with replacement of ureter by isolated segment of small intestine in the research department of plastic and reconstructive oncurology of National Cancer Institute.

Unilateral UHN was diagnosed in 7 (38,8 %) patients, bilateral – in 11 (61,2 %).

Patients were performed comprehensive survey with the study of anatomical and functional changes in the urinary tract and kidney function, both before and after the operation , which included: laboratory tests, ultrasound, excretory urography, antegrade pyeloureterography, cystography, computerized tomography, MRI, clearance tests of endogenous creatinine, dynamic renoscintigraphy, uroflowmetry.

The age of patients ranged from 33-67 years and averaged 56,4 + 8,2 years. Men 2 (11,1 %), women 16 (89,9 %).

Unilateral intestinal plastics of ureters was performed in 7 (38,8 %) patients, bilateral – 11 (61,2 %).

Long-term results were studied in 14 patients (77,7 %) in the period from 3 months to 5 years. Evaluation the effectiveness of surgical treatment was performed on a 4-point scale:

- Excellent result: absence of patient's complaints and expressions of pyelonephritis, full restoration of urodynamics in the upper urinary tract, restoration of normal size of ureter, calyx-pelvis system of the kidney, quantitative indexes of glomerular filtration in the normal range, absence of vesico-ureteral reflux, employability is preserved.

- Good result: may be periodic minor complaints on pains in the side of injury of ureter, exacerbation of pyelonephritis is absent, compared with the preoperative radiological indicators of X-ray studies is noticed positive dynamics of anatomical and functional changes that involves normalizing of sizes or reducing of ectasia of fistular system of kidney, improvement of urodynamics and kidney function, farmaco stimulation by lasix helps to eliminate contrast material from the kidney, employability is preserved.

- Satisfactory result: the patient's complaints on intermittent pain of aching character in the lumbar region, may be periodic exacerbation of pyelonephritis undergoing antibiotic therapy, urodynamic and kidney function remain on preoperative level, possible vesico-ureteral reflux, in the absence of CRF employability is preserved.

- Unsatisfactory result: when the operation does not lead to subjective improvement of patient's state, urodynamic and kidney function progressively deteriorates, progression of CRF with bilateral pathology, is diagnosed recurrent obstruction of ureter.

Results

The most frequent indication to perform ileo-uretero-plastics because of iatrogenic ureteral injury was post radiation retroperitoneal fibrosis – in 13 (72,2 %) patients, in 3 (16,6 %) cases iatrogenic ureteral injury occurred during panhysterectomy, 1 (5,6%) – during anterior resection of rectum, 1 (5,6%) – during

extirpation of rectum. In 2 cases iatrogenic ureteral injury was complicated by fistula of ureter.

Analysis of clinical data showed that in all patients the cause of deterioration of kidney function was ureterohydronephrosis. The occurrence of the latter was due to a blockade of ureter over a large area (more than 1/3 its part). The cause of these changes was retroperitoneal fibrosis that occurred as a result of radiation therapy (13 patients), and urinary race due to damage of ureter (5 patients).

Worsening of kidney function manifested in the presence of ureterohydronephrosis, absence or reduction in the allocation of X-ray contrast medium.

During the first phase of treatment, 14 patients (19 ureters) had nephrostomy under ultrasound control.

Indications for percutaneous nephrostomy were: absence or sharp decrease of the excretory function of kidney on excretory urography in intact parenchyma (renal parenchyma thickness > 8 mm) – 10 patients, (in 6 was performed bilateral nephrostomy); reversal of pyelonephritis development – 4 patients; elimination of functioning ureter-vaginal – 1 patient, and ureter-cutaneous fistula – 1 patient.

In the study of renal function before operation renal failure was diagnosed in 14 patients (77,7 %). In 3 (21,4 %) patients was diagnosed the latent stage of CRF according to classification of M.A. Lopatkin and I.M. Kuchynskyi (1973), in 4 (28,6 %) – compensated, in 7 (50 %) – intermittent (Table 1).

Table 1. Stages of CRF (M.A. Lopatkin, I.M. Kuchynskyi – 1973)

Stage of CRF	TGF, ml/min.	n = 14 (%)
I	50,8 ± 4,1	6 (42,9)
II	36,4 ± 1,9	5 (35,7)
III	30,3 ± 2,4	3 (21,4)
CRF – chronic renal failure TGF – total glomerular filtration n – number of patients		

In 5 cases (17,2%) were diagnosed ureteral obstruction at the level of upper and middle third of the ureter, in 16 (55,2 %) – at the level of lower half of the ureter, in 8 (27,6 %) - at the level of lower third.

Indications for ureteral replacement by the segment of small intestine in oncologic patients were extended damages of the ureter with the development of irreversible fibrosis changes at its side, absence of signs of progression of the main oncologic disease, preserved kidney function (level of glomerular filtration on the affected side more than 12 ml/min.).

Contraindications to intestinal plastics of ureters were: adhesive disease of the gastrointestinal tract, terminal renal failure, decompensated comorbidities, progression of the main oncologic disease, etc.

As a result of the use of intestinal plastics of ureters we adhered to these principles of operation performance. Intestinal transplant should have adequate length. The average length of small intestine that was used to replace the ureter had 21,4 + 3,6 cm. Too long transplant contributes to poor passage of urine and can cause acidosis. Bowel segment should be cut off at a distance of 40 cm from ileocolic valve because the terminal part of small intestine has a common blood supply and innervation with cecum, vitamin B12 is absorbed mainly in the distal part of ileum. Restoring of patency of small bowel was performed by imposing anastomosis end-to-end. When the length of intestinal transplant is more than 15 cm, its location must be iso-peristaltic. Ureteral anastomosis in colon was imposed end-to-side. The mucous membrane of transplant in the early days produces large amounts of mucus, so it must be drained. Intestinal transplant was placed in the abdominal cavity and anastomoses – extraperitoneal. During the replacement of both ureters it is necessary to use one transplant that was placed iso-peristaltic. In 14 patients, to prevent vesico-intestinal reflux, distal part of intestinal transsplant was simulated by the method of prof. E.O. Stakhovskyi that involved the formation, at the site of intestinal-vesical anastomosis, of two separate channels.

In 18 cases, the operation was carried out by laparotomy access under combined epidural anesthesia. Blood loss was 93 + 38 ml. Postoperative bed day 13,2 + 1,4 days.

Postoperative complications were diagnosed in 7 (38,9%) patients: in one case there was a severe bowel obstruction, in 3 – postoperative suppuration, in 1 – long intestinal paresis and in 2 – exacerbation of pyelonephritis.

Exacerbation of CRF in the early postoperative period was observed in 4 (22,2%) patients with CRF of III st., requiring pharmacological therapy of nitrogen metabolism, fluid and electrolyte balance and antibiotic therapy.

14 (77,7 %) patients had control inspections in the remote postoperative period in terms from 3 months to 5 years.

In all 14 patients, that were examined in the remote postoperative period, was marked recovery of urodynamics in the urinary tract.

Comparative evaluation of comprehensive examination before and after surgical treatment using an isolated segment of small intestine allowed evaluating the effectiveness of operation by analyzing anatomical and functional changes in the kidney and UUT (Table 2).

Table 2. Anatomical and functional characteristic of UUT before and after replacement of ureter by the segment of small intestine

	Before operation, n = 18 (%)	After operation (3 months), n = 14 (%)	p
UHN (ureters)	29 (80,5)	7 (25)	$X^2 = 19,7$ $p < 0,05$
GF on the affected side (ml/min)	$24,6 \pm 5,3$	$29,2 \pm 7,5$	$p < 0,05$
TGF (ml/min)	$42,5 \pm 13,6$	$62,4 \pm 7,4$	$p < 0,001$
CRF (TGF \leq 60 ml/min)	14 (77,7)	6 (42,8)	$X^2 = 4,09$ $p = 0,12$

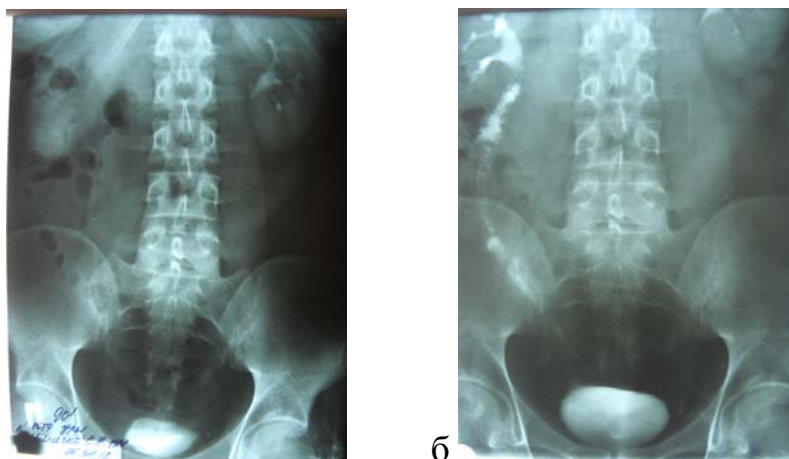
After a control check within 3 months, after reconstructive surgery using segment of small intestine, the number of UHN significantly decreased and amounted to 7 cases (25%).

The conducted estimation of glomerular filtration resolution on the affected side and total glomerular filtration revealed that conduction the intestinal plastics of ureters allowed to improve glomerular filtration from 24,6 to 29,2 ml/min on the affected side and total glomerular filtration from 42,5 to 62,4 ml/min ($p < 0,05$).

The conducted statistical analysis revealed no significant difference between the number of patients with chronic renal failure before and after surgery, which was due to a small number of patients included in the study ($X^2 = 4,09$; $p = 0,12$), although we noted a positive dynamic in reducing the number of patients with CRF from 14 (77,7 %) to 6 (42,8%) after ileo-uretero-plastics.

Among the 14 patients, studied in the postoperative period, vesico-intestinal reflux was diagnosed in 2 (14 + 10%) patients.

Analysis according to the criteria for evaluating the effectiveness of treatment showed that 4 (28,6 %) patients had an excellent result (pic. 1), 6 (42,8%) – good, 4 (21,4 %) – satisfactory, unsatisfactory results were not observed.



Pic. 1. Data of survey of the patient O. before and after intestinal plastics of ureter:

a) excretory urography before surgery: sharp decline in secretory-excretory function of the right kidney, absent contrasting of staining cavity of the kidney and ureter as a result of traumatic injury of the ureter and urinary race.

b) excretory urography after surgery: good secretory-excretory function of the right kidney after total intestinal plastics of the right ureter – fistular system of kidney is not enlarged, marks the contrast on 10 minutes, intestinal transplant is contracting.

Despite good functional results, oncological outcome in 5 patients was poor. So in 2 patients was diagnosed progression of primary oncologic disease in the first year of observation. Due to local recurrence, multiple metastases in parenchymal organs, patients died 5 and 7 months after reconstructive surgery.

In other 3 patients were diagnosed metastases during the follow-up. These patients received adjuvant chemotherapy, 2 patients with progression of oncologic disease are in remission now, to the closure of observation period.

Discussion

To date, in Ukraine, despite the preserved kidney function in extended injuries of ureter, is performed nephrectomy or lifetime nephrostomy, that in two cases lead to disability. In some cases, patients with oncologic diseases need comprehensive treatment that provides for adjuvant chemotherapy. Its nephrotoxic effect and comorbidities (diabetes, hypertension, etc.) contribute to the development and deepening of chronic renal failure. It should be noted that renal dysfunction, lowering the level of glomerular filtration are one of contraindications to chemotherapy because improvement of renal function, by restoring urodynamics, enables a comprehensive approach to the treatment of oncologic patients.

Lack of excretory function of the kidney on excretory urography should not be an indication for nephrectomy. Our results show that puncture nephrostomy, as the first stage of surgical treatment, makes it possible to restore the excretory function of the kidney, perform the required functional (clearance tests of endogenous creatinine) and instrumental examination (antegrade pyeloureterography, determination of ureteral obstruction), thereby solve the question of advisability and volume of surgical intervention. Also puncture nephrostomy can reduce the level of creatinine and blood urea at bilateral disease, reversal of pyelonephritis, pain expression, etc.

Result of our study showed that the main indication for intestinal plastics is the extended ureteral injury with irreversible changes in its wall, which improves kidney function by restoring urodynamics and quality of life.

It should be noted that our operative technique of performance of the intestinal plastics of ureters differs from the one described in domestic and foreign literature. We, in contrast to the described methods (D.P. Chukhryenko, A.V. Liulko, 1972; F. Hynman, 2007), place intestinal transplant intra-abdominal, which is the prevention of ischemia of segment of small intestine, provides adequate diastalsis of excluded segment of intestine; uretero-ileo-anastomosis we place extraperitoneal end to side to prevent stricture of anastomosis, extraperitoneal placement of warning about the formation of urinary race. Another feature of the technique is that ileal transplant should have adequate length because too long segment of the small intestine promotes the formation of inflection of transplant, causing stagnation of mucus, urine, increasing the risk of acidosis. In turn, a short transplant causes tension and ischemia of transplant that violates peristalsis, promotes formation of anastomosis stricture.

In the study, only in 2 (14 + 10%) from 14 patients, examined in the remote postoperative period, was observed vesico-intestinal reflux, which caused no significant changes in urodynamics and kidney function, for the listed patients was not performed intraileal plastic to prevent reflux. In both cases, vesico-intestinal reflux was not accompanied by clinical signs and did not need further medical therapy.

The level of complications in the early postoperative period was observed in almost 39 % of patients. This complication rate was due to the fact that 13 (72,2 %) from 18 patients were treated with radiation therapy, 16 (88,8 %) – had 2 or more operations on the pelvic organs and retroperitoneal space. Patients, who received radiation therapy, had a higher rate of postoperative complications such as early infection, intestinal obstruction, which are associated with the development of radiation-induced fibrosis, ischemia and adhesive disease.

Ileo-uretero-plastics in the remote postoperative period do not require both external and internal drainage of the kidney, thereby giving patients quality of life.

In the remote postoperative period was marked the increase of the level of glomerular filtration on the affected side after the reconstructive surgery from 24,6 to 29,2 ml/min that made it possible to reduce the number of patients with CRF almost on 35%.

Conclusion

The main indication to the performance of intestinal plastics of ureter is extended irreversible changes in the ureter with intact kidney function.

Intestinal plastics of ureter make it possible to keep the kidney and improve its function, thereby reducing the number of patients with chronic renal failure, which enables a comprehensive approach to the treatment of oncologic patients. Therefore, preservation of kidney due to extended injuries of UUT is very important task in oncology.

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