

Clinical Value of Ureteral Catheterization before Trans-abdominal Radical Hysterectomy and Pelvic Lymphadenectomy

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Abstract

Introduction: Being in the close vicinity, chances of ureteral injury is high while doing radical operation for cervical cancer. Although the incidence is low, if it is not found during the operation, it can lead to serious complications such as urinary fistula. Timely detection and repair of ureteral injury can reduce the occurrence of serious complications. The placement of ureteral catheter before radical hysterectomy can be a good method to identify the ureter during operation to prevent injury. The objective of the study was to explore the advantages and disadvantages of the placement of ureteral catheter in radical operation of cervical cancer.

Methods: 103 patients who were diagnosed as cervical cancer and underwent operation in the department of Obstetrics and Gynecology, Jinling Hospital from January 2019 to April 2020 were analyzed in this study. The clinical stage ranges from IA to IIA. Among them, 23 cases were placed with double J stent before operation (observation group), 80 cases were operated without stent (control group). The intra-operative condition, operation and postoperative complications were analyzed retrospectively.

Results: There was a significant difference in the operation time and intra-operative blood loss between the two groups ($P < 0.05$), and there was no significant difference in blood transfusion between the two groups ($P > 0.05$). There was no significant difference in the incidence of urinary tract infection and urinary retention between the two groups ($P > 0.05$). The incidence of postoperative hematuria (including microscopic hematuria) was significant in two groups ($P < 0.05$). Ureteric injury occurred in the 9 patients in the control group (11.25%).

Conclusion: Ureteral catheter inserted before radical operation of cervical cancer can help to identify the ureter easily, decrease urinary tract injury, shorten operation time and reduce intra-operative blood loss, and will not increase urinary retention and urinary tract infection. It is safe and effective method especially for young gynecologists .

Keywords: Cervical Cancer, Ureteral Catheter, Radical Hysterectomy, Ureteric Injury

Introduction

Cervical cancer is one of the most common gynecologic malignancy in females in China.¹ Incidence and mortality are second only to breast cancer. At present, trans-abdominal

radical hysterectomy plus pelvic lymphadenectomy is the standard method for the surgical treatment of cervical cancer.² Due to the extensiveness of this surgery, the risk of adjacent ureter and bladder injury is high,

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which seriously affects the post-operative recovery of patients.³ Ureteral catheter is currently the most commonly used internal drainage device in urological practice. Studies have confirmed that ureteral catheter has a protective effect on ureter in gynecological surgery.⁴ The purpose of this study is to retrospectively evaluate the clinical outcomes and complications of ureteral catheter placement before trans-abdominal radical hysterectomy and pelvic lymphadenectomy.

Material and methods

Clinical data One hundred and three patients with cervical cancer who underwent radical hysterectomy and pelvic lymphadenectomy in department of Obstetrics and Gynecology, Jinling Hospital from January 2019 to April 2020 were retrospectively analyzed. The average age of patients is 42.56 ± 3.53 years (range, 29-75 years). The patients were divided into observation group (n = 23) and control group (n = 80) according to whether the ureteral catheter was placed before operation. The patients in observation group were placed ureteral catheter before operation, and the patients in control group were not placed ureteral catheter. Both groups were diagnosed as cervical cancer by cervical biopsy before operation. In the observation group, the average age was (45.65 ± 5.34) years (range, 30-75 years), and the clinical stages were stage IA2 in 4 cases, stage IB1 in 8 cases, and stage IIA1 in 11 cases. In the control group, the average age was (45.83 ± 5.52) years (range, 29-64 years); clinical stage: 14 cases of stage IA2, 30 cases of stage IB1 and 36 cases of stage IIA1. There was no significant difference in general information between the two groups ($P > 0.05$). The staging of the two groups were based on the International Federation of Obstetrics and

gynecology (FIGO) 2018 .

Surgical procedure:

Ureteral catheterization: Under general anesthesia, the patient was kept in lithotomy position, routinely disinfected and draped. Cystoscopy was performed with 21 fr sheath and 30 degree telescope, bilateral ureters were inserted by gliding over a glide wire with 6 fr ureteric catchers after overall inspection of urinary bladder. The catheters were tied with the foleys catheter at end of procedure to prevent slipping out. The ureteral catheters was taken out after completion of operation.

Radical hysterectomy and pelvic lymphadenectomy: The operation procedure methodology was according to the third edition of gynecology and obstetrics surgery edited by Liu Xinmin.⁵

Postoperative treatment: The postoperative patients were given the second generation cephalosporin antibiotics were given during and for 1 day after to prevent infection. Indwelling foleys catheterization was continued for 14 days of postoperative period. According to the pathological results, the postoperative adjuvant treatment was decided.

Parameters of observation: 1. The intra-operative condition of the two groups: operative time, intra-operative bleeding, whether there is blood transfusion (indication of blood transfusion: blood loss volume > 500 ml or hemoglobin level was less than 9g/dL). 2. Post-operative complications of the two groups included urinary tract infection, hematuria, urinary retention, ureteral injury. The number of bacteria in the clean catch urine culture of more than 10^5 /ml or 3-5 leukocytes/HPF of urine routine examination were considered urinary tract infection. After removal of foleys catheter, the difficulty of urination or the residual urine

volume over 100 mL were considered urinary retention. Urinary system complications includes direct injury to ureter and bladder, Cysto-vaginal fistula and development of hydro-ureter.

Statistical methods SPSS 26.0 was used for statistical analysis. Measurement data are expressed as mean value \pm standard deviation ($\bar{x} \pm s$). T test was used. The number of cases and percentage of counting data were expressed, and the comparison of rates were performed by χ^2 test or Fisher exact probability method. The difference was statistically significant ($P < 0.05$).

Results

Comparison of operative time, blood loss and blood transfusion

There was significant difference in operative time and intra-operative blood loss between the two groups ($P < 0.05$), but there was no significant difference in blood transfusion between the two groups ($P > 0.05$) (Table 1).

Comparison of intraoperative and

postoperative complications between the two groups

There was no significant difference in the incidence of urinary tract infection and urinary retention between the observation and the control group ($P > 0.05$). There was significant difference in the incidence of postoperative hematuria ($P < 0.05$) (Table 2). The observation group had no urinary system injury, while the control group had 5 ureteric injury, the difference was statistically significant ($P < 0.05$). In 2 cases, the left ureter was injured while opening ureteral tunnel during operation. Ureteral end-to-end anastomosis was performed and double "J" ureteral stent was inserted. The ureteric catheter was removed 3 months after operation without complications. In 3 cases ureteric/bladder injury was detected in post-operative period in the form of vaginal leakage 1 weeks after operation in 1 case, and in 2 weeks in 2 cases. One had Vesico-vaginal fistula and 2 were uretrecto-vaginal leak. They were treated with temporary percutaneous diversion and subsequent repair and re-implantation. All recovered well.

Table 1 Comparison of intra-operative conditions between the two groups

Group	Case	Operative time (min)	Bleeding(ml)	Blood transfusion
Observation	23	171.74 \pm 16.488	276.74 \pm 38.78	2 (8.70%)
Controls	80	213.75 \pm 17.016	381.25 \pm 76.03	7 (8.75%)
t/ χ^2		10.505	8.908	0.000
P		0.000	0.000	1.000

Table 2 Comparison of operation and postoperative complications between the two groups

Group	Hematuria	Urinary infection	Urossepsis	Urinary system injury
Observation	19 (82.61%) *	4 (17.39%)	2 (8.70%)	0
Control	11 (13.75%)	14 (17.50)	12 (15%)	5 (6.25%)
χ^2	41.033	0.000	0.187	0.461
P	0.000	1.000	0.666	0.497

* $P < 0.05$

Discussion

Clinically, 75% of ureteral injuries are iatrogenic injuries, 64% - 82% of which are caused by obstetrics and gynecological surgery, ⁶ and 54% of which are caused by hysterectomy.⁷⁻⁸ Studies had shown that the risk of urinary tract injury and postoperative urinary infection after radical hysterectomy is higher than in other gynecological malignancies.⁹ Ureteral injury affects the postoperative recovery of patients, increases the rate of secondary surgery, which increases the financial burden and psychological stress of patients .

Causes of ureteral injury after radical hysterectomy and pelvic lymphadenectomy

Radical hysterectomy plus pelvic lymphadenectomy is the standard of care operation for the treatment of cervical cancer.¹⁰ According to foreign guidelines and expert consensus of gynecological oncology in China, ¹¹ open surgery is regarded as the standard surgical approach for early cervical cancer. Due to the close vicinity of the organs, the incidence of intra-operative ureteral injury is still high.¹² The main causes of ureteral injury in this operation are as follows:1)The scope resection is extensive: the main uterine ligament, utero-sacral ligament and 3 cm of upper vaginal segment should be removed and pelvic lymph node dissection should be performed. Therefore, it is necessary to understand the anatomical landmarks of the ureter and its vicinity during the operation; When pelvic lymph node dissection is performed, the ureter was clearly identified above the common iliac bifurcation. If the anatomy of ureter is not identified during the operation, it may easily be

injured. 2)The ureter is sometimes injured due to accidental massive bleeding, blind clamping or suture hemostasis. 3) Because Cervical enlargement, tissue thickening and hardening, it is difficult to dissect ureter from the surrounding tissue during operation, resulting in ureteral injury. 4) During the operation, the ureteric wall injury, resulting in ureteral fistula due to ureteral ischemic and necrosis. In this study, there was no ureteral injury in the observed group but in 5 cases in the control group, the incidence of ureteral injury was 6.25% in the control group. Although there was no statistical significance between the two groups, the causes of ureteral injury were analyzed. In two cases, the left ureteral adventitia injury was found when the ureter was free in the ureteral tunnel during the operation, and the ureteral double "J" tube was immediately repaired and placed during the operation, and the removal after three months. In the other 3 cases, vaginal leak was found 1-2 weeks after operation, and ureterovaginal fistula was diagnosed. Because it exceeded the golden time of ureteral repair, nephrostomy was performed first, and repair was performed 3 months later. Ureterovesical implantation and double "J" tube were placed. After 3 months, it was removed ,the patients recovered well. In the observed group, the position and course of the ureter were touched by the rigid ureteral stent, and the ureter was accurately identified under the condition of complex local anatomical relationship. Secondly, the operator can separate the ureter completely according to the guidance of ureteral catheter, which reduces the injury and accidental injury of ureter. Finally, because of the supporting function of ureteral catheter, the operator can find the

injury of ureter in time and repaired it, so as to reduce the incidence of postoperative complications such as urinary fistula.

Significance of ureteral catheter

Insertion of ureteral catheter before operation can be used to identify the ureter during operation, which can reduce the risk of ureteral injury.¹³ Ureteral insertion of catheter was performed by cystoscope just before operation and it was removed at the end of operation. Ureteral catheter is used in wide range of applications in urology. It can be used in the treatment of renal drainage, ureteral stricture and ureteric calculi. In the diagnosis, it can also be used in retrograde pyelography. Previous studies have shown the benefits of indwelling ureteral catheter through cystoscope before operation in a complex pelvic tumor to separate and protect the ureter during operation.¹⁴ Once ureteral injury occurs during operation, it will be found while in the time of operation, so as to find out the location and severity of ureteral injury and take remedial measures in time. Because rigid ureteral catheter is easy to fall off, poor histocompatibility, and can not be retained in ureter for a long time, its clinical application is gradually replaced by double "J" catheter. However, rigid ureteral catheter has the advantages of simple catheterization, easy removal and low cost. It can be kept in the ureter for a short period of time. In addition to its application in diagnosis, ureteral catheter also has a new application in tubeless percutaneous nephrolithotomy. In this study, in order to play a guiding role in the operation of the ureter, such as intra-operative examination of the ureter without damage, and to be immediate removal after operation, the choice is ureteral catheter. The results showed that the operation time and intra-operative blood loss of

the observation group were less than those of the control group showing the efficiency of operation could be greatly improved by the ureteral catheter. The direct reason was that the presence of ureteral catheter has made it easier for the operator to judge the adjacent relationship between the ureter and the peripheral blood vessels, at the same time satisfactory recognition of ureter will reduce the injury of ureter and adjacent tissues, which will reduce the amount of bleeding. This study observed the occurrence of urinary tract infection and urinary retention in two groups of patients. It was found that there was no significant difference between the two groups, but the incidence of postoperative hematuria was significant in control group. This result is similar to that reported by Cui Yan et al.¹⁵ But even if there is postoperative hematuria, after hydration, post-operative symptoms improved in 24-48 hours.

Indications of preoperative ureteral catheterization

Preoperative ureteral catheterization has certain clinical significance for gynecological pelvic surgery, but indwelling ureteral catheterization under cystoscope is an invasive procedure,¹⁶ which may cause hematuria, urinary tract infection, urethral injury, urethral stricture, bladder perforation, ureteral injury, ureteral perforation, urinary leakage, ureteral stricture and other adverse reactions and complications. So it should not be used as routine operation of gynecological surgery. Zheng Xiaoxia et al. Analyzed 62 cases of ureteral injury caused by gynecological surgery, and believed that pre-operative assessment of the patient's condition was indicative of high risk of ureteral injury during the operation. When felt necessary, ureteral stent should be placed before the

operation, which is conducive to intra-operative identification, avoiding injury and early detection after injury.¹⁷ It is suggested that the urology department should be consulted and the ureteral catheter should be placed before the operation when the tumor diameter is large, the ureter is compressed with lymph node metastasis, the extent of pelvic operation is large, or the normal anatomical position of ureter is changed.

To sum up, preoperative ureteral catheterization is helpful to identify ureters in the operation of radical abdominal hysterectomy and pelvic lymph node dissection, reduce ureteral injury, save operation time and reduce intra-operative bleeding. Immediate removal of ureter catheter after operation does not increase the risk of postoperative urinary tract infection and urinary retention. Although hematuria occurs, it is only temporary and has no long-term effect. But after all, considering its invasiveness, this should not be used as a routine procedure in gynecological surgery. In young gynecological oncologists, and complex pelvic tumor surgery, preoperative ureteral catheter can be considered, which has a certain clinical value in reducing ureteral injury and other complications.

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