ORIGINAL ARTICLE

Retrospective Analysis of Ureteric Injuries: Etiological, Management and Outcome Details From a Single Clinical Center

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ABSTRACT

Background: Ureteric injuries represent infrequent but devastating consequences of iatrogenic injuries during gynecological, obstetric, pelvic and urological procedures.

Aim: To evaluate the etiology, management and outcome of ureteric injuries over a three-year period in local clinical settings.

Methods: We performed a retrospective study to review the etiology, management, and treatment outcomes in patients presenting with ureteric injuries at our tertiary care single center in Pakistan. The data was analyzed for descriptive statistics using SPSS version 20.

Results: A total of 59 cases of ureteric injuries were identified over a period of three years. Most of the ureteric injuries (83%, 49/59) resulted in the development of ureterovaginal fistula. Among these, around 14% (8/59) cases of ureterovaginal fistula also had other concomitant fistulae, while ureterocutaneous fistula only was seen in another 3% (02/59) of patients. The main etiological factor associated with ureteric injury and subsequent ureterovaginal fistula formation was gynecological procedures (56%, 33/59) followed by obstetric surgeries (32%, 19/59) in our case series. Most frequently, ureteral reimplantation with ureteral stenting (54%, 32/59) and Boari flap reconstruction (27%, 16/59) were used to repair ureterovaginal fistula in our study. While, ureteral stenting alone in repairing ureterovaginal fistula was possible in only 5% (03/59) cases. The overall success rate of ureteric injury repair was 95% (56/59 cases).

Conclusions: Ureteric injuries resulting in ureterovaginal fistula formation are not uncommon after gynecological and obstetric surgeries. Early diagnosis and intervention with surgical approach produces excellent results. **Keywords:** Ureterovaginal fistula; iatrogenic injuries; ureteral reimplantation; ureteral stenting; Pakistan

INTRODUCTION

Ureteric injuries often lead to fistula formation which refers to abnormal connection between ureter and vaginal tract manifesting mostly as continuous urinary leakage from vagina along with normal micturition and rarely with anuria if ureters ligated bilaterally. It is associated with significant morbidity and healthcare burden in terms of requiring a secondary surgical, and often leads to prolonged hospital stays, risk of deteriorated renal function particularly when ureters are ligated bilaterally, and urosepsis^{1,2}. In addition to the clinical situation, ureteric injuries also have devastating social and psychological effects on woman's quality of life involving depression, social isolation and even divorce^{3,4}.

Ureterovaginal fistulas are mostly caused by iatrogenic ureteral injuries following gynecological procedures (most commonly hysterectomy) in the developed world or after obstetric procedures (most often following caesarian section) in the low-resource settings^{2,5}. However, they can also result from or associated with normal childbirth, radiation therapy, colorectal and vascular surgeries, endoscopic urology surgery, abdominal penetrating injury, malignancy, and endometriosis^{3,6,7}.

Estimates show that there are around three million women globally with an untreated fistula, and the relative incidence of fistulae varies between resource-limited and

Received on 15-04-2020 Accepted on 27-08-2020 resourceful settings where about 30,000 to 130,000 cases of fistulae are reported annually mostly from Africa and Asia². In general, the incidence of iatrogenic ureteral injuries leading to fistulae formation is 0.5-2.5% during major gynecological procedure⁷.

latrogenic ureteral injuries resulting in fistulae formation can be identified intra-operatively in even in the resource-limited settings⁵, however, diagnosis is often established after surgery by a combination of relevant medical history, clinical examination and appropriate radiological investigations. Cystoscopy, ureteroscopy and vaginal examination is often performed to identify or rule out concomitant vesicovaginal fistula. Advances in endourological treatment helped with ureteral stenting as first line treatment option for ureterovaginal fistulas⁽⁶⁾, however, this is not the case seen in routine clinical practice and surgical procedures are often used in this regard as evident from published literature during the last decade for management of ureterovaginal fistulas in local as well as international settings^{5,6,8-11}.

This retrospective study analyzes and describes our demographic, diagnostic, etiological and interventional experience regarding ureterovaginal fistulas in local clinical settings.

SUBJECTS AND METHODS

The present retrospective study reviewed the medical data of 59 patients who were diagnosed with and subsequently

received treatment for ureteric injuries at Department of Urology, Sir Ganga Ram Hospital, Lahore, Pakistan, over a time period of three years (from March, 2017 to March, 2020). All patients which presented in the outpatient clinic or emergency room or for whom pre-operative calls were received and had a confirmed diagnosis of ureteric injury were included in this study. The patients were selected by a nonprobability purposive sampling method. Patients where urinary incontinence was explainable by causes other than ureteric injury and patients with other fistula types (including vesicovaginal and rectovesical) were excluded, unless a concurrent ureteric injury was also identified. Medical data of patients with ureteric injuries was evaluated regarding diagnosis, management and outcomes. Approval of study protocols for this retrospective record review was obtained from Ethical Review Committee of Sir Ganga Ram Hospital, Lahore, Pakistan.

Diagnosis of ureteric injury was confirmed after careful review of detailed medical and surgical history, physical examination, routine laboratory investigations (including complete blood count, urine routine examination and clinical biochemistry data), and radiological investigation including ultrasonography and contrast studies (*i.e.* intra-venous pyelogram with cystogram or computed tomography urogram). In all patients with ureteric injuries, surgery was planned and under general anesthesia, cystoscopy and uretroscopy was performed along with vaginal speculum examination.

Ureteric injury was managed by either using DJ Stent or retroperitonal approach where ureteric reimplantation was done by ureteroneocystostomy or Boari flap reconstruction, accordingly. The success of the treatment procedure was taken as absence of any urinary incontinence with restoration of satisfactory renal function in the last follow up done.

Retrieved medical data of included ureteric injury patients was entered into and analyzed by SPSS version 20. Descriptive statistics, such as frequencies and percentages, were used to present the diagnostic, etiological, interventional procedures and their outcome data in the present sample set.

RESULTS AND DISCUSSION

Retrospective data analysis identified a total of 59 patients with ureteric injury included in the present study. Of these, ureteric injury lead to ureterovaginal fistula formation alone in 83% (49/59) cases, while another 10% (06/59) and 3.5% (02/59) ureteric injury cases had ureterovaginal fistula with concomitant vesicovaginal fistula and vesicovaginal fistula + rectovesical fistula, respectively. Another 3.5% (02/59) ureteric injury patients manifested with ureterocutaneous fistula. Ureterovaginal fistula was seen unilaterally in 82% (40/49) cases, while it was bilateral in 18% (09/49) cases (Table 1).

As presented in Table 2, majority (56%, 33/59) of the ureteric injury cases were seen following gynecological procedures that involved mostly abdominal hysterectomy (82%, 27/33) followed by vaginal hysterectomy (9%, 03/33) and pelvic malignancy (9%, 03/33), respectively. While 32% (19/59) cases of ureteric injury cases ensued after obstetric surgeries including caesarian hysterectomy (68%, 13/19) and caesarian section (32%, 06/19). Yet another

10% (06/59) cases developed ureteric injuries after urological procedures comprising ureteroscopy (83%, 05/06) and ureterolithotomy (17%, 01/06), respectively. The present sample set had only one case (2%, 01/59) of ureteric injury in a male patient as a result of penetrating abdominal injury and ureterolithotomy.

All of the ureteric injury patients were female except two. The mean age at diagnosis of ureterovaginal fistula patients was 41.42 ± 8.43 years (range 25-57 years). The principal clinical presentation in most of the ureterovaginal fistula patients was a classical history of continuous urinary leakage along with normal micturition.

03 out of 59 (5%) ureteric fistula patients were managed with double-J ureteral stenting, which was successful in 02/03 of attempted cases (success rate-66.6%) and subsequently treated by implantation. Whereas, 32/59 (54%) ureteric fistula patients required ureter reimplantation with ureteral stenting, and another 16/59 (27%) underwent Boari flap reconstruction. 08/59 (13.5%) ureteric fistula cases had concomitant vesicovaginal fistula or vesicovaginal fistula + rectovesical fistula, which were repaired in the same setting with a success rate of 75% (06/08 of these cases). Overall, the success rate of ureteric injury repairs was 95% in the present study with only 03/59 cases requiring additional repair procedures to achieve complete absence of any urinary leakage with restoration of adequate renal function (Table 3).

Ureteric injury is a rare but devastating complication of gynecological and obstetric procedures. We retrospectively review our three-year experience regarding 59 local ureteric injury cases at a single center in Pakistan and report that; (1) \approx 83% of ureteric injuries manifested as ureterovaginal fistula whereas 13.5% ureteric fistula cases also had other concomitant fistulae, (2) gynecological procedures (\approx 56%) followed by obstetric surgeries (\approx 32%) were the most common etiological factors associated with ureteric injuries in our case series, and (3) ureteral reimplantation with ureteral stenting (\approx 54%) and Boari flap reconstruction (\approx 27%) was used to repair ureteric injury in our study.

In the pelvic region, ureter is intimately associated with female genital tract, which makes lower ureter most susceptible to iatrogenic injury during gynecological procedures (especially abdominal hysterectomy) and obstetric surgeries (particularly caesarean hysterectomy and caesarean section), the most common causes of ureteric injuries worldwide^(1,10). Complete or partial ureteral transection (64%), laceration/excision (29%), partial or complete suture ligation (7%), crush injury, and ureteral ischemia resulting from operative mediated compromised ureteral blood supply as well as urinary extravasation following creation of distorted anatomical planes during the course of surgical intervention highlight some of the mechanisms that may lead to ureteric injury and fistula formation^(1,11,12).

The last decade has seen a change in etiological trend of ureterovaginal fistula formation with apparent differences between developed and developing world where most fistulae result from gynecological procedures in resourceful settings whereas obstetric fistulae are reported mainly in resource-limited settings^{1,2,3}. In our study, the principal etiological factor leading to ureterovaginal fistula

formation was gynecological procedures (56% cases), mainly hysterectomy (>80% of these procedures). This is consistent with reports from earlier such studies from Indo-Pak region⁸⁻¹¹ and United States⁶ where 60-90% of ureteric injuries occured after gynecological procedures. In contrast, a large retrospective review of ureteric injuries from 11 countries (mostly African) reported that about 67% of ureterovaginal fistula cases were due to obstetric procedures⁵.

Although diagnosis of a ureteric injury can be made intra-operatively, unfortunately, this represents only a fraction of ureterovaginal fistula cases. Patients usually present within 4 weeks of surgery with constant urinary leakage which may be accompanied by flank pain, urinary tract infection and obstructive uropathy, and thus have to endure long periods of continuous urinary leakage which may aggravate clinical situation in addition to causing social and psychological problems^{5,10}. A confirmed diagnosis of ureteric injury can be made by a combination of relevant medical/surgical history, thorough clinical examination and use of suitable imaging modalities including intra-venous pyelogram with cystogram and/or computed tomography urogram. Cytoscopic examination is essentially useful when evaluating ureterovaginal fistulae as previous studies report that in 7-15% of cases, ureterovaginal fistula is accompanied by other fistulae (most commonly a vesicovaginal fistula)^{6,10}. Indeed, in our study we also detected other concomitant fistulae in 13.5% (8/59) of ureteric injuries cases. Of the 40 unilateral ureterovaginal fistulae observed in our study, 50% involved left ureter and the other 50% involved right ureter. Interestingly, many of the previous investigations report that left ureterovaginal fistulae are more commonly seen as compared to right sided fistulae with possible explanation that operating surgeons usually stand on the right side of the patient under procedure and in case of bleeding on the left side efforts to control it using clamps are made under obscured vision9,11,13.

A successful management of ureterovaginal fistula involves resolution of the urinary incontinence along with prevention of urosepsis and ensuring preservation of normal kidney physiology. Factors of pivotal importance in determining a successful treatment outcome in repairing ureterovaginal fistula include time intervals between diagnosis of the fistula and iatrogenic injury and intervention, and site and degree of ureteral injury. An early and successful intervention using conservative management by ureteric stenting after diagnosis of ureterovaginal fistula may avoid surgical necessity and associated morbidities. If not, surgical repair by ureteral reimplantation, which may require psoas hitch or rarely boari flap when the gap between ureter and bladder is more, has also produced excellent results with minimal complications, making it the procedure of choice for the repair of ureterovaginal fistula in many clinical settings for the last few years^(5,9-11).

In our study, repair of the ureterovaginal fistula in >50% of cases was performed by ureteral reimplantation with ureteral stenting, while ureteric injury repair in 27% cases required Boari flap reconstruction. In only 03/59 ureteric injury patients, double-J stenting was employed alone. A similar trend was observed in other studies where 66-87% of ureteric fistula repairs involved ureteral reimplantation (ureteroneocystostomy), Boari flap or psoas hitch in Indo-Pak and African/Asian settings with only small fraction of ureteric fistula cases being managed by ureteral stenting alone (17-26%)^(5,9-11). In contrast, a US study employed conservative management of simple ureterovaginal fistula by ureteral stenting as the first line therapy in 83% cases⁶. The difference perhaps lies in improved ability to successfully place a ureteral stent by making use of technical advances in endoscopic surgery and interventional radiology in more developed US settings, and also in careful selection of suitable ureteric fistula patients (un-complicated ureteric fistula resulting from hysterectomy) and early intervention as an Indian study was also able to use ureteral stenting alone successfully in 96% of cases to repair ureterovaginal fistula⁽¹⁴⁾. The overall success rate of repairing ureteric injuries was 95% in our study which is also comparable with that reported in the previous studies^{5,9,10,11}.

In conclusion, we presented a series of 59 patients with ureteric injuries managed at a single local center in Pakistan. latrogenic injuries following gynecological / obstetric procedures represent the leading cause of ureterovaginal fistula formation. Thorough training in the female pelvic surgeries and improvement in the obstetric care may help in preventing these iatrogenic injuries and subsequent fistulae formation. Endoscopic ureteric stenting may represent an effective and minimally invasive approach towards management of ureterovaginal fistula provided early intervention, surgeons prior experience and adequate use of instrumentation. In complicated cases or where placing ureteral stents is not feasible, surgical intervention involving ureteral reimplantation also offers excellent results for repairing ureteric injuries with no recurrence and minimal complications.

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Table 1: Diagnostic features of the ureteric injury patients included in this stud	y
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Serial number	Diagnosis	Number	Percentage
1	UVF only	49	83%
1	Unilateral	40	82%
11	Bilateral	09	18%
2	UVF with concomitant VVF	06	10%
3	UVF with concomitant VVF and RVF	02	3.5%
4	UCF	02	3.5%
	Total	59	100%

UVF; Ureterovaginal fistula, VVF; Vesicovaginal fistula, RVF; Rectovesical fistula, UCF; Ureterocutaneous fistula.

Serial number	Etiological factors	Number	Percentage
1	Gynecological procedures	33	56%
1	Abdominal hysterectomy	27	82%
11	Vaginal hysterectomy	03	9%
III	Pelvic malignancy	03	9%
2	Obstetric surgeries	19	32%
1	Caesarean hysterectomy	13	68%
II	Caesarean section	06	32%
3	Urological procedure	06	10%
1	Ureteroscopy	05	83%
11	Ureterolithotomy	01	17%
4	Penetrating pelvic trauma	01	2%
	Total	59	100%

Table 2: Etiological factors associated with ureteric injuries and fistula formation in the present study

Table 3: Procedures used to repair ureteric injuries

Repair procedure	Number of	Successful repair	Repair requiring
	patients		additional procedures
Ureteral stenting alone	03	02	01
Ureteral reimplantation with ureteral stenting	32	32	00
Boari flap reconstruction	16	16	00
Ureteral reimplantation with simultaneous VVF repair	06	05	01
Ureteral reimplantation with simultaneous VVF, RVF repair and colostomy	02	01	01
Total	59	56 (95%)	03 (5%)

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