

Clinical retrospective analysis of urinary tract injury at the time of total laparoscopic hysterectomy

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Summary

Purpose: To investigate the incidence and risk factors of urinary tract injury during total laparoscopic hysterectomy. **Materials and Methods:** All seven patients with urinary tract injury during past 14 years were reviewed retrospectively. The incidence of urinary tract injury and postoperative complications were studied. **Results:** There were two cases of bladder injury, three cases of ureteral injury, and two cases of vesicovaginal fistula. The urinary tract injuries were mainly diagnosed by indigo carmine dye, type-B ultrasonic, cystoscopy or intravenous pyelography. Two cases of bladder injury received bladder repair by laparoscopic or laparotomy successfully, three cases of ureteral injury were treated with internal ureteral stenting successfully, and two cases of vesicovaginal fistula accepted fistula repair by laparotomy three months after the initial total laparoscopic hysterectomy. Outcomes were all well in all cases. **Conclusion:** Early diagnosis and appropriate management of urinary tract injury is vital to allow prompt repair and limit postoperative morbidity.

Key words: Bladder injury; Ureteral injury; Vesicovaginal fistula; Total laparoscopic hysterectomy.

Introduction

Hysterectomy is the most commonly performed major gynecologic surgical procedure worldwide and can be performed using an abdominal, vaginal, or laparoscopic approach. Compared with patients undergoing abdominal hysterectomy, the patients who undergoing laparoscopic total hysterectomy return to normal activities quicker, have significantly lower mean blood loss, and drop in hemoglobin [1], the routine use of laparoscopic total hysterectomy is common in the field of department of gynecology. However, there are several complications, such as bleeding, visceral injury, and infection occurring intraoperatively and postoperatively.

Although the incidence of urinary tract injury is fairly low [2, 3], there are several complications that involve injury to the urinary tract, specifically the bladder and/or ureters during laparoscopic total hysterectomy [4, 5]. Although the injury of the urinary tract can be diagnosed intraoperatively, many injuries go undetected [6]. Therefore, the true risk of injury to the urinary tract from a total laparoscopic hysterectomy is unknown. In order to further understand the main reason, clinical characteristics, treatment, and prevention of the urinary tract injury during laparoscopic total hysterectomy, the authors will retrospectively review and analyze the clinical data of

seven patients who suffered urinary tract injury in total laparoscopic hysterectomy in the Third Affiliated Hospital, Suzhou University, and the Affiliated Jintan Hospital, Jiangsu University.

Materials and Methods

The clinical data of seven patients who suffered urinary tract injury during total laparoscopic hysterectomy for benign disease at the Third Affiliated Hospital, Suzhou University, and the Affiliated Jintan Hospital, Jiangsu University from January 2000 to July 2014 were collected. The patients were 39 to 57 years of age and the median age was 49 years. All seven patients have had married and fertility. All underwent total laparoscopic hysterectomy for benign disease, and the bladder or ureters were injured. The patients' age, clinical characteristics, reproductive history, gynecology examination, and auxiliary examination (including intra-vesical methylthionine chloride experiment, pelvic ultrasound, creatinine (Cr) and blood urea nitrogen (BUN) examination for pelvic drainage, or IVP), intraoperative situation, and the technique used for re-operation and postoperative recovery, etc., were summarized. Laparoscopic total hysterectomy was completed by the gynecologist from the Third Affiliated Hospital, Suzhou University, and the Affiliated Jintan Hospital, Jiangsu University. Treatment to the bladder or ureteral tract was completed by urologist. Written informed consent was obtained from all patients.

Table 1. — *The clinical data of seven patients who suffered urinary tract injury.*

Number	Age (years)	Weight (kg)	Reproductive history	Cesarean section (time)	Clinical diagnosis	Clinical features	Surgical treatment	Urinary system injury
1	39	52	G3P1	0	CIN III	Contact hemorrhages	Total laparoscopic hysterectomy	Bladder injury
2	45	66	G3P2	2	Adenomyosis	Progressive dysmenorrhea	Total laparoscopic hysterectomy	Bladder injury
3	46	55	G4P1	1	Adenomyosis	Progressive dysmenorrhea	Total laparoscopic hysterectomy	Vesicovaginal fistula
4	49	65	G3P1	1	Adenomyosis	Dysmenorrhea Menorrhagia	Total laparoscopic hysterectomy	vesicovaginal fistula
5	55	67	G2P1	1	Adenomyosis	Dysmenorrhea Menorrhagia	Total laparoscopic hysterectomy	ureteral injury on right side
6	49	70	G1P1	0	Uterine myoma*	Menorrhagia	Total laparoscopic hysterectomy#	ureteral injury on left side
7	57	53	G2P1	0	Uterine myoma	Menorrhagia anemia	Total laparoscopic hysterectomy	ureteral injury on left side

* With gallbladder stones, mesosalpinx cyst on the right side, and uterine adenomyoma; # Laparoscopic cholecystectomy + the right side of the the mesosalpinx cystectomy.

Results

The median age of the seven subjects was 49 years. The all subjects married and fertility, and five patients had a prior cesarean delivery. All patients underwent surgery for gynecological disorders included adenomyosis (four cases), or uterine myoma (two cases) or cervical intraepithelial neoplasia grade III (CIN III one case). Among the seven patients who suffered urinary tract injury, there were two cases of bladder injury, two cases of ureter injury on the left side, one case of ureteral injury on the right side, and the other two cases of vesicovaginal fistula. The two patients who suffered bladder injuries were found intraoperatively. The three patients who suffered ureteral injuries were found two to three days after total laparoscopic hysterectomy. The other two cases who suffered vesicovaginal fistulas were diagnosed two to three weeks after total laparoscopic hysterectomy. Demographic and intraoperative data are shown in Table 1.

Two patients of bladder injury presented catheter blood in the urine, increased vaginal drainage or seeing the catheter balloon through the bladder defect. Three of these ureteral injuries were diagnosed two to three days by image examination after total laparoscopic hysterectomy. The patients presented abdominal pain, fever, and peritonitis, and two patients of vesicovaginal fistulas were diagnosed gynecological examination two to three weeks after laparoscopies. The patients presented increased vaginal drainage two to three weeks after laparoscopies. Ureteral obstruction developed two weeks after surgery and was detected during gynecological examination.

Two bladder injuries were injected with methylthionine chloride liquid using the catheter intraoperatively, and the blue liquid was found leaking from the bladder

lesion. Three ureteral injuries were diagnosed by pelvic ultrasound examination after total laparoscopic hysterectomy. The ultrasound showed the pelvic drainage fluid and the Cr or BUN was increasing in the pelvic drainage fluid (Cr significantly increasing, BUN of one case was normal, and BUN of another was slightly increasing). IVP showed that the ureteral was injured and the contrast agent resided in pelvic cavity. Two vesicovaginal fistulas were diagnosed by gynecological examination. The examination showed that the vaginal anterior wall fistula and the bladder were injected the methylthionine chloride liquid using the catheter, and the blue liquid leaked from the vagina.

Of the seven patients, two bladder injuries were diagnosed intraoperatively. Intraoperatively, the patients were found with obvious urine leakage from the bladder lesions by bladder methylthionine chloride perfusion experiment. One patient was found with a breach of 0.3–0.5 cm in diameter in the posterior wall of the bladder. The patient was treated with laparoscopic repair of the bladder. The other patient was found a breach of 1.2 cm in diameter in the posterior wall of the bladder, and after consultation of the urologist, the patient was treated by opening the abdomen to repair the bladder. One of three ureteral injuries occurred on the right side. The patient recovered after six months without another operation by a ureteral intubation under cystoscope by the urologist. The other two ureteral injuries on the left side were treated with ureteral bladder implantation surgery through the abdomen. An appropriate intraoperative repair, applying the F6 # catheter at the bottom of the bladder was successful. The seven patients all recovered well postoperatively. Relevant data are shown in Table 2.

Table 2. — *Treatment and outcome in seven patients with urinary tract injury.*

Number	Age (years)	Urinary tract injury	Clinical characteristic	Auxiliary examination	Cause analysis	Processing method	Outcome
1	39	Bladder injury	Blood in the urine	Positive of methylthionine chloride experiment	Laparoscopy is not skilled	Bladder repair by laparoscopic	Good
2	45	Bladder injury	Outflow of urine	Positive of methylthionine chloride experiment	Cesarean section twice, adhesion	Bladder repair laparotomy	Good
3	46	Bladder vagina fistula	Vaginal leakage of urine	Positive of methylthionine chloride experiment	Bladder thermal damage and necrosis	Fistula repair by laparotomy	Good
4	49	Bladder vagina fistula	Vagina leakage of urine	Positive of methylthionine chloride experiment	Suture of vaginal misidentification of bladder	Fistula repair by laparotomy	Good
5	55	Ureteral injury on the right side	Abdominal pain, fever	Pelvic cavity accumulates fluid by ultrasound, IVP contrast leakage	Pelvic adhesion, larger uterus; surgical wound	Ureteral catheter intubation	Self healing
6	49	Ureteral injury on the left side	Fever	Ultrasound, IVP abnormalities, fluid of drainage Cr↑	Pelvic adhesion, surgery was mortally wounded	Ureteral catheter applied	Good
7	57	Ureteral injury on the right side	Abdominal pain, fever	Ultrasound, IVP abnormalities, fluid of drainage Cr and BUN↑	More uterine fibroids, larger uterus, surgery was mortally wounded	Ureteral catheter applied	Good

Discussion

A higher risk of injury to the ureter or bladder may exist with total laparoscopic hysterectomy [3]. The bladder is dissected completely off the vaginal tissue, potentially increasing the likelihood of bladder injury. Additionally, a surgeon's expertise could potentially elevate or reduce the risk of injury to the urinary tract. The present authors found that one patient of bladder injuries was due to the surgeon's poor expertise. The other patient injury was due to bladder cervical adhesion. Three ureteral injuries included patients with uterine myoma or adenomyosis. Of the two vesicovaginal fistulas, one patient was mainly due to management of the bladder when stitching vaginal stump and from a fistula along the surgical suture. The other case was mainly due to thermal damage, which led to tissue necrosis and ultimately formed a fistula. The consequences of thermal damage tend to be serious and some patients even develop chronic renal damage [7].

From the present study, it appears that not all urinary tract injuries are detected intraoperatively. The diagnosis of urinary tract injury mainly depends on the clinical manifestation of patients and related auxiliary examination. The injuries in this study were recognized by use of cystoscopy with indigo carmine. The catheter of bladder injuries often discharges blood in the urine, the volume of urine is reduced, and sometimes urine leaks to the pelvic cavity. When suspecting bladder injury, absent ureteral spill of indigo carmine can be detected in patients. If necessary, the bladder injury can be diagnosed by cystoscope or bladder angiography examination.

The clinical symptoms of ureteral tract injury depend on

the damage type and degree. When the symptoms appear at short time postoperatively, the injury may generally be more severe, perhaps due to ureteral rupture. When the symptoms appear at long term postoperatively, the damage is generally lighter and the symptoms are not typical. The characteristics of ureteral injury are ureteral stricture, obstruction, fracture, and ureteral fistula. The common symptoms include oliguria, abdominal distension, abdominal pain, waist pain, fever, blood in urine, pelvic cavity accumulates fluid, vaginal discharge, etc. In the present study, the main clinical characters of three ureteral injuries included lower quadrant abdominal pain, fever, and peritonitis signs postoperatively. Therefore the doctor should take into serious consideration when the patients appear with symptoms as mentioned above. In addition, the urine generally leaks into the pelvic cavity with bladder or ureteral injury and due to the absorption of pelvic urine, the BUN or Cr in patient's blood can be significantly increased. Urea nitrogen, uric acid, and creatinine levels increasing in the abdominal drainage fluid can be found by collecting and testing the fluid to confirm bladder or ureteral injuries. Unconfirmed injuries of bladder or ureters can be confirmed through retrograde bladder imaging or IVP which depict the contrast agent's extravasation.

The reasonable repair technique should be chosen, such as vaginal or abdominal or laparoscopic surgery to treat the urinary tract injuries, according to the condition of patients and the skills of surgeons. For bladder injuries detected intraoperatively, they can be directly repaired by laparoscopic or laparotomy. Not all urinary tract injuries are detected intraoperatively. For the bladder injury detected postoperative, the patient should be prescribed the appropriate

antibiotics to reduce the complications. If the bladder injury is not serious or angiography shows that only a small amount of urinary extravasation or clinical symptoms are slight, conservative treatment could be considered. It generally includes balloon catheter continuous drainage from 7~10 days. An operation should be performed as soon as possible if the bladder injury is serious and with urine extravasation. For the two bladder injuries in the present study, both were repaired in time intraoperatively and recovered well.

The main complication of ureteral tract injuries intraoperatively is more clear liquid flowing from the wound, and it is the best time for surgical repair, because at this time, the wound has not yet formed tissue edema and adhesion, hence the surgery is relatively simple, the prognosis is good, and the complications are fewer. For the ureteral injury which is diagnosed 72 hours postoperatively, it also be advised to immediately carry out repair surgery, and intraoperatively, attention should be paid to protect renal function, prevent serious infection, and adopt the corresponding treatment measures according to the location and degree of damage. For the small injury, it can be generally treated by placement D-J catheter in line stent drainage. For one ureteral injury on the right side, the case was healing without a second surgery. Six months after surgery of ureteral intubation under cystoscope by the urologist, the injury should be repaired by bladder ureteral implantation if D-J tube placement is not successful [8, 9]. The success opportunity of surgery is higher with the bladder ureter implantation.

The subjects in this study were few, however from these, it appears that the incidence of injury to the urinary tract was underestimated. The increase in ureteral injury during laparoscopic hysterectomy was not significant, and this study had too few subjects to draw any meaningful conclusions. However, in this study, the authors can conclude that urinary tract injury is a serious complication of gynecological laparoscopy and more attention should be paid to the injury possibility. Timely and effective measures should be taken and renal function should be protected once the urinary injury is identified [10]. Surgeons should consider performing cystoscopy with intravenous indigo carmine dye at the time of total laparoscopic hysterectomy. Most patients can achieve optimal results when they are diagnosed early and treated correctly.

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References

- [1] Johnson N., Barlow D., Lethaby A., Tavender E., Curr L., Garry R.: "Methods of hysterectomy: Systematic review and meta-analysis of randomised controlled trials". *BMJ*, 2005, 330, 1478.
- [2] Frankman E.A., Wang L., Bunker C.H., Lowder J.L.: "Lower urinary tract injury in women in the United States, 1979-2006". *Am. J. Obstet. Gynecol.*, 2010, 495, e1-e5.
- [3] Tian Y.F., Lin Y.S., Lu C.L., Chia C.C., Huang K.F., Shih T.Y. et al.: "Major complications of operative gynecologic laparoscopy in southern Taiwan: a follow-up study". *J. Minim. Invasive. Gynecol.*, 2007, 14, 284.
- [4] Pompeo A., Molina W.R., Seht D., Tobias-Machado M., Mariano Costa R.M., Pompeo A.C., Kim F.J.: "Laparoscopic Ureteroneocystostomy for Ureteral Injuries after Hysterectomy". *JSLs*, 2013, 17, 121.
- [5] Daly J.W., Higgins K.A.: "Injury to the ureter during gynecologic surgical procedures". *Surg. Gynecol. Obstet.*, 1988, 167, 19.
- [6] Ku J.H., Kim M.E., Jeon Y.S., Lee N.K., Park Y.H.: "Minimally invasive management of ureteral injuries recognized late after obstetric and gynaecologic surgery". *Int. J. Care. Injured*, 2003, 34, 480.
- [7] Frankman E.A., Wang L., Bunker C.H., Lowder J.L.: "Lower urinary tract injury in women in the United States, 1979-2006". *Am. J. Obstet. Gynecol.*, 2010, 202, 495.
- [8] Hwang J.H., Lim M.C., Joung J.Y., Seo S.S., Kang S., Seo H.K., et al.: "Urologic complications of laparoscopic radical hysterectomy and lymphadenectomy". *Int. Urogynecol. J.*, 2012, 23, 1605.
- [9] Hwang J.H.: "Urologic complication in laparoscopic radical hysterectomy: meta-analysis of 20 studies". *Eur. J. Cancer*, 2012, 48, 3177.
- [10] Choi K.M., Chio J.S., Lee J.H., Lee K.W., Park S.H., Park M.I.: "Laparoscopic ureteroureteral anastomosis for distal ureteral injuries during gynecologic surgery". *J. Minim. Invasive. Gynecol.*, 2010, 17, 468.

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