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Delayed Diagnosis and Management of Ureteral Injuries after Procedures Following Gynecological Cancers

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Abstract

Introduction. Ureteral injuries (UI) are considered one of the most common complications following oncogynecological surgeries.
Purpose. Analysis of treatment outcomes of ureteral injuries following oncogynecological procedures, aimed at improving the effectiveness of their management.
Materials and methods. Within 2010 to 2022, 30 women aged between 35 to 71 years with UI were managed in the urology clinic, which occurred during surgical procedures for oncological diseases of the reproductive organs in stages T1-T2. Certainty of the UI were detected only in the postoperative period within 1 to 90 days after the primary oncogynecological operation.
Results. Management and follow up of the patients by urologists was divided it into 3 stages. At the first stage, all patients were examined, investigated, and operated upon, on the date of admission to the urological hospital. Distribution of the operations are: 16 patients underwent minimally invasive endoscopic ureteral stenting, 11 patients had a percutaneous nephrostomy, and 3 patients had an open access ureteroneocystoanastomosis. At the second stage, after 40–90 days in a hospital settings, short term outcomes of urological operations were analyzed. Findings revealed that, ureteral patency was completely restored in 18 patients, and the remaining 12 underwent surgeries. At the third stage, a long-term outpatient follow-up and rehabilitation program was developed for each patient. In other to study the long-term treatment outcomes, all 30 patients underwent an inpatient follow up check-up after 2 years. A good management outcome was achieved in 23 (76.7%) patients, and a satisfactory outcome – in 7 (23.3%).
Conclusion. UIs during the oncogynecological surgeries occurred in most often times following radical hysterectomy 21 (70.0%). Endourological procedures were largely used in the treatment of patients with the UIs. All patients with UI after urological operations, are recommended for long-term dynamic outpatient follow-up.

Keywords: ureteral injury, radical hysterectomy, oncogynecological procedures, minimally invasive surgical treatment, ureteroscopy, ureteral stenting, percutaneous nephrostomy

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Отсроченная диагностика и лечение повреждений мочеточника после операций при онкогинекологических заболеваниях

Конфликт интересов: не заявлен.
Информированное согласие: все пациенты дали согласие на участие в исследовании.
Этическое заявление: исследование было одобрено кафедрой урологии Белорусского государственного медицинского университета и проводилось в соответствии с этическими стандартами, изложенными в Хельсинкской декларации.
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Резюме

Введение. Повреждение мочеточника (ПМ) считается одним из наиболее частых осложнений после онкогинекологических вмешательств.
Цель. Анализ результатов лечения ПМ после онкогинекологических вмешательств, направленный на повышение эффективности их ведения.
Материалы и методы. В течение 2010–2022 гг. в клинике урологии наблюдали 30 женщин в возрасте от 35 до 71 года с ПМ, которое произошло при проведении хирургического лечения в гинекологических отделениях по поводу онкозаболеваний органов репродуктивной сферы T1-T2. Факт травмы мочеточника подтвержден через 1–90 дней после операции после перевода пациентов в урологический стационар.
Результаты. Организация лечения пациентов с ПМ в урологии разделена на 3 этапа. На первом этапе в день поступления все пациенты были обследованы и прооперированы. Структура проведенных операций: у 16 пациентов проведены малоинвазивные эндоскопические процедуры с установкой внутреннего стента мочеточника, у 11 – установлена чрескожная пункционная нефростома, у 3 – уретеронеоцистоанастомоз из открытого доступа. На втором этапе в условиях стационара через 40–90 дней изучены ближайшие результаты проведенных урологических операций. Установлено, что у 18 пациентов проходимость мочеточника восстановлена полностью, остальные пациенты оперированы повторно. На третьем этапе проводилось многолетнее диспансерное наблюдение и реабилитационные мероприятия. Все пациенты через 2 года прошли контрольное стационарное обследование. Хороший результат лечения достигнут у 23 (76,7%) пациентов, удовлетворительный – у 7 (23,3%).

Выводы. ПМ при онкогинекологических операциях чаще всего возникали после радикальной гистерэктомии. Эндоурологические вмешательства широко использовались в лечении пациентов с ПМ. Все пациенты с ПМ после восстановления его проходимости нуждаются в длительном динамическом наблюдении уролога.
Ключевые слова: онкогинекологические вмешательства, повреждение мочеточника, эндоскопические операции в урологии, уретероскопия, стентирование мочеточника, чрескожная пункционная нефростомия

■ INTRODUCTION

Studies show that injuries to the ureter result in approximately 0.5–2% of all cases during abdomino-pelvic surgeries (gynecology, urology, colorectal and vascular), with traumas to the ureter following obstetrics and gynecological surgeries constituting the bulk of the total number of injuries, which amounts up to 70–75% [1]. The frequency of ureteral injuries (UI) increases significantly during procedures for malignant neoplasms of the genitals [1, 2]. Incidences of bilateral UIs are rare, and being reported as isolated cases, but their occurrence present considerable treatment challenges [3, 4].

The background cause of these UIs is the anatomo-embryonic intertwined relation between organs of the female reproductive and urinary systems, most often at the region of the infundibulo-pelvic ligament or uterine artery [5]. Irrespective of the advent of more sophisticated minimally invasive innovative surgical techniques, and the subsequent dexterity of surgeons, complications following UI during oncogynecological procedures continue to increase and cause serious problems and morbidities in patients. The resultant effect of this upward rise of UI, subsequently leads to secondary surgical procedures in majority of occasions, including ureteral reimplantation [6].

UIs occur primarily from transection and ligation of the uterine and ovarian vessels, during ureteral mobilization, and attempts at controlling massive pelvic hemorrhage during surgeries. UIs during these procedures are often associated with some risk factors, that lead to the distortion of the normal anatomy of the surgical field. Frequent among the risk factors are: previous surgical procedures in the abdomino-pelvic region, endometrial lesions, obesity, previous inflammatory pelvic diseases, anomalies of organs of the urinary system (duplicate urinary organs, retrocaval ureter, horseshoe kidney), previous radiation therapy, and etc. [7, 8].

Most likely mechanisms that lead to UI are: ligation or clipping of the ureter, partial or complete dissection into the ureteral lumen, crushing with a clip, electrocautery/thermal trauma, ischemia due to blood supply disorders, resection of the ureteral segment [8].

It is alarming that intraoperative diagnosis of UI is approximately less than 10–25.0% of cases during surgery [9–11]. Trauma to the ureter is recognized intraoperatively or in the early hours postoperatively, if transected or ligated, whereas, delayed recognition is typical with injuries from electrocautery, where symptoms suggestive of UI are noticed from 10 days and above. Intraoperatively diagnosed UIs usually undergo direct management, with open repair over a double-J (D-J) ureteric stent. On the other hand, late diagnosis of UI often leads to the formation of generalized urinary streaks and urinary fistulas, ureteral strictures/obstruction, the subsequent development of

secondary ureterohydronephrosis, chronic pyelonephritis with kidney shrinkage and, as a result, chronic renal failure. All of the above negatively affects the final outcome of repair procedures, significantly complicating postoperative rehabilitation of patients. The management of UIs established postoperatively, with the subsequent formation of ureteral strictures/obliteration or ureterovaginal fistula, has witnessed constant transformations over the past decade, ranging from the frequently used open approach, to the minimally invasive endourological procedures such as retrograde or antegrade stent insertion, and percutaneous nephrostomy tube placement [12–16]. Coupled with UIs, complications from pelvic surgeries could lead to other lower urinary tract dysfunction, for example, injuries to the pelvic nerves, can cause long-term bladder dysfunction in patients [17, 18].

The ultimate goal in the management of UI, is in the prompt, early and timely diagnosis, and in the choice of adequate management options, because complications from UI after their primary gynecological procedures, requiring several and lengthy hospital admissions, reducing their quality of life, reduced sexual activity, leading to a drop in the chances of conception and childbearing, and patient's low self-esteem, which can cause psycho-emotional trauma, socio-cultural isolation [7, 11, 19].

■ PURPOSE OF THE STUDY

Analysis of treatment outcomes of ureteral injuries following oncogynecological procedures, aimed at improving the effectiveness of their management.

■ MATERIALS AND METHODS

Research to analyze the effectiveness of the management outcomes of 30 women who sustained UIs following oncogynecological operations, within 2010–2022 was carried out. The age range of these women on the date of admission into the urology center were between 35 and 71 (51.6±18,4) years. The UIs were first diagnosed only (1–90 days) after their initial oncogynecological procedures in all 30 patients. Conversely, women whose ureteral traumas were recognized intraoperatively during the primary oncogynecological surgeries, and underwent repair procedures in the process were not included in the study. Further urological examinations, investigations and surgical treatment of the 30 patients in the study group after establishing the diagnosis of UIs were carried out in three urological wards of the 4th City Hospital named after. N.E. Savchenko, Minsk.

In course of the study of all patients, we exhaustively analyzed in details, their gynecological histories, including protocols of the initial procedures carried out in the gynecological hospitals, information on urological examination findings and investigation outcomes, indications and surgical options performed in the urology center. Also analyzed were early and long term post-operative courses and complications, and the outcomes of years of outpatient follow up observations. Routine and complex investigative methods were used to recognize and establish the trauma to the ureters, verify the sites, types, degrees, extents and severities, which enabled in determining the management options to be used. The main diagnostic methods carried out were: ultrasound scan of organs of the urinary system, cystoscopy and ureteroscopy; retrograde ureteropyelography, and contrast-enhanced computed tomography or excretory urography. The severity of the UIs were established according to The American Association for Surgery of Trauma classification scale.

Based on the analysis of documentations received from the gynecological hospital, it was established that all 30 women underwent oncogynecological surgical procedures for various malignant neoplastic diseases in stages T1 and T2, none of which underwent prior radiotherapy, nor had chemotherapy. Out of which 15 (50.0%) patients – had cancer of the uterine body, 9 (30.0%) – for cervical cancer, and 6 (20.0%) %) – for ovarian cancer. Analysis of the distribution of the primary oncogynecological surgical procedures showed that, open access surgeries were performed in 25 (83.3%) patients, while laparoscopic route was used in 5 (16.7%) cases. A distribution of operations based on the surgical approach used were: from open route – radical hysterectomy – 21 (84.0%), hysterectomy without appendages – 2 (8.0%), Wertheim-Meigs' procedure – 1 (4.0%), adnexectomy – 1 (4.0%). All 5 patients operated on via the laparoscopic access underwent radical hysterectomy.

Analysis of statistical differences in qualitative variables was done using Pearson's chi-square test (χ^2). Differences were considered statistically significant if the probability of an error-free prediction was more than 95.5% ($p<0.05$).

■ RESULTS AND DISCUSSION

We discovered that all 30 patients had unilateral UI, the left ureter was injured – in 17, and the right – in 13 women. All 30 (100%) lesions were found in the distal third of the ureters. Injuries to the ureters were established, and diagnosis made only in the postoperative period as follows: 3 (10.0%) patient – within 1–4 days, from 5 to 30 days – in 16 (53.3%), and from one month to three months after their primary surgeries in the remaining 11 (36.7%). We established from research data that, ureterovaginal fistula formations were detected in 10 (33.3%) of the 30 women.

Based on analysis of results of investigations, taking into account – the site, extent, type and severity of injury, as well as the elapsed duration after the initial oncogynecological surgeries, all women underwent different surgical procedures in the urological hospital, both minimally invasive endourological and using open access.

All 30 patients underwent necessary diagnostic and treatment procedures within the first day of admission into the urology hospital. Management of the women with UI was done in three stages (Table).

In line with the universally accepted options in the management of patients with UIs, all 30 women initially underwent endourological diagnostic procedures – ureteroscopy, at the first stage, in which the diagnostic procedure was logically converted to minimally invasive procedures, using endourological methods within the framework of a single anesthesia in 27 (90.0%) women. A distribution of the procedures carried out in the 27 patients at the first stage revealed D-J ureteral stents were installed in 16 women,

Diagnostic and management plan of patients in the study group (n=30)

Stages	Plans
First	Investigations and surgical treatment on the date of admission into the urological hospital
Second	Analyze short-term outcomes of surgical treatment: outpatient follow up investigations and assessments of patients in the urological hospital 40-90 days after surgical treatment at the 1st stage,+ additional surgical management in patients who failed to have urodynamics restored
Third	Analysis of long-term outcomes of management 2 years after commencement of surgical treatment in a urological hospital

which are as follows: ureteral stenting was performed in 13 (43.3%) women, endoscopic bougienage + D-J ureteral stenting – in 2 (6.7%), retrograde laser endoureteroplasty of ureteral stricture + D-J ureteral stenting in 1 (3.3%), while percutaneous nephrostomy (PCN) tube was installed – in 11 (33.3%) cases. Only in three patients, in whom endourological interventions at the first stage were unsuccessful and in terms of the time elapsed after trauma to the ureter, they met the conditions for repair procedure, and subsequently underwent reconstructive surgical operations via an open route - ureteral reimplantation into the bladder using Demel's modification.

At the second stage, short-term management outcomes of all women were evaluated following comprehensive complex investigations in the urological hospital, 40–90 days after the first stage urological operations. Their outcomes showed that, ureteral patency was completely restored in one of the three patients after ureteral reimplantation via an open access at the first stage of management, but, the remaining two required endourological procedures to restore ureteral patency. One of them had – ureteral stenting, and the second underwent – bougienage of ureteral stricture + D-J ureteral stenting.

Of the 16 patients who underwent minimally invasive endoscopic procedures via D-J ureteral stenting, urodynamics was completely restored in 15 (93,8%) patients, and the remaining one underwent a repeat endourological intervention in the form of endoscopic laser ureteral stricture endotomy and ureteral bougienage + D-J stenting. Among the 11 patients who had PCN tube installed, 2 women had ureteral patency restored without requiring any additional urological interventions. The remaining 9 underwent reconstructive repair surgery using an open approach: ureteral reimplantation into the bladder using Demel's modification (n=8), and intestinal replacement ureteroplasty (n=1). It should be especially noted that the presence of a nephrostomy tube created favorable conditions for additional diagnostic procedures to determine the location and extent of ureteral strictures or obliterations in 9 patients, as well as to ascertain adequate restoration of urodynamics in 2. For this purpose, all patients underwent contrast-enhanced antegrade pyeloureterography, or simultaneously combining contrast-enhanced antegrade pyeloureterography with retrograde ureteropyelography at the second stage. The nephrostomy tube installed was also used for analyzing renal functions on the side of the injury, by determining the amount of urea in the daily urine from the ipsilateral kidney and carrying out clearance tests. We believe that the presence of PCN in these 9 patients created favorable conditions for preparing the women for subsequent surgical procedures at the second stage. In course of further outpatient follow-up of the women, 7 patients had the need to treat chronic recurrent pyelonephritis, with associated abnormal urinalysis and urine culture findings within 2–4 months.

After carrying out the 2nd stage management program for the patients, all patients consented to a long-term follow-up. Depending on the rehabilitation or recovery potential of the patient, the severity of the UI according to The American Association for Surgery of Trauma classification scale, outcomes of initial investigations and evaluation by the urologists, outcomes of urological procedures performed, and the prognosis of the outcome of surgical treatment, an individual rehabilitation program was developed for each patient, indicating the frequency of outpatient evaluation by the urologist, the frequency of laboratory investigations, ultrasound scan and other radiological investigative methods.

Also, considering the history of their oncologic gynecological diseases, all patients, in accordance with protocols, were under observation by oncogynecologists at the city oncological center. Furthermore, 2 years after the start of treatment in the urological hospital, to assess the long-term outcomes of surgical management (as part of management at the third stage). Cumulative analysis of findings of all available medical documentations for each patient, in the entire period of observation in urology clinic revealed that, recurrent course of chronic pyelonephritis was observed in 5 (16.7%) of the 30 patients within 1–2 years after the completion of surgical treatment in urology. Due to unrestored urodynamics, 1 patient required an ureteroscopy, bougienage of stricture site, its dissection using a laser + D-J stent placement. Another two patients, 11 and 18 months after initial stenting as first stage of treatment, and later ureteral reimplantation procedure at the second stage of treatment, had the need for a repeat ureteroneocystoanastomosis following the diagnosis of recurrent ureteral stricture, with subsequent ureterohydronephrosis.

Good management outcomes were considered in cases where, there were absence of complaints suggestive of impairment in normal urinary outflow from the kidney, absence of dilation of the renal pelvis system on the side of the trauma, and the absence of clinical manifestations and laboratory signs suggestive of chronic pyelonephritis. And satisfactory outcome is considered, when there is a moderate dilatation of the pelvicalyceal system of the kidney, slight ureteral dilation above the site of the previous injury on the ipsilateral side, according to findings of radiological studies, a moderate impairment in the excretion of the radiopharmaceutical agents from the upper urinary tract on the side of the previous procedure, and no signs of urinary tract infection. And results from the Long-term outpatient observations showed that, a good outcome was achieved in 23 (76.7%) patients, and satisfactory outcome – in 7 (23.3%) cases. (χ^2=33.9; p<0.001).

■ CONCLUSIONS

1. The main criteria to be taken into account while drawing up patients' urological management program should be, findings from results of ureteroscopy, retrograde ureteropyelography and antegrade pyeloureterography if there is a nephrostomy tube, and computer tomography.
2. Endourological minimally invasive procedures played a pivotal role in the diagnosis and management of the UIs of patients in the first stage treatment in the urological hospital, with which ureteral patency was achieved in 17 (56.7%) patients.
3. Urodynamics and ureteral patency were restored in 2 of the 11 patients, after the placement of PCN at the first stage of treatment without requiring any additional surgeries. The use of PCN in the remaining 9 patients created favorable conditions for additional diagnostic procedures and preparation for reimplantation surgeries.
4. All patients with UI after urological operations, are recommended for long-term dynamic outpatient follow-up observations on individual basis. Using such approaches revealed, a good management outcome was achieved in 23 (76.7%) patients, and satisfactory outcome – in 7 (23.3%) cases (χ^2=33.9; p<0.001).

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