Urinary complications of gynecologic surgery: iatrogenic urinary tract system injuries in obstetrics and gynecology operations

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Summary

Objectives: To evaluate iatrogenic urinary tract system injuries in obstetrics and gynecology operations and compare the results with the literature. *Patients and Methods:* We examined the records of patients who had obstetric and gynecology operations at the Ministry of Health, Dr. Zekai Tahir Burak Women's Health, Training and Research Hospital between June 2007 and June 2010. All the patients who were diagnosed as having urinary system injuries in either the intraoperative or postoperative period were determined. *Results*: During this period, 25,998 gynecologic and obstetrical operations were performed, 0.03% ureteric, 0.20% bladder, and one case of urethral injury, in a total of 0.24% urinary tract injuries were observed. The bladder was the most frequently injured organ. Total urinary tract injury rates were 0.79% (0.49% bladder, 0.24% ureteral) in gynecologic operations and 0.19% (0.18% bladder and 0.01% ureteral) in obstetric operations. *Conclusion:* Urinary system injuries are seen in approximately 1% of all gynecologic and obstetric surgeries. The complication rates observed in our patients were comparable with the other studies in the literature. A gynecologic surgeon must become familiar with the anatomy of the urinary tract and must be aware of common intraoperative and postoperative complications to decrease the risk of morbidity.

Key words: Medical and surgical complications of pregnancy; Surgical techniques; Urogynecology.

Introduction

Gynecologic surgery can have major perioperative morbidity, including urinary tract and bowel injuries, infection, hemorrhage, thromboembolism, and death [1]. There have been many advances in surgical techniques and with the help of perioperative anesthetic and postsurgical care these complications have decreased, however lower urinary track injury at gynecologic and obstetric surgery is still a serious problem, which may cause significant morbidity [2]. This study aimed to evaluate iatrogenic urinary tract system injuries in obstetrics and gynecology operations and compare the results with the literature.

Patients and Methods

We examined the records of patients who had obstetric and gynecology operations at the Ministry of Health, Dr. Zekai Tahir Burak Women's Health, Training and Research Hospital between June 2007 and June 2010. Approval was obtained from the institution to use its records for research.

Total abdominal hysterectomy (TAH), TAH+Bilateral salpingo-oophorectomy (TAH+BSO), radical hysterectomy (RH), vaginal hysterectomy (VH), cesarean section, oophorectomy and other procedures (i.e., cystourethropexia, myomectomy) were determined as main operation types.

The files and computer records of the urology clinic were scanned because of the late postoperative complications. All the patients who were diagnosed as having urinary system injuries in either the intraoperative or postoperative period were determined.

The SPSS package program and chi-square test were used to compare the complication rates of the study groups with each other, and $p < 0.05$ was considered statistically significant.

Results

Between 2006 and 2009, 0.03% ureteric, 0.20% bladder, and one case of urethral injury in a total of 0.24% urinary tract injuries were observed. The mean age of these patients was 37.2 years (19-64 years). During this period, 25,998 gynecologic and obstetrical operations were performed. Urinary tract injuries are summarized in Table 1 according to the operation types performed. The complications and treatments are summarized in Table 2.

The bladder was the most frequently injured organ. Total urinary tract injury rates were 0.79% (0.49% bladder, 0.24% ureteral) in gynecologic operations and 0.19% (0.18% bladder and 0.01% ureteral) in obstetric operations.

Of the patients, 82.53% (n = 52) of the patients underwent intraoperative repair and 17.46% (n = 11) of the patients needed delayed repair. The patients who received a repair later underwent vesicovaginal fistula repair and the uretheroneocysostomia procedure.

In the statistical analysis with chi-square test, it was noteworthy that the RH group had the highest urinary injury rates ($p < 0.05$).

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Table 1. — *Distribution of urinary tract injuries in the patients according to the operation types performed.*

Type and number of surgery		Total number of bladder injuries	Total number of ureteric injuries	Total number of urethral injuries
TAH	432	1	1	-
TAH+BSO	648	3	2	-
VH	360	2	0	-
RH	221	4	2	
Cesarean section	23,979	44	3	–
Others	363	–	–	1

TAH: Total abdominal hysterectomy
TAH+BSO: Total abdominal hysterectomy plus bilateral salpingo-oophorectomy
VH: Vaginal hysterectomy
RH: Radical abdominal hysterectomy
Others: Myomectomy, oopherectomy, cystectomy

Table 2. — *Type and treatment of urinary tract injuries.*

Indication for surgery	Type of surgery	Type of urinary tract injury	Treatment
Uterine myoma	TAH	Bladder injury	Intraoperative repair
Uterine myoma	TAH+BSO	Ureteric injury	Intraoperative repair
Cervix cancer	RH	Ureteric injury	Intraoperative repair
Cervix cancer	RH	Bladder injury	Late VVF repair
Ovarian cancer	RH	2 Bladder injuries	Late VVF repair
Ovarian cancer	RH	Bladder injury	Intraoperative repair
Ovarian cancer	RH	Ureteric injury	İntraoperative repair
Ovarian cancer	RH	Ureteric injury	Late UNC
Uterine descensus	VH	2 Bladder injuries	Late VVF repair
Uterine descensus	VH	Bladder injury	İntraoperative repair
Uterine descensus	VH	2 Bladder injuries	İntraoperative repair
Uterine descensus	VH	Ureteric injury	Late UNC
Previous CS	CS	41 Bladder injuries	Intraoperative repair
Previous CS	CS	3 Bladder injuries	Late VVF repair
CPD	CS	2 Ureteric injuries	Intraoperative repair
Breech presentation	CS	Ureteric injury	Late UNC
Vaginal cyst	Cystectomy	Urethral injury	Intraoperative repair
Total			63

TAH: Total abdominal hysterectomy
TAH+BSO: Total abdominal hysterectomy plus bilateral salpingo-oophorectomy
VH: Vaginal hysterectomy
RH: Radical abdominal hysterectomy
UNC: Ureteroneocystostomy
CPD: Cephalo pelvic disproportion
Others: Myomectomy, oopherectomy, cystectomy
VVF: Vesicovaginal fistula
Total urinary tract injury rate in gynecologic operations is 0.79% (0.49% bladder, 0.24% ureteral).
Total urinary tract injury rate in obstetric operations is 0.19 % (0.18% bladder and 0.01% ureteral).

In one case, complete urethral injury occurred during vaginal cyst excision. The patient who underwent edge-to-edge repair recovered completely.

Discussion

The urinary tract injury must be always considered in gynecologic and obstetrical operations because of the embryologic and anatomically close relationship of the female genital and urinary tracts. General complications of gynecologic surgery are ureter, bladder injuries, bowel injury, vessel injury, infection, and thromboembolism [3]. The bladder is the most frequently affected organ. All these are rare complications but lead to a high morbidity rate.

Previous studies have reported a 0.4% to 2.5% rate of urinary tract injury during benign pelvic surgery, and only one-third of these injuries were recognized during surgery [4]. Intraoperative identification of injury and immediate repair are extremely important because urine leakage during postoperative period can cause urinoma, peritonitis, and sepsis [5].

Figure 1. — Retrograde pyelography of a 50-year-old woman who developed ureterovaginal fistula following radical hysterectomy.

Injury to the bladder dome can easily be sustained on entry into the abdominal cavity if the bladder is not adequately drained [6]. The supratrigonal area of the bladder lies in direct opposition to the interior vaginal fornix. This area is approximately 1-2 cm above the interureteric ridge and can be easily damaged during abdominal or laparoscopic hysterectomy. Supratrigonal section and trigone can also be injured during vaginal hysterectomy and anterior colporrhaphy.

It is estimated that gynecologic surgery accounts for 75% of all ureteral injuries [7]. Anatomically, as the ureter approaches the pelvis, it is crossed anteriorly by the ovarian vessels In the cardinal ligament, the ureter passes under the uterine artery approximately 1.5 cm lateral to the cervix at the level of the internal os [8]. After coursing under the uterine artery, the ureter then passes medially over the anterolateral vaginal fornix before entry to the trigone. In a computed tomography (CT) imaging study, Hurd *et al*. measured a mean distance between ureter and the cervix of 2.3 ± 0.8 cm with a range of 0.1 to 5.3 cm [9].

Intraoperative injury to the ureter may result from ligation, angulation, transection, laceration, crush, ischemia, and resection [10]. Major postoperative signs are flank or pelvic pain, hematuria, pyelonephritis, sepsis, urinoma, ureterocutaneous fistula [11].

Of ureteric injuries in gynecologic operations, 85% occur in the distal part of ureter [12].

The most common sites of operative injuries to the

ureter during routine abdominal hysterectomy or salpingo-oophorectomy are beneath the infundibulopelvic ligament, over the illiac arteries, within the cardinal ligament at the level of the cervical os and at the anterolateral fornix of the vagina as the ureters enter the bladder [13].

In cystourethropexy operations, urethral injuries usually occur near the ureterovesical junction [13]. In obstetric operations, ureteral injury can occur as a result of suturing to control the bleeding within the broad ligament or performing hypogastric artery ligation [13].

While Pandyan *et al*. identified 20 (0.23%) iatrogenic bladder injuries in 8,684 cases [14], Bai *et al*. detected 29 (0.33%) urinary tract injuries in 8824 major gynecological operations [15]. Nawaz *et al*. detected a bladder injury rate of 0.25% and an ureteral injury rate of 0.02% in 12,567 obstetric operations, whereas there were 0.7% bladder and 0.6% ureteral injuries in 5,966 gynecologic operations [16]. Furthermore, Messaoudi *et al*. determined 20 bladder and four ureteral injuries in their obstetrics and gynecologic cases and reported their total urinary tract injury rates as 0.21% [17]. In another study on 839 patients who underwent hysterectomy, 24 patients (2.8%) had bladder injury and 15 (1.8%) patients had ureteral injury, and thus the rate of urinary tract injury was reported to be 4.3% in total [18].

The complication rates observed in our patients were comparable with other studies in the literature. Moreover, in our cases, the bladder was the most frequently injured organ. Ureteric ligation was determined as the most frequent cause of damage in the ureter, which is also compatible with the findings in the literature.

Pelvic malignancies, endometriosis, large ovarian masses, pelvic inflammatory disease, previous pelvic surgery, and history of pelvic radiation are the common risk factors [10, 19]. Sixty-eight percent of our pateints had these risk factors.

The treatment modalities in ureteric injury cases were reported as endoscopic ureteral stent application, percutaneous drainage and open surgery (suture loosening, ureteroneocystostomy, transureteroureterostomy, and nephrectomy) [20, 21]. In 60% of our patients, interventions were made in the same operations. Diagnosis of an intraoperative complication is a serious event. However, misdiagnosis results in far more serious consequences. Repair of a recognized urinary tract injury during the operation has good outcome usually but unrecognized injuries repaired later have problematic outcomes. Delayed repair of an unrecognized urinary tract injury may cause urinoma, ileus, oliguria, anuria, flank pain, fever, fistula formation, or loss of renal function [11]. In our cases all the bladder injuries realized during the gynecologic and obstetrical operations were treated intraoperatively and successfully. However in three cases late vesicovaginal fistula repair was performed. Five ureteral injuries were treated intraoperatively, but in three cases late uretroneocystostomy was performed. In ureteral injury cases, ureterolysis and ureterouretrostomy were frequently used. Patients with delayed diagnosis a secondary operation was needed.

During the surgery, the gynecologic surgeon must keep im mind the possibility of injury to the ureter or bladder. If any doubt exists, the patient should not leave the operating room before bladder integrity and urethral patency are demonstrated.

Conclusion

Urinary system injuries are seen in approximately 1% of all gynecologic and obstetric surgeries. A gynecologic surgeon must become familiar with the anatomy of the urinary tract and must be aware of common intraoperative and postoperative complications to decrease the risk of morbidity. Clearly, prevention is the best defense mechanism against an iatrogenic urinary tract injury. As with all operative complications, the key to a good outcome is early recognition and treatment.

References

[1] David-Montefiore E., Rouzier R., Chapron C., Daraï E., Collegiale d'Obstétrique et Gynécologie de Paris-Ile de France: "Surgical routes and complications of hysterectomy for benign disorders: a prospective observational study in French university hospitals". *Hum. Reprod*., 2007, *2,* 260.

[2] Gilmour D.T., Das S., Flowerdew G.: "Rates of urinary tract injury from gynecologic surgery and the role of intraoperative cystoscopy". *Obstet. Gynecol*., 2006, *107,* 1366.

[3] Maxwell G.L., Synan I., Hayes R.P., Clarke-Pearson D.L.: "Preference and compliance in postoperative thromboembolism prophylaxis among gynecologic oncology patients". *Obstet. Gynecol*., 2002, *100,* 451.

[4] Drake M.J., Noble J.G.: "Ureteric trauma in gynecologic surgery". *Int. Urogynecol. J. Pelvic Floor Dysfunct.,* 1998, *9,* 108.

[5] Mendez L.E.: "Iatrogenic injuries in gynecologic cancer surgery". *Surg. Clin. No. Am*., 2001, *81,* 897.

[6] Utrie J.W. Jr.: "Bladder and ureteral injury: prevention and management". *Clin. Obstet. Gynecol*., 1998, *41,* 755.

[7] Thompson J.D.: "Operative injuries to the ureter: Prevention, recognition and management". In: te Linde's Operative Gynecology, 8th edition, Rock J.A. and Thompson J.D. (eds.). Philadelphia, Lippincott-Raven, 1997, 1135.

[8] Elkins T.E., Hopper J.B., Goodfellow K., Gasser R., Nolan T.E., Schexnayder M.C.: "Initial report of anatomic and clinical comparison of the sacrospinous ligament fixation to the high McCall culdoplasty for vaginal cuff fixation at hysterectomy for uterine prolapse". *J. Pelvic Surg.,* 1995, *1,* 12.

[9] Hurd W.W., Chee S.S., Gallagher K.L., Ohl D.A., Hurteau J.A.: "Location of the ureters in relation to the uterine cervix by computed tomography". *Am. J. Obstet. Gynecol*., 2001, *184*, 336.

[10] Taneja S.S., Smith R.B., Ehrlich R.M.: "Complications of urologic surgery: Prevention and management". 3rd edition (eds.). Philadelphia, W.B. Saunders, 2001, 637.

[11] Aronson M.P., Bose T.M.: "Urinary tract injury in pelvic surgery". *Clin. Obstet. Gynecol.,* 2002, *45*, 428.

[12] Selzman A.A., Spirnak J.P.: "Iatrogenic ureteral injuries: a 20-year experience in treating 165 injuries". *J. Urol*., 1996, *155*, 878.

[13] Chan J.K., Morrow J., Manetta A.: "Prevention of ureteral injuries in gynecologic surgery". *Am. J. Obstet. Gynecol.,* 2003, *188,* 1273.

[14] Pandyan G.V., Zahrani A.B., Awon A.R., Al-Rashid M., Al-Assiri M., Dahnoun M.: "Iatrogenic bladder injuries during obstetric and gynecological procedures". *Saudi Med. J.,* 2007, *28*, 73.

[15] Bai S.W., Huh E.H., Jung da J., Park J.H., Rha K.H., Kim S.K. *et al*.: "Urinary tract injuries during pelvic surgery: incidence rates and predisposing factors". *Int. Urogynecol. J. Pelvic Floor Dysfunct.,* 2006, *17,* 360.

[16] Nawaz F.H., Khan Z.E., Rizvi J.: "Urinary tract injuries during obstetrics and gynaecological surgical procedures at the Aga Khan University Hospital Karachi, Pakistan: a 20-year review". *Urol. Int.,* 2007, *78,* 106.

[17] Messaoudi F., Ben Jemaa S., Yazidi M., El Housseini S., Basly M., Sbai N.: "Lower urinary trauma complicating gyneacologic and obstetrical surgery". *Tunis Med*., 2008, *86,* 740.
[18] Ibeanu O.A., Chesson R.R., Echols K.T., Nieves M., Busangu F., Nolan T.E.: "Urinary tract injury during hysterectomy based on universal cystoscopy". *Obstet. Gynecol*., 2009, *113*, 6.
[19] Liapis A., Bakas P., Giannopoulos V., Creatsas G.: "Ureteral injuries during gynecological surgery". *Int. Urogynecol. J. Pelvic Floor Dysfunct*., 2001, *12,* 391.
[20] Al-Awadi K., Kehinde E.O., Al-Hunayan A., Al-Khayat A.: "Iatrogenic ureteric injuries: incidence, aetiological factors and the effect of early management on subsequent outcome". *Int. Urol. Nephrol*., 2005, *37,* 235.
[21] De Cicco C., Ret Dávalos M.L., Van Cleynenbreugel B., Verguts J., Koninckx P.R.: "Iatrogenic ureteral lesions and repair: a review for gynecologists". *J. Minim. Invasive Gynecol*., 2007, *14,* 428.

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