ORIGINAL ARTICLE

URETERAL TRAUMA DURING OPEN SURGERY: AETIOLOGY, PRESENTATION AND MANAGEMENT

Saadia Nawaz Durrani, Ata ur Rehman, Sarhad Khan, Hazrat Ullah, Muhammad Kamran Khan, Anayat ullah

Urology and Transplant Unit, Institute of Kidney Diseases, Hayatabad Medical Complex, Peshawar, Pakistan.

Background: Ureteric injury during a surgical procedure is a serious complication with significant morbidity. The objective of this research was to study the aetiology, clinical features and management of iatrogenic ureteric injuries after open surgical procedures. **Methods**: This descriptive study was carried out in the Urology and Transplant unit of Institute of Kidney Diseases, Peshawar, from 1st August 2008 to 30th April 2011. Patients with clinical diagnosis of ureteral trauma due to open surgical procedures were included in the study through convenient sampling after informed consent. Important variables under study were: aetiology of ureteric injury, presenting features, time from injury to diagnosis, type of ureteric injury, treatment options, and outcome of treatment. Follow up was at 1, 3, 6 and 12 months. **Results**: The study included 43 patients; 33 (76.7%) were females and 10 (23.3%) males. Abdominal hysterectomy was the commonest cause 20 (46.5%) of ureteric injury. Common presenting features were urinary incontinence 13 (30.23%), flank pain 7 (16.3%) and anuria 10 (23.3%). Median time from ureteric injury to urological referral was 10 days. Distal ureter was most commonly injured. Percutaneous nephrostomy was carried out in 14 (32.5%) cases. Ureteroscopic ureteric stenting was successful in 5 (11.6%) cases. Ureteroneocystostomy was carried out 25 (58%) cases. Two (4.7%) cases presented very late with non-functioning kidneys and required nephrectomy. Patients developing ureteric stricture after ureteroneocystostomy were managed successfully by endo-urological procedures. Renal function remained stable in all the patients during follow-up and there was no mortality. **Conclusion**: Timely recognition of ureteric injury and its management is associated with good outcome and decreased morbidity.

Keywords: Ureteric injuries, iatrogenic, complication, open surgery, management

J Ayub Med Coll Abbottabad 2013;25(3-4):86–9

INTRODUCTION

Inadvertent ureteral injury during a surgical procedure is a serious complication with significant morbidity and sometimes death occurs. The incidence of iatrogenic ureteric injuries varies from 0.5–10% in different studies.[1–4] It can occur during any difficult abdomino-pelvic surgery. Obstetric and gynaecological surgery, vascular surgery, general surgical procedures especially colorectal surgery and urological procedures are commonly responsible for ureteric injuries.[4] Endourological procedures also account for many ureteric injuries.[4,5]

During abdominopelvic surgery, ureteric injury may be in the form of crush injury by a clamp, inadvertent diathermy injury, suture ligation, transaction, resection of a segment of ureter, kinking of ureter, and devascularization of a segment of ureter due to extensive dissection close to ureter. Patient may develop urinary fistula with adjacent organ or end up with non-functioning kidney later on.[6] Prompt recognition and immediate treatment give the best results. However, most cases of ureteric injuries are recognized late.[4–8] Patients may present with flank pain, fever, prolonged ileus, ascites, urinary incontinence, anuria and azotemia with 5% patients present very late with hydronephrosis and non-functioning kidney.[7,8]

The objective of this study was to assess the aetiology, clinical features and management of iatrogenic ureteric injuries.

MATERIAL AND METHOD

This descriptive study was carried out at the Urology unit of Institute of Kidney Diseases, Hayatabad Medical Complex, Peshawar, during the period from 1st August 2008 to 30th April 2011. The study included 43 patients of either gender and any age with iatrogenic ureteric injuries. Written informed consents were taken from all the patients before including them in the study.

The study excluded patients with ureteric injuries due to accidental trauma, endo-urological procedure related injuries and patients unwilling to participate in the study. Complete history and thorough physical examinations were carried out in all patients. Investigations included full blood count, blood urea, serum creatinine level, serum electrolytes, serology for hepatitis B and C, chest X-ray and ECG. Abdomino-pelvic ultrasound, intravenous urography if renal function tests were normal, retrograde pyelography and in some cases antegrade pyelography and CT-urography were carried out for assessment.

Iatrogenic ureteric injury was defined as an inadvertent ureteric injury resulting from a surgical

procedure, which required additional surgical procedure for its management. Patients were admitted; and started on intravenous fluids, and third generation antibiotics. Nephrologist, anaesthesiologist and gynaecologist (where appropriate) were consulted prior to surgery. Haemodialysis was carried out if needed.

Patients were followed up at 4 weeks, 3 months and 6 months and then at 12 months. At each visit Full Blood Count, Renal Function Tests, Urinalysis, Urine culture sensitivity (in selected cases) and ultrasound of the renal tract were carried out. At 3 and 12 months intravenous urography (IVU) and renal isotope scan (in selected cases) were carried out.

Cause of ureteric injury, indication of the procedure, presenting features, time from injury to the diagnosis, type of ureteric injury, treatment of ureteric injury, and outcome of treatment were among the variables that were recorded on a *pro forma*. Data was analysed using SPSS-16.

RESULTS

The study included 43 patients. Out of these 33 (76.7%) were female. Mean age was 40 years. The most common cause of ureteric trauma was abdominal hysterectomy 20 (46.5%). Aetiology of iatrogenic ureteral trauma is given in Table-1. All patients were diagnosed in the postoperative period. Patients were referred from other hospitals or periphery since our hospital does not have facilities for general surgical or gynaecological procedures. Mean time from injury to urological consultation was 10 days (range 2–186 days). Presenting features are shown in Table-2. Ten cases (23.3%) presented with anuria. Eight patients had bilateral ureteric injury and two had solitary functioning kidney with injury to ipsilateral ureter. These patients required preoperative hemodialysis.

Table-3 shows types of ureteric injuries. Distal ureter was most commonly injured 34 (79%). Ureteroscopy and retrograde Double J stenting (DJ) was tried in 10 patients and was successful in 5 of them. It obviated the need for surgery in those in whom it was successful. The remaining five patients required open surgery. Antegrade stenting was tried in two patients with success.

Thirty six (84%) patients underwent open exploration soon after the diagnosis after stabilization, out of these 14 (32.5%) required initial percutaneous nephrostomy. Commonest procedure was ureteroneocystostomy, which was carried out in 25 (58.1%) cases. All reconstructive procedures were performed over double J stents. Simple nephrectomy was performed in 2 (4.7%) cases; these patients presented very late with unilateral non-functioning obstructed kidney. Table-4 shows different types of procedures performed. Mean hospital stay was 5 days (range 3–15 days).

Follow up revealed urinary tract infection in 5 (11.6%) cases that settled with antibiotics. Two patients (4.7%) developed superficial wound infection, which required conservative measures. Two patients developed stricture of distal most part of ureter after uretero-neocystostomy for uretero-vaginal fistula. They were treated successfully by ureteroscopic intervention and DJ stenting. There was no deterioration of renal function. Successful outcome was observed in 90% patients. There was no mortality.

Three patients were lost to follow up. Two were Afghan refugees; they migrated back to Afghanistan after surgery. One patient refused to come for follow up despite repeated invitations. Thus, 40 patients completed the study.

Table-1: Aetiology of Iatrogenic Ureteric Injury

Procedure	Number	Percentage
Caesarean section	8	18.6
Abdominal hysterectomy	20	46.5
Colectomy	3	6.9
Appendicectomy	2	4.6
Retroperitoneal tumor excision	2	4.6
Vascular surgery	1	2.3
Other gynaecological procedures	4	9.3
Urological procedures	3	6.9
Total	43	100

Table-2: Presentation of Ureteric Injuries

Presenting Features	Number	Percentage
Per vaginal urine leak	13	30.23
Flank pain	7	16.3
Urinary tract infection	6	13.9
Anuria/oliguria	10	23.3
Flank pain and Urinary tract infection	5	11.6
Non-functioning kidney	2	4.7
Total	43	100

Table-3: Types of Ureteric Injuries.

Types of Ureteric Injury	Number	Percentage
Suture ligation	17	39.5
Ureteric transection	6	14
Excision of ureteric segment	5	11.6
Ureterovaginal fistula	15	34.8
Unilateral ureteric injury	35	81.3
Bilateral ureteric injury	8	18.6

Table-4: Procedures for the Treatment of Ureteric Injuries

Procedures performed	Number	%
Percutaneous nephrostomy *	14	32.5
Ureteroscopy and retrograde Double J stenting	5+	11.6
End to end ureteroureterostomy	4	9.3
Ureteroneocystostomy	25	58.1
Psoas hitch and Ureteroneocystostomy	4	9.3
Psoas hitch, Boari flap, Ureteroneocystostomy	3	6.9
Simple Nephrectomy	2	4.7

*All patients with percutaneous nephrostomy underwent definitive surgery after stabilization of their condition. +Two cases developed ureteric stricture managed by ureteroscopy and DJ stenting. These two cases are not mentioned in the table.

DISCUSSION

Ureteric injury is a serious complication of any surgical procedure. Ureteric injury can occur during endo-urologic procedures and abdomino-pelvic operations. In one study, abdominal hysterectomy was responsible for 54% of all ureteric injuries, colorectal surgery 14%, pelvic surgery 8%, and abdominal vascular surgery for 6% cases of ureteric injury.[1]

The risk factors for iatrogenic ureteric injury include nature and indication of the abdominal or pelvic surgery, patient related factors such as: pelvic adhesions from previous surgeries, history of pelvic radiation, enlarged uterus, pelvic malignancy, pelvic endometriosis, and anatomical abnormalites.[7,8] Surgeon's experience is also an important risk factor.[9]

In our study, abdominal hysterectomy was responsible for 46.5% of ureteric injuries while 18.6% had history of Caeserian section. Five hysterectomies were performed by experienced consultants and were referred from tertiary care hospital; two cases had history of cervical carcinoma with difficult dissection. Rest of the gynaecological cases were either performed by junior doctors in tertiary hospital or were referred from periphery.

Most ureteric injuries occur in the distal most part of the ureter where it is closely related to the uterine vessels. Bilateral ureteric injuries occur in 5–10% patients.[10] In this study 74% (n=39) had distal ureteric injury; bilateral injury was seen in 18.6% (n=8). These figures are comparable to that reported by other studies.[4,10,11]

Presenting features included fever, loin pain, per-vaginal urine leak, prolonged ileus, oliguria, anuria and uraemic symptoms.[10,12,13] About 5% patients remain asymptomatic and present years later with hydro-nephrotic, non-functioning kidney on investigations.[13] The management of ureteric injury depends on the time of diagnosis, patient's condition, nature and site of ureteric injury. If the injury is recognized intra-operatively then it must be managed immediately.[14]

The treatment options range from percutaneous nephrostomy, endo-urological procedures to open surgical repair. Each procedure has its own merits and de-merits. Many authors have suggested that early recognition and management of ureteric injuries is associated with better outcome.[10–12] Delayed diagnosis results in increased morbidity, loss of renal function and even mortality. It is considered the single most controllable factor adversely affecting the outcome of ureteric injuries.[12] Most ureteric injuries after abdomino-pelvic surgeries are diagnosed late.

Many authors recommend percutaneous nephrostomy drainage in cases of absorbable ligature injuries with spontaneous recovery of ureter occurs in many cases.[4,8] Some authors recommend percutaneous nephrostomy drainage in all ureteric injuries with spontaneous recovery of ureter in up to 80% cases.[8,10,15] In a study by Lask *et al*, 20 patients with ureteric injuries underwent percutaneous nephrostomy, out of these 16 (80%) had complete spontaneous recovery of injured ureter after 14–66 days.[15] In our region most patients are uneducated, poor and belong to far flung areas; they cannot manage percutaneous nephrostomy tube at home. In our study percutaneous nephrostomy was carried out in 32.5%. However, nephrostomy tube was used only to stabilize the patients and all of these patients required additional definitive procedures.

Some authors advocate immediate placement of DJ ureteral stents. However, retrograde DJ stenting is possible in only 20–50% patients.[8] DJ stenting obviates the need for definitive surgery in up to 73% patients.[8] In our study retrograde stenting was successfully carried out in 11.6% cases.

In the case of unsuccessful retrograde stenting, a combined approach can be used. Tsai *et al* have reported combined use of ureteroscopy and fluoroscopically guided antegrade snare for ureteral stenting. Six of their patients did not require further intervention. Three cases developed stricture, which was managed by endoscopic balloon dilatation. One patient required ureteroneocystostomy.[16] Other endo-urologic procedures include balloon dilatation, endo-ureterotomy with cold/hot knife, Holmium Laser.

There is considerable controversy regarding the timing of surgical repair of ureteric injuries after uro-gynaecological procedures. Traditional approach is to delay the repair till the inflammation and oedema at the site of injury subside.[8] However, recent studies have reported similar results after early and delayed repair.[4,8,13,17] Early repair is associated with shorter hospital stay compared to delayed repair. In a study by Khaleel al-Awadi *et al*, mean hospital stay was 4.8 days (range 2–8 days) after early repair; hospital stay was 10.1 days (range 6–39 days) after delayed repair.[4] In our study, 84% patients underwent open surgical repair soon after diagnosis and stabilization; mean hospital stay was 5 days (range 3–15 days). This is comparable with other studies.[4,11,13]

Various options include ureteroneocystostomy, Boari flap, Psoas hitch and trans-ureteroureterostomy.[4,11,17] In our study 58.1% underwent ureteroneocystostomy. Ureteroneocystostomy with Boari flap and Psoas hitch was required in 6.9% cases. Follow up revealed ureteral stricture development in 4.7% cases after ureteroneocystostomy. These figures are comparable

with that of other reports. Other options include ileal segment replacement, appendix interposition and auto-transplantation. In our study Nephrectomy was carried out in 4.7% cases; this is similar to that reported by other authors.[18]

Every effort should be made to prevent ureteric injuries. Surgeon must have adequate knowledge of abdominal and pelvic anatomy especially the close relation of ureter with adjacent structures. Urologist must be consulted in the preoperative period in patients at risk for ureteral injury such as those with pelvic adhesions, pelvic radiation, pelvic malignancy, extensive surgery etc. Appropriate imaging of the urinary tract may be required in the preoperative period.

There were many limitations of our study such as small sample size, short follow up and descriptive nature of the study, therefore, caution needs to be exercised to interpret them.

CONCLUSION

Iatrogenic ureteric injury is a serious complication. Urologist must be involved early when iatrogenic ureteric injury is suspected. Timely recognition and intervention is associated with good outcome.

REFERENCES

1. St Lezin MA, Stoller ML: Surgical ureteral injuries. Urology 1991;38:497–506.
2. Carver BS, Bozeman CB, Venable DD. Ureteral injury due to penetrating trauma. South Med J 2004;97:462–4.
3. Fraga GP, Borges GM, Mantovani M, Ferreira U, Laurito TL, Netto NR Jr. Penetrating ureteral trauma. Int Braz J Urol 2007;33:142–50.
4. Al-Awadi K, Kehinde EO, 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;37:235–41.
5. Geavlete P, Georgescu D, Niţă G, Mirciulescu V, Cauni V. Complications of 2735 retrograde semirigid ureteroscopy procedures: a single-center experience. J Endourol 2006;20:179–85.
6. Schimpf MO, Gottenger EE, Wagner JR. Universal ureteral stent placement at hysterectomy to identify ureteral injury: a decision analysis. BJOG 2008;115:1151–8.
7. Chou MT, Wang CJ, Lien RC. Prophylactic ureteral catheterization in gynaecologic surgery: a 12-year randomized trial in a community hospital. Int Urogynecol J Pelvic Floor Dysfunct 2009;20:689–93.
8. Kim J.-H, Moore C, Jones JS, Rackley R, Daneshgari F, Goldman H, *et al*. Management of ureteral injuries associated with vaginal surgery for pelvic organ prolapse. Int Urogynecol J 2006;17:531–5.
9. Hammad FT, Alqaiwani KM, Shirodkar SS. The role of urologists in the management of urological injuries during obstetric and gynaecologic surgery. Int Urogynecol J Pelvic Floor Dysfunct 2010;21:1237–41.
10. Rafique M, Arif MH. Management of iatrogenic ureteric injuries associated with gynaecological surgery. Int Urol Nephrol 2002;34:31–5.
11. Anwar MS, Tariq M, Saeed K, Ghafoor T, Mustafa G. Causes of ureteric injuries and outcome of different surgical procedures for the repair of ureter. J Sheikh Zayed Med Coll 2010;1:16–20.
12. Ghali AM, El Malik EM, Ibrahim AL, Ismail G, Rashid M. Ureteric injuries: diagnosis, management and outcome. J Trauma 1999;46:150–8.
13. Mensah J, Klufio G, Ahiaku F, Osafo C, Gepi-Attee S. Delayed recognition of bilateral ureteral injury after gynaecological surgery. Ghana Med J 2008; 42:133-6.
14. Visco AG, Taber KH, Weidner AC, Barber MD, Myers ER. Cost-effectiveness of universal cystoscopy to identify Ureteral injury at hysterectomy. Obstet Gynecol 2001;97:685–92.
15. Lask D, Abarbanel J, Luttwak Z, Manes A, Mukamel E. Changing trends in the management of iatrogenic ureteral injuries. J Urol 1995;154:1693–5.
16. Tsai CK, Taylor FC, Beaghler MA. Endoscopic ureteroureterostomy: longterm followup using a new technique. J Urol 2000;164:332–5.
17. Routh JC, Tollefson MK, Ashley RA, Husmann DA. Iatrogenic ureteral injury: can adult repair techniques be used on children? J Pediatr Urol 2009;5:53–5.
18. Selzmann AA, Spirnak JP. Iatrogenic ureteral injuries: a 20-year experience in treating 165 injuries. J Urol 1995;155:878–81.

Address for Correspondence:

Dr Saadia Nawaz Durrani, Urology and Transplant Unit, Institute of Kidney Diseases, Hayatabad Medical Complex, Peshawar, Pakistan. **Cell**: +92-343-9069329
Email: sndurrani@yahoo.com