

Ureteric injuries during obstetric and gynecologic procedures

Yousef S. Matani, MBChB, FRCS(Glasg), Kamal E. Bani-Hani, MD, FRCS(Glasg), Ibrahim H. Bani-Hani, MBChB, FRCS(Ed).

ABSTRACT

Objective: To review the ureteric injuries resulting from obstetric and gynecologic procedures with a comparative analysis of current pertinent literature.

Methods: From January 1994 - December 1997, the medical records of all patients who sustained ureteric injuries as a result of obstetric or gynecologic procedures and managed at the Princess Basma Teaching Hospital, North of Jordan were reviewed. The clinical presentations, investigations, features of injury and treatment modalities were studied.

Results: There were 17 patients with 19 ureteric injuries incurred during obstetric or gynecologic procedures during the study period. Patients were relatively young and presented with loin pain. The left lower ureter was injured in 11 cases. Hysterectomy, alone, accounted for 13 injuries mainly in association with malignancy. Deliveries, in general, were

associated with very low rate of injury. Ureteric ligation was the most common mechanism of injury (47%). Injuries were intraoperatively recognized in 41.2% (7/17) of cases. Patients were treated by either endourological or formal surgical repair. The overall success rate after an average of 32.3 months of follow-up was achieved in 89.5% (17/19). This outcome was not significantly altered by either the features of injury or by the treatment schedules.

Conclusion: Iatrogenic ureteric injury is still a major cause of harm and concern. The time taken to detect the injury remains the most important morbidity-related factor. Recent trends towards earlier intervention and the use of various endourological means of repair deserve support and promotion.

Saudi Med J 2003; Vol. 24 (4): 365-368

Injury to urinary tract in medical practice was first described on 1030 AD in the opus called "Al-Kanoun". It was earlier observed by Derry in the mummy of Henhenit who lived in the court of King Mentuhotep II on 2050 BC.¹ Iatrogenic ureteric injury (IUI) remains a possibility and morbid sequel in any abdominal or pelvic procedure. It is more common compared to non-iatrogenic causes^{2,3} with an overall incidence of 0.5-1%.^{4,5} Recent change in the etiology of operative ureteric injury has been well documented in the excellent review of Selzman and Spirnak.⁶ They found that obstetric, gynecologic and general surgical operations are less frequently associated with IUI than urological interventions. Our study is a retrospective analysis of 17 patients who sustained IUI during an

obstetric or gynecologic procedure, which emphasize on management and long-term follow-up. An overview of the current literature is also included.

Methods. From January 1994 to December 1997, 17 patients with IUI were referred to the Urology Division in Princess Basma Teaching Hospital from Princess Bade'a Maternity Hospital at the same province. Both hospitals are located in Irbid Governate, which is the 2nd largest demographic area in Jordan with approximately 1.25 million population. These patients were studied in terms of clinical management and injury-related characteristics. The ureter was anatomically divided into: upper, middle and lower

From the Department of Urology (Matani, I. Bani-Hani), Faculty of Medicine, Princess Basma Teaching Hospital and the Department of Surgery (K. Bani-Hani), Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan.

Received 31st August 2002. Accepted for publication in final form 11th December 2002.

Address correspondence and reprint request to: Dr. Kamal E. Bani-Hani, Surgical Department, Faculty of Medicine, Jordan University of Science and Technology, PO Box 3030, Irbid 22110, Jordan. Tel. +962 (79) 5500014. Fax. +962 (2) 7060300. E-mail: kamal@just.edu.jo

segments.⁷ Iatrogenic ureteric injury was defined as any damage inflicted on the ureter and recognized either during or after gynecologic or obstetric procedure and required an unplanned repair or stenting. The recognition time of injury was arbitrarily divided into: intraoperative, early (≤ 1 week) and late (> 1 week). The cases, identified postoperatively, underwent various necessary imaging (anatomical) and functional studies before institution of the planned intervention. Follow-up ranged from 12-58 months with an average of 32.2 months. This includes routine clinical assessment, urine examination, outpatient ultrasonography and at least one intra venous uroterography (IVU) at 3-month and one-year visits. Success was defined as symptom and infection-free patient with no evidence of leak or obstruction documented by one year IVU.

Results. Bade'a Maternity Hospital is a very busy health institution. **Table 1** illustrates the number of obstetric and gynecologic procedures performed yearly during the specified study period. During the 4-year study period, 17 women with IUI were referred to the Urology Division. Their ages ranged from 18-56 years with an average of 36.6 years. A total of 19 IUI's were documented. The laterality of these injuries was left lower (9 ureters), right lower (5 ureters), right middle (one ureter), bilateral middle (2 ureters), and bilateral lower (2 ureters). One ureteric injury occurred during vaginal delivery, one following right oophorectomy, 4 during cesarean section (CS), and the remaining 13 injuries occurred during hysterectomy (3 cesarean hysterectomy, 2 hysterectomy for benign conditions and 8 hysterectomy for malignant disease). Among such a relatively high fertility rate, the probability of IUI during vaginal (spontaneous or instrumental) was found to be 0.03 per 1000 and CS deliveries was found to be one per 1000. Hysterectomy, on the other hand, was associated with significantly higher rate of injury of 20 per 1000. All injuries encountered in cesarean hysterectomy were during attempts to arrest severe bleeding. They were of the blind crushing (clamping) and ligation types. The most common mechanism of injury was ureteric ligation (9/19 = 47%), and only 7 patients (41.2%) had their IUI recognized intraoperatively (**Table 2**). The most common mode of presentation was disproportionate loin pain (12/17). Incontinence was noted in 3 and anuria was noted in 2 patients. The average period for the late presentation was 12.1 weeks. Almost equal numbers of ureters were managed by either endourological stenting or formal operative ureteric reconstruction (**Table 2**). All the cases were managed actively as soon as the diagnosis was made. Seven patients required a form of ureteroneocystostomy and 3 of them had psoas hitch repair. One patient had severe bilateral ureteric crush injury associated with right common iliac vein tear and severe bleeding during hysterectomy for dysfunctional uterine bleeding. The patient had vascular repair and homeostasis while the ureteric injury was left unnoticed.

She presented within one week with anuria and acute renal failure. Urgent cystoscopy, retrograde urography and exploration revealed very badly crushed right middle ureter and left lower ureter. Repair was achieved by transureteroureterostomy with left ureteric reimplantation. One patient lost her kidney due to late presentation with benign obstructing ureteric stricture after hysterectomy. There were 2 interesting injuries to left lower ureters, one with tangential tear and the other was anchored by a stitch. The anchored ureter was stented and the other was reimplanted into the bladder after ascertaining its good vascular supply. Three patients with ureterovaginal fistulae presented early and were treated by internal stenting for a period of 6 weeks. One of them did not heal and underwent reimplantation later. Two cases of ureteric stricture were managed by primary operative repair. Attempt for endourological correction was not entertained due to lack of facilities at the time of presentation. These 2 cases were diagnosed 2 weeks after the injury (**Table 2**). Ischemic stricture due to devascularization usually develops after a longer period of time and these strictures developed from direct trauma to the ureter. Long-term follow-up for an average of 32.2 months disclosed 2 procedure-related failures with an overall success rate of 89.5% (17/19). Endourological stenting was curative in 8 of 9 IUI's (88.9%) with one ureterovaginal fistula failing to heal after 6 weeks of double J stenting. The patient had an early open repair with successful outcome. Operative repair was successful in 9/10 (90%) injuries. One patient developed stenosis after 2 months of psoas hitch repair and underwent early successful revision. There was one procedure-unrelated and unavoidable renal unit loss due to delay in presentation.

Discussion. Iatrogenic ureteric injury during obstetric and gynecological procedures is becoming less common. Gynecologic surgery has accounted for more than 50% of these injuries in the past. Recent data have revealed a very significant drop in such incidence down to 0.4-2.5%. Obstetric causes, have always been less frequent. Marked changes in the etiology and pattern of

Table 1 - Major obstetrics and gynecology procedures.

Year	Vaginal delivery	Cesarean section	Hysterectomy
1994	8809	878	151
1995	8574	789	142
1996	8341	947	136
1997	8564	925	139
Total	34288	3539	568

Table 2 - Distribution of iatrogenic uteric injuries (IUI) according to time of recognition and treatment.

Type of injury	n of IUI	Intraoperative recognition	Early recognition ≤1 week	Late recognition > 1 week	Endo-stenting	Formal repair
Ligation	9	5	1(bilateral)	2	5	4
Anchorage	1	-	1	-	1	-
Tangential cut	1	1	-	-	-	1
Transection	1	1	-	-	-	1
Crushing	2	-	1(bilateral)	-	-	2
Stricture	2	-	-	2	-	2
Fistula	3	-	1	2	3	-
Total (%)	19	7/17 (41.2)	4/17 (23.5)	6/17 (35.3)	9/19 (47.4)	10/19 (52.6)

IUI resulted from the introduction and increased use of endoscopic surgery. Urological procedures, for instance, account for approximately 30% of IUI compared to other non-urological operations.^{6,8-10} General surgery is incriminated in approximately 5-15% of these injuries,¹¹⁻¹⁴ with increasing number of laparoscopy-associated trauma.^{9,15} Significantly higher incidence is noted during hysterectomy for malignant disease especially in association with radiotherapy.^{6,8,16-19} The overall incidence in the current series was 0.02% with 61.5% (8/13) occurring in these circumstances. All of our cases occurred while the surgeon was attempting to achieve homeostasis without proper identification of the ureter. Obstetric injury in our series is very rare particularly to the large characteristic denominator of our population coupled with improved care. Most of these injuries occur during instrumental vaginal delivery with or without a history of previous CS.²⁰⁻²² Another possible contributing factor, in some countries, is the more liberal indication for CS.²³ Bladder is more commonly injured in these cases. The injury is usually recognized intraoperatively or present later with leakage.^{24,25} Most of IUI's are unilateral and involve the left lower segment^{3,6,8,16,26} as also seen in this series. Involvement of the lower part is due to close proximity of the ureter to the uterine artery and anterior vaginal fornix. The predilection to the left side is difficult to explain! Major vascular accidents, as the case reported in our group, are generally uncommon and have been more likely encountered in gynecologic operations for malignancy.²⁷ Obstruction with pain or urinary leakage was the most common mode of postoperative presentation. Among this group of patients, ligation was the most common mechanism of injury. Intraoperative recognition rate for the injury is still universally low. It ranges from approximately 11-33%.^{2,3,8,19,28} The value of operative recognition of IUI cannot be over-emphasized. Various

maneuvers to avoid and recognized it operatively have been tried with the variable success. Attempts at ureteric exposure, extra care in high-risk procedures, preoperative contrast studies and ureteric catheterization with the urologist's involvement at an earlier stage are some of these precautions.²⁹ Significant improvement in detection was achieved for both bladder and ureteric injuries by resorting to routine cystoscopy during major gynecologic operations.³⁰ Treatment of IUI underwent considerable changes. More emphasis is placed, nowadays, on early repair with the increasing use of endourological techniques as the primary option. Detailed account of various treatment modalities is not within the scope of this analysis and is to be found in many reviews and standard urology textbooks.^{2,6-9,31-39} The rate of ureteric healing over a long-term follow-up was not significantly dependent on either the site of trauma or type of repair.^{8,41} In the current series, all the 7 injuries (5 ligation, one tangential cut, one transection) diagnosed intraoperatively and treated by stenting or repair had successful long-term outcome. This was also the experience of Mendez and McGinty.⁴⁰ We feel, as others,^{6,8,41} that intraoperative correction carries less morbidity, provides better quality of life and reduces legal litigations. It does not interfere with future repair and provides a comparable or even better chance of success. This notion was beautifully coined by Higgins⁴ who stated: "The venial sin is injury to the ureter, but the mortal sin is the failure of recognition".

References

1. Kremling H. Labor-induced bladder injuries: historical observation. *Gynakol Geburtshilfliche Rundsch* 1996; 36: 197-200.
2. Ghali AM, El-Malik EM, Ibrahim AI, Ismail G, Rashid M. Ureteric injuries: diagnosis, management, and outcome. *J Trauma* 1999; 46: 150-158.

3. Benchekroun A, Lachkar A, Soumana A, Farih MH, Belahnech Z, Marzouk M, et al. Ureter injuries. A propose of 42 cases. *Ann Urol (Paris)* 1997; 31: 267-272.
4. Higgins CC. Ureteral injuries during surgery. A review of 87 cases. *JAMA* 1967; 199: 82-85.
5. Corriere JN Jr. Ureteral injuries. In: Gillenwater JY, Grayhack JT, Howards SS, Duckett JW, editors. Adult and Pediatric Urology. 2nd ed. St. Louis (MO): Mosby; 1991. p. 491-498.
6. Selzman AA, Spirnak JP. Iatrogenic ureteral injuries: a 20-year experience in treating 165 injuries. *J Urol* 1996; 155: 878-881.
7. Franke JF, Smith JA Jr. Surgery of the ureter. In: Walsh PC, Retik AB, Vaughan ED, Wein AJ, editors. Campbell's Urology. 7th ed. Philadelphia (PA): WB Saunders Company; 1998. p. 3062.
8. Giberti C, Germinale F, Lillo M, Bottino P, Carmigani G. Obstetric and gynecological ureteric injuries: treatment and results. *Br J Urol* 1996; 77: 21-26.
9. Chou YH, Chen MT, Huang CH. Changing trends of ureteral injuries. *Kao Hsiung I Hsueh Ko Hsueh Tsa Chih* 1998; 14: 751-753.
10. Dowling RA, Corriere JN, Sandler CM. Iatrogenic ureteral injuries. *J Urol* 1986; 135: 912-915.
11. St. Lezin MA, Stoller ML. Surgical ureteric injuries. *Urology* 1991; 38: 497-506.
12. Fry DE, Milholen L, Harbrecht PJ. Iatrogenic ureteral injuries. Options in management. *Arch Surg* 1983; 118: 454-457.
13. Spirnak JP, Hampel N, Resnick MI. Ureteral injuries complicating vascular surgery: is repair indicated? *J Urol* 1989; 141: 13-14.
14. Hughes ES, McDermott FT, Polglase AL, Johnson WR. Ureteric damage in surgery for cancer of large bowel. *Dis Colon Rectum* 1984; 27: 293-295.
15. Saidi MH, Sadler RK, Vancaillie TG, Akright BD, Farhart SA, White AJ. Diagnosis and management of serious urinary complications after major operative laparoscopy. *Obstet Gynecol* 1996; 87: 272-276.
16. Baranyai E. Injuries of ureteral lower segment and the bladder during surgery. *Acta Chir Hung* 1987; 28: 149-153.
17. Ralph G, Tamussino K, Lichtenegger W. Urological complications after radical hysterectomy with or without radiotherapy for cervical cancer. *Arch Gynecol Obstet* 1990; 248: 61-65.
18. Goodno JA Jr, Powers TW, Harris VD. Ureteral injury in gynecologic surgery: a ten-year review in a community hospital. *Am J Obstet Gynecol* 1995; 172: 1817-1820.
19. Yeong CT, Lim TL, Tan KH. Ureteral injuries in an obstetric and gynecology teaching hospital. *Med J Malaysia* 1998; 53: 51-58.
20. Onuora VC, Al-Ariyan R, Koko AH, Abdelwahab AS, Al-Jawini N. Major injuries to the urinary tract in association with childbirth. *East Afr Med J* 1997; 74: 523-526.
21. Kattan SA. Maternal urological injuries associated with vaginal deliveries: change of pattern. *Int Urol Nephrol* 1997; 29: 155-161.
22. Rajasekar D, Hall M. Urinary tract injuries during obstetric intervention. *Br J Obstet Gynecol* 1997; 104: 731-734.
23. Rutkow IM. Obstetric and gynecologic operations in the United States, 1979 to 1984. *Obstet Gynecol* 1986; 67: 755-759.
24. Buchholz NP, Daly-Grandeau E, Huber-Buchholz MM. Urological complications associated with cesarean section. *Eur J Obstet Gynecol Reprod Biol* 1994; 56: 161-163.
25. Raut V, Shrivastava A, Nandanwar S, Bhattacharya M. Urological injuries during obstetric and gynaecological surgical procedures. *J Postgrad Med* 1991; 37: 21-23.
26. Daly JW, Higgins KA. Injury to the ureter during gynecologic surgical procedures. *Surg Gynecol Obstet* 1988; 167: 19-22.
27. Palfalvi L, Bosze P, Ungar L. Vascular injuries in the surgical management of gynecological malignancies. *Eur J Surg Oncol* 1993; 19: 601-603.
28. Aghaji AE, Odoemene C. Ureteric injuries in Enugue, Nigeria. *East Afr Med J* 1999; 76: 184-188.
29. Mann WJ, Arato M, Patsner B, Stone ML. Ureteral injuries in an obstetrics and gynecology training program: etiology and management. *Obstet Gynecol* 1988; 72: 82-85.
30. Gilmour DT, Dwyer PL, Carey MP. Lower urinary tract injury during gynecologic surgery and its detection by intraoperative cystoscopy. *Obstet Gynecol* 1999; 94: 883-889.
31. Png JC, Chapple CR. Principles of ureteric reconstruction. *Curr Opin Urol* 2000; 10: 207-212.
32. Armenakas NA. Current methods of diagnosis and management of ureteral injuries. *World J Urol* 1999; 17: 78-83.
33. Watterton JD, Mahoney JE, Futter NG, Gafield J. Iatrogenic ureteric injuries: approaches to etiology and management. *Can J Surg* 1998; 41: 379-382.
34. Frego E, Scanzi M, Aulenti V, Zambolin T, Giambroni L, Cancarini G. Controversies on the subject of traumatic lesions of the ureter. *Arch Ital Urol Nefrol Androl* 1993; 65: 41-46.
35. Mariotti G, Natale F, Trucchi A, Cristini C, Furbetta A. Ureteral injuries during gynecologic procedures. *Minerva Urol Nefrol* 1997; 49: 95-98.
36. Dovlatian AA. Strategy and results of restorative surgery in urinary tract injuries in obstetric and gynecology practice. *Akush Ginekol (Mosk)* 1994; 1: 51-54.
37. Blandy JP, Badenoch DF, Fowler CG, Jenkins BJ. Early repair of iatrogenic injury to the ureter or bladder after gynecological surgery. *J Urol* 1991; 146: 761-765.
38. Witters S, Corenelissen M, Vereecken R. Iatrogenic ureteral injury: aggressive or conservative treatment. *Am J Obstet Gynecol* 1986; 155: 582-584.
39. Tankington MA, Dejter SW Jr, Bresette JF. Early surgical management of extensive gynecologic ureteral injuries. *Surg Gynecol Obstet* 1991; 173: 17-21.
40. Mendez R, McGinty DM. The management of delayed recognized ureteral injuries. *J Urol* 1978; 119: 192-193.
41. Turk SK, Muneer L, Memon AS. Treatment of gynecological and obstetric ureteric injuries. *J Surg Pakistan (Int)* 1999; 4: 31-34.