

Research Article

Management of Iatrogenic Ureteric Injuries in Abdominopelvic and Endourological Surgery: Seventeen Years of Experience

Turgut Yapanoglu¹, Fatih Ozkaya^{2*}, Senol Adanur¹, Tevfik Ziypak¹, Hasan Riza Aydın³

¹Department of Urology, Ataturk University Medical Faculty, Erzurum, Turkey

²Department of Urology, Erzurum Regional Training and Research Hospital, Erzurum, Turkey

³Department of Urology, Recep Tayyip Erdogan University Medical Faculty, Department of Urology, Rize, Turkey

*Corresponding author: Fatih Ozkaya, Erzurum Regional Training and Research Hospital, Department of Urology, 25240 Erzurum, Turkey. Tel: +905059436892; E-Mail: drfatihm@gmail.com

Citation: Ozkaya F, Yapanoglu T, Adanur S, Ziypak T, Aydın HR (2017) Management of Iatrogenic Ureteric Injuries in Abdominopelvic and Endourological Surgery: Seventeen Years of Experience. J Urol Ren Dis 2016: J118. DOI: 10.29011/2575-7903.000018

Received Date: 29 December, 2016; **Accepted Date:** 10 February, 2017; **Published Date:** 17 February, 2017

Abstract

Objective: To investigate etiological factors, the effect of early diagnosis and surgical treatment on the outcome of iatrogenic ureteric injuries treated in our urology unit over a 17-year period.

Patients and Methods: A retrospective review was performed on all patients referred for management of an iatrogenic ureteric injury from 1998 to 2015. Data collected and analyzed included incidence of injury, etiological factors, modalities of treatment and the outcome of management of the injuries.

Results: There were 79 iatrogenic ureteric injuries in 75 patients over the 16-year period. Urological, obstetrical, gynecological, general surgical and neurosurgery procedures were involved in 18 (22.8%), 14 (17.8%), 36 (45.5%), 10 (12.7%), 1 (1.2%) of the injuries, respectively. The commonest types of injuries encountered were ureteral ligations. The commonest treatment option used was end-to-end anastomosis. Ten patients were treated using the Boari bladder flap, 7 by ureteroneocystostomy, 28 by end-to-end anastomosis, 8 by deligation, 11 by double-J stent insertion, 4 by primary repair and 2 patient was followed conservatively. Five patients underwent nephrectomy. The overall successful resolution of ureteric injuries in this series was 74/79 (94.9%). There was no mortality attributable to these ureteric injuries.

Conclusions: Iatrogenic ureteric injuries are globally rare but are liable to occur due to the inherent ureteric anatomic factors in the pelvis. The practical principles for the prevention and repair of ureteric injuries are presented and discussed. The true risk to the patient lies in delayed, missed diagnosis and inadequate treatment. Despite preoperative studies and intra operative inspection, ureteral injury may remain undiagnosed until after abdominopelvic surgery. Early detection and appropriate management ensure successful recovery.

Keywords: Iatrogenic; Ureter; Injuries; Treatment

Introduction

Ureteral injury is a potential complication of gynaecological, obstetric, gastroenterological and urological compelling abdominopelvic surgery [1]. In many series, its incidence rate varies between 0.5% and 1% [2,3]. Although it may be injured on any area in the ureteral retroperitoneal space, it is most commonly injured in the distal area. In open surgeries, ureteral injury risk is

high mostly on infundibulopelvic ligament, near ovarian vascular pedicle, between ureter and uterine artery, in vaginal fornix and near lateral rectal pedicles. In therapeutic laparoscopy, ureteral injury risk is high in adnexa and cardinal ligament level. In difficult ureteroscopy, calculus manipulation in intramural and iliac segments is the cause of many urological injuries [4]. Intraoperative injury in ureter may be observed in the form of ligation, angulation, transection, laceration, crush injury, ischemia or resection [5]. Many cases are recognized as postoperative and as the postopera-

tive diagnosis is made, morbidity is higher; particularly when the injury is not diagnosed, it can lead to demoralizing consequences for both the patient and the doctor.

The purpose of this study was to assess the patients who applied to our clinic in the last 17 years due to ureteral injury during abdominopelvic and endourological surgery. We examined evaluation predisposing factors, treatment methods according to injury type, diagnosis time, postoperative course and results. Early diagnosis and appropriate treatment in these patients provides early relief from the effects of trauma. The most important thing for diagnosis is to suspect.

Materials And Methods

A retrospective analysis was performed on all patients referred for management of an iatrogenic ureteric injury from 1998 to 2015. The patients were analyzed with regard to nature of injury, time of recognition, method of definitive repair and the postoperative outcome.

Complications of Open Surgery

Ureterovaginal Fistula: Twelve patients (8 with left, 4 with right) with ureterovaginal fistulas were admitted to hospital in late stage. There had been no attempt at repair in any of these patients before referral. Intravenous urography (IVU), retrograde pyelography, ureterocystoscopy and vaginoscopy were performed for diagnosis. Five of the patients were treated with ureteroneocystostomy and 7 with the Boari bladder flap technique. Hospital stay ranged from 10 to 18 days (mean: 3.2 ± 7.8). Double-J and transureteral catheters were inserted in all patients intraoperatively. Transureteral and double-J catheters were removed on the 10th and the 21st days, respectively.

Ureteral Ligations: Twenty-three patients (19 with unilateral, 4 with bilateral) with ureteral ligation were admitted to our department. The patients with bilateral ureteral ligation were young females. The patients had been previously operated for uncontrollable hemorrhage after a spontaneous vaginal delivery and total abdominal hysterectomy was performed. Anuria was noticed generally 6 hours after the operation. We considered bilateral ureteral ligation in all patients, which was confirmed by retrograde pyelography. The patients underwent an emergency operation. Two patients were treated using bilateral end-to-end anastomosis. The other patients was treated with bilateral deligation performed and double-J stents were inserted. In the 19 patients with unilateral ureteral ligation, deligation was performed in 5 with insertion of double-J stents, 9 patients were treated by end-to-end anastomosis, and Boari bladder flap was performed in 3 patients. Two patient was treated with nephrectomy because of very late admission and non- functional kidney.

Retroperitoneal Extravasation: Retroperitoneal extravasation was determined in 6 patients by IVU. In 2 patients with incomplete section, double-J stent was inserted and percutaneous nephrostomy was made at site of extravasation. Laparotomy was performed in the other 4 patients followed by end-to-end anastomosis.

Ureteral Laceration: Primary repairs was performed in 5 patients with incomplete section, double-J stent was inserted. Two patients with complete transection was performed end-to-end anastomosis.

Complications of Endourological Surgery

Avulsion: Avulsion occurred in 4 patients during ureteroscopy. In 1 patient in whom the avulsion involved the distal ureter, ureteroneocystostomy was performed. In 2 patients were repaired primarily with end-to-end anastomosis over a ureteral stent. The other patient was performed nephrectomy.

Perforation: Perforation occurred in 5 patients during ureteroscopy. A ureteral stent was placed in all patients for 3 to 6 weeks.

False Passage: False passage was determined in 5 patients during ureteroscopy. A short-term ureteral stent was placed in 3 of the patients. The others were followed conservatively without a stent.

Extravasation / Urinoma: Urinary extravasations and urinoma were determined in 1 patient. Treatment in this patient included placement of a ureteral stent and nephrostomy tube in urinoma. All patients were followed up with IVU and urine culture 3 months later.

Results

There were 79 iatrogenic injuries in 75 patients during the 17-year period. Patients included 42 women aged between 18-62 years old (mean: 33 years) and 14 men aged between 16-78 years old (mean: 34 years). We found 79 cases of ureteric injury, 48 of which concerned the left and 31 the right ureter. Gynecological and endourological surgery were the most important etiologic factors in these patients (Table 1).

Cause	No of ureters	No of patients
Gynecological		
Repeated cesarean section	14*	12
Abdominal hysterectomy	36*	34
General Surgical		
Resection of tumor	8	8
Exploratory laparotomy	2	2
Urological		
Ureterorenoscopy	18	18

Neuro surgery	1	
Total	79	75

* Includes patients with bilateral ureteric injury

Table 1: Causes of 79 ureteric injuries in 75 patients.

Shows the causes of iatrogenic ureteric injuries in this series. The time of recognition of injury in 15 cases was during primary surgery (endourological surgery), whereas in the remainder, injury was recognized after surgery and repair of the ureter was performed. The most common complaint of the patients was flank pain, followed by fever and urinary leakage. The detected symptoms are shown in (Table 2).

Symptoms	No. of patients	% of patients
Flank pain	50	66.60%
Urinary Leakage		
Ureterovaginal fistulas	18	24%
Retroperitoneal extravasations	10	13.30%
Anuria	4	5.30%
Fever	20	26.60%
Asymptomatic	2	2.60%

Table 2: Presenting symptoms of patients.

Ten of the patients were treated with the Boari bladder flap, 7 by ureteroneocystostomy, 28 by end-to-end anastomosis, 8 by deligation, 11 by inserted double-J stent, 4 by primary repair and 2 with only conservative follow-up. Nephrectomy was performed in 5 patients. Surgical procedures are shown in (Table 3).

Type Of Injuries	Type Of Repair Performed
Ureterovaginal fistula	Ureteroneocystostomy Boari flap
Unilateral ureteral ligations	Deligation and double-J stent End-to-end anastomosis Nephrectomy Boari flap
Bilateral ureteral ligations	Bilateral deligation and double-J stent End-to-end anastomosis
Retroperitoneal extravasation percutaneous nephrostomy End-to-end anastomosis Ureteral avulsion	Double-J stent and Ureteroneocystostomy End-to-end anastomosis
Ureteral perforation	Double-J stent
False passage	Ureteral stent Follow-up

Table 3: Surgical procedures carried out for repair according to ureteric injuries.

All patients were successfully treated with one operation.

Discussion

Although ureter is protected by dorsal muscles, vertebral co-

lon, lateral and front abdominal muscles, it may often have iatrogenic injuries due to its anatomic localization. Furthermore, ureter is considerably small, movable and flexible. Ureteral injury may be partial or total, as well as blunt or penetrating [1,4]. Although it has been reported that iatrogenic ureter injury incidence rate varies between 0.5% and 1% in series; iatrogenic ureter injury rate increases in malignancy-related operations, in presence of ovarian debris, and as a consequence of disrupted anatomy and induration development due to endometriosis or previous surgeries [2,3].

In cases where bleeding control is difficult; both cautery-related thermal injury and suture ligation-related ureteral injury may be observed [6]. Despite the fact that the rate of ureteral injury incidences was previously low in urological processes, the number of ureteral injuries also tends to increase in recent years due to the increase in the number of complex minimal invasive endoscopic procedures. However, although the number of ureteral injuries increases in urological procedures, identification of injuries during the procedure and realization of early treatment produce successful results for the majority of patients [5].

The main source of early diagnosis in ureteral injuries is the suspicion of injury, as imaging methods and urine analyses are not reliable. Many injuries are successfully treated with primary repair [6]. Morbidity rate is high in such injuries; increased hospitalization duration, unsuccessful original surgery results, secondary invasive interventions, secondary operations, loss of renal function and impaired quality of patient's life are present [7]. During pelvic and abdominal surgeries, ureteral injuries in the retroperitoneal space from renal pelvis to urinary bladder are more commonly caused by gynaecology and general surgery clinics [8,9]. Ureteral injury incidence rate in gynaecological procedures varies between 0.4% and 2.5% [10], however these rates most likely are below real rates, since injuries occurring during operations and asymptomatic patients are not included in these values [11,12].

Urological ureteral injuries typically take place during ureteroscopy, and are successfully treated through intraoperative stent placement. Stent must remain inserted for 1-2 week(s) for minor defects and 6 weeks for major defects [13]. Similarly, 4-6 week internal stent placement is required for the recovery of thermal injuries. In our series, urological ureteral injuries except for avulsion were treated through internal stent placement. Three patients were treated with ureteroneocystostomy and end-to-end anastomosis. In the IVU conducted after three months; renal functions were found to be normal and urine analysis was assessed as sterile. Although the number of ureteral injuries during ureteroscopy is on increase, ureteroscopy is a highly reliable method. In our series of 1400 cases, the complication was observed only in 14 cases (0.1%).

If the patient suffers from disrupted renal functions and

complete anuria after hysterectomy, bilateral ureter ligation should be suspected. In unilateral ureter ligation; abdominal distension, lumbar pain and sometimes sepsis may be observed [14]. Ligation injuries may simply be treated with delegation. Crush injuries may occur during ligation and may lead to more injuries than assumed and also ischemic injuries [15]. If there is suspicion with regard to the vitality of ureter, reanastomosis through excision and fish mount may be required. If a long ureteral segment loss is in question, Psoas hitch [16,17] or Boari flap [18] should be performed. Ileal ureter [19], renal autotransplantation [20] and trans uretero-ureterostomy may also be required [21].

Occasionally, nephrectomy is needed. We treated 20 patients due to ureteral ligation. We treated four patients with bilateral ligation through delegation in early period. Other patients applied to our clinic in late period. Along with delegation, Double-J stents were placed with delegation on eight patients (Figure 1).



Figure 1: IVU showing obstruction due to ligation around the left distal ureter.

12 patients were treated with end-to-end anastomosis, Boari Flap was performed on 3 patients, nephrectomy was performed on one patient with severe parenchymal loss. All surgical interventions were performed in single session. No complication was observed in postoperative period. IVU was conducted on all patients in the postoperative 3rd month in order to demonstrate renal functions (Figure 2).



Figure 2: Follow-up IVU 3 months after deligation and double-J stent insertion.

Main reason of uterovaginal fistulas is gynaecological and obstetric surgeries [22]. Uterovaginal fistula's main symptom is vaginal urinary incontinence during urination and backache [23]. Diagnosis is made through the common use of clinical findings and IVU for all cases. The procedure is conducted by closing the ureterovaginal fistula and restoration of ureteral function [24]. If there is only a partial obstruction in ureter; retrograde or antegrade stent placement can be conducted for the fistula repair [25]. If this procedure turns out to be unsuccessful, antegrade D-J is placed by using percutaneous nephrotomy [26]. If the ureter is completely blocked or the fistula continues despite the stent placement, the standard treatment method is ureteroneocystostomy, Boari flap and Psoas Hitch methods [27]. Standard treatment methods should be applied on all cases with complete obstruction. We treated 5 patients by using ureteroneocystostomy and 7 patients by using Boari flap technique.

Extravasation and urinoma occurring due to abdominopelvic and endourological surgeries may be treated with double-J stent placement [12]. If there is urinoma, it should be discharged.

If this procedure turns out to be unsuccessful, open surgery technique should be applied. We treated 3 patients suffering from extravasation through the placement of D-J stent and percutaneous nephrotomy catheter instead of extravasation. Four patients were also treated through laparotomy and end-to-end anastomosis.

Consequently; although the number of ureter traumas is low among general traumas, iatrogenic ones are commonly encountered in urological practice. Early diagnosis and appropriate treatment in these patients provides early relief from the effects of trauma. Successful results are obtained through early diagnosis and suitable treatment. The most important thing for diagnosis is to suspect.

References

1. Al-Awadi K, Kehinde EO, Al-Hunayan A, Al-Khayat A (2005) Iatrogenic ureteric injuries: incidence, aetiological factors and the effect of early management on subsequent outcome. *IntUrolNephrol* 37: 235-241.
2. Bright TC 3rd and Peters PC (1977) Ureteral injuries secondary to operative procedures. Report of 24 cases. *Urology* 9: 22-26.
3. Neuman M, Eidelman A, Langer R, Golan A, Bukovsky I (1991) Iatrogenic injuries to the ureter during gynecologic and obstetric operations. *SurgGynecolObstet* 173: 268-272.
4. Routh JC, Tollefson MK, Ashley RA, Husmann DA (2009) Iatrogenic ureteral injury: can adult repair techniques be used on children? *J Pediatr Urol* 5: 53-55.
5. De Cicco C, Ret Dávalos ML, Van Cleynenbreugel B, Verguts J, Koninckx PR (2007) Iatrogenic ureteral lesions and repair: a review for gynecologists. *J Minim Invasive Gynecol* 14: 428-435.
6. Preston JM (2000) Iatrogenic ureteric injury: common medicolegal pitfalls. *BJU Int* 86: 313-317.
7. Selzman AA and Spirnak JP (1996) Iatrogenic ureteral injuries: a 20-year experience in treating 165 injuries. *JUrol* 155: 878-881.
8. Dobrowolski Z, Kusionowicz J, Drewniak T, Habrat W, Lipczynski W, et al. (2002) Renal and ureteric trauma: diagnosis and management in Poland. *BJU Int* 89: 748-751.
9. Modi P, Goel R, Dodiya S (2005) Laparoscopic ureteroneocystostomy for distal ureteral injuries. *Urology* 66: 751-753.
10. Polat O, Gül O, Aksoy Y, Ozbey I, Demirel A, et al. (1997) Iatrogenic injuries to ureter, bladder and urethra during abdominal and pelvic operations. *IntUrolNephrol* 29: 13-18.
11. Kim JH, Moore C, Jones JS, Rackley R, Daneshgari F, et al. (2006) Management of ureteral injuries associated with vaginal surgery for pelvic organ prolapse. *IntUrogynecol J Pelvic Floor Dysfunct* 17: 531-535.
12. Rafique M and Arif MH (2002) Management of iatrogenic ureteric injuries associated with gynecological surgery. *IntUrolNephrol* 34: 31-35.
13. Drake MJ and Noble JG (1998) Ureteric trauma in gynecologic surgery. *IntUrogynecol J Pelvic Floor Dysfunct* 9: 108-117.
14. Symmonds RE (1976) Ureteral injuries associated with gynecologic surgery: prevention and management. *Clin Obstet Gynecol* 19: 623-644.
15. Gözen AS, Cresswell J, Canda AE, Ganta S, Rassweiler J, et al. (2010) Laparoscopic ureteral reimplantation: prospective evaluation of medium-term results and current developments. *World J Urol* 28: 221-226.
16. Png JC and Chapple CR (1993) Principles of ureteric reconstruction. *CurrOpinUrol* 10: 207-212.
17. Berger Y, Fernandez LA, Breen JL. Repairs to ureters damaged by gynaecologic surgery. *Contemp Urol* 51: 9.
18. UPark JH, Park JW, Song K, Jo MK (2012) ureteral injury in gynecologic surgery: a 5-year review in a community hospital. *Korean J Urol* 53: 120-125.
19. Blandy JP, Badenoch DF, Fowler CG, Jenkins BJ, Thomas NW (1991) Early repair of iatrogenic injury to the ureter or bladder after gynecological surgery. *J Urol* 146: 761-765.
20. Mensah J, Klufio G, Ahiaku F, Osafo C, Gepi-Attee S (2008) Delayed recognition of bilateral ureteral injury after gynecological surgery. *Ghana Med J* 42: 133-136.
21. Badenoch DF, Tiptaft RC, Thakar DR, Fowler CG, Blandy JP (1987) Early repair of accidental injury to the ureter or bladder following gynaecological surgery. *Br J Urol* 59: 516-518.
22. Ehrlich RM, Melman A, Skinner DG (1978) The use of vesico-psoas hitch in urologic surgery. *J Urol* 119: 322-325.
23. Paick JS, Hong SK, Park MS, Kim SW (2006) Management of post-operatively detected iatrogenic lower ureteral injury: should ureteroureterostomy really be abandoned? *Urology* 67: 237-241.
24. Benson MC, Ring KS, Olsson CA (1990) Ureteral reconstruction and bypass: experience with ileal interposition, the Boari flap-psoas hitch and renal autotransplantation. *J Urol* 143: 20-23.
25. Armatys SA, Mellon MJ, Beck SD, Koch MO, Foster RS, et al. (2008) Use of ileum as ureteral replacement in urological reconstruction. *J Urol* 181: 177-181.
26. Thome ID and Resnick MO (1986) The use of bowel urologic surgery: A historical perspective. *UrolClin North Am* 13: 179-191.
27. Wiesner C, Bonfig R, Stein R, Gerharz EW, Pahernik S, et al. (2006) Continent cutaneous urinary diversion: long-term follow-up of more than 800 patients with ileocecal reservoirs. *World J Urol* 24: 315-318.