Original Article

Ureteric Injuries Following Obstetrics and Gynaecologic Surgeries: A Single-Center Experience

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Abstract

Background: Ureteric injuries are not uncommon in obstetric and gynaecologic surgeries. Some specific procedures predispose to these injuries. Recognition is often delayed. This study aims to present a single-center experience on the presentation, risk factors, and management of ureteric injuries.

Methodology: We retrospectively reviewed case files of patients primarily presenting or referred to our urology division with ureteric injuries following obstetrics or gynaecologic surgeries from June, 2005 to May, 2015. Data extracted included the time of presentation or recognition, the specific offending surgery, the laterality and site involved, the repair performed, and outcome.

Results: Twenty-three patients had injuries (with a total of 25 ureters involved owing to 2 bilateral injuries). Caesarian-section is the commonest offending surgery in 13 (56.5%). The reasons for early recognition were sudden anuria in two and urinary leakage in the operating field in four patients constituting 26.0%, while 17 (74.0%) were recognized in the post-operative period. Urinary fistulae were the commonest presentation in 13 (76.5%) patients recognized postoperatively. Transection and ligation are the commonest mechanisms of injury. The distal third was the site involved in all patients, while ureteroneocystostomy alone was the most predominant repair in 18 (72.0%). Ureteroneocystostomy with Psoas hitch and Boari flap reconstruction was offered in six (24.0%) suggesting greater than5cm ureteral loss.

Conclusions: Ureteric injuries often occur following obstetrics and gynaecologic surgeries. Caesarian-section is the commonest predisposing surgery in our center. Prompt recognition and repair is recommended.

Keywords: Ureteric injuries; Obstetrics and Gynecologic surgery; Iatrogenic.

Key Message: Ureteric injuries following obstetrics and gynaecologic surgeries are not uncommon in our centre. Caesarian-section is responsible for 56.5% of these injuries in this study, differing from South-West and South-East, where findings suggest that hysterectomy is the predominant offending surgery. The clinical presentations, injuries profile, and repair modalities do not differ from other centres.

Introduction

The common embryologic origin, anatomic proximity, and connectivity of the urinary and the genital organs predispose to ureteric injuries during obstetrics and gynaecologic surgeries. These injuries commonly occur below the level of the pelvic brim where the ureter crosses the iliac artery (at distal third) as it courses posterior to the broad ligament and ovarian vessels. At the base of the cardinal ligament where it crosses the uterine artery, the ureter is at a

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distance of about 12mm from the vagina and as it moves towards the bladder it becomes even closer, and this put it at risk of injury during surgical procedures in the pelvic region.[1]

It is thus not an uncommon complication of obstetric and gynaecologic surgeries worldwide. The incidence of iatrogenic ureteric injuries varies with the level of advancement of the treatment centers and the experience of the operating gynaecologist, and generally ranges from 0.5% to 10.0% from different studies.

The likelihood of injury to the ureter is increased in radical gynae-oncologic operations, hysterectomies, caesarean sections, surgeries for inflammatory pathologies, surgeries in a previously explored lower abdomen, or for severely ruptured uterus. The risk is much worse when some of these operations are difficult, carried out as emergencies, or done by junior and inexperienced surgeons. Ureteric injuries have also been reported in vaginal and laparoscopichysterectomies. Injuries are rarely reported during the ovarian cystectomy or retrieval of the oocytes for in vitro fertilization (IVF).

Some of these factors are perhaps inherent in underdeveloped nations like ours,it is therefore not surprising that suture ligation, transection, excision, crush, or laceration of the ureter can occur during obstetrics and gynaecologic surgeries. When the terminal part of the ureter is transected and incorporated into the suture bites taken to ligate bleeders in the vicinity of the vagina or while closing the vaginal stump, this will eventually slough off and may present with uretero-vaginal fistula.

This injury is a potentially distressing condition. Its medico-legal implication has been a major concern when such incidences occur. It can lead to anuria, uretero-vaginal fistula, urinoma, wound infection, and urosepsis which might result in longer hospital stay, repeat surgeries, potential kidney function impairment, anxiety, psychological devastation, waning quality of life, and even mortality.[1]

Intra-operative recognition and prompt management are therefore important steps in preventing ureteric injury with its attendant complications. The pattern and outcome of management of ureteric injuries differ from one setting to another, from surgeon to surgeon, and from one type of operation to another. Thus, this study aims to present our experience on the pattern of presentation, risk factors, and management of ureteric injuries following obstetrics and gynaecologic surgeries.

Subjects and Methods

This was a retrospective study of all patients with ureteric injuries following obstetrics and/or gynaecologic operations primarily managed in our hospital or referred to urologists in our center between June 2005 and May 2015. Patients with ureteric injuries from other surgical causes were excluded. Approval of the institutional ethics review board was obtained.

Information on the period the injury was recognized, cause of injury, type of injury, the side, and site of injury, complications that ensued, the definitive treatment offered, and outcome of management were noted. Early complications were defined as those recognized on-table or within the immediate post-operative period while late complications were defined as those that were recognized in the late postoperative period. Data was analyzed using Statistical Package for Social Sciences version 20.0.

Results

Hospital records of a total of 23 patients were retrieved. Six (26.0%) were recognized intra-operatively while 17 (74.0%) were discovered in the post-operative period. There were a total of 25 ureteric injuries, bilateral injuries were seen in two patients (8.7%) while unilateral injuries occurred in 21 (91.3%). The offending obstetrics and gynaecologic surgical causes of the ureteric injuries are shown in Table 1.

Anuria occurred in four patients (66.7%) whose injuries were detected intra-operatively while urine spillage into the operation field was seen in only two (33.3%) of them. The pattern of presentation of patients who had late recognition of their ureteric injuries is as shown in Table 2. All the injuries (100.0%) occurred in the distal one-third of the ureter. The most common mechanism of injury was ureteric transection and suture ligation seen in 10 (40.0%) and eight (32.0%), respectively. The specific pathologies and types of ureteric injuries identified are shown in Table 3. Early recognition in six patients was due to combined unilateral ligation and contralateral transection in three patients (50.0%), bilateral ligation in two patients (33.3%), and bilateral transection in one patient(16.7%). The definitive treatment (ureteric surgeries) performed in these patients are shown in

Table 4. No death was recorded in all the patients managed.

Table 1: Surgical cause of ureteric injuries in the patient population

Surgical Procedure	Frequency	Percentage (%)
Caesarian Section	13	56.5
Hysterectomy	7	30.4
Myomectomy	3	13.0

Table 2: Clinical presentation in patients with late recognition of ureteric injuries (N=17)

Clinical Presentation	Frequency	Percentage (%)
Ureterovaginal and ureterocutaneous fistula	13	76.5
Flank and lower quadrant abdominal pain	7	41.2
Nausea, occasional vomiting, and fever	6	35.3
Anuria	2	11.8
Urinary ascites	1	5.9

Table 3: Causative pathology of the ureteric injuries in the patient population

Pathology	Frequency	Percentage (%)
Ureteric transection	10	40.0
An excised segment of ureter	5	20.0
Suture ligation	8	32.0
Unknown	2	8.0

Table 4: The definitive ureteral surgeries carried out in a total of 25 ureters

Type of ureteral surgery	Frequency	Percentage (%)
Ureteric reimplantation only	18	72.0
Ureteric reconstruction with Boari flap	2	8.0
Ureteric reimplantation with psoas hitch	4	16.0
De-ligation	1	4.0

Discussion

Ureteric injuries are not uncommon following abdominopelvic surgeries. Incidence rates of ureteric injuries of 0.4-2.5% of all open abdominopelvic surgeries have been reported. This is particularly so for obstetric and gynaecologic surgeries, which account for 52-82% of all iatrogenic ureteric injuries.[7,8] However, the reported incidences vary with the type of gynaecologic, obstetric, or abdominal surgeries carried out, the center, and the surgeon's experience. Carley et al. in 2002 reported occurrence of ureteric injuries in 0.36% following abdominal hysterectomy, 0% from vaginal hysterectomy, and 1.71% for obstetric hysterectomy, while Gilmour et al. observed ureteral injury following vaginal hysterectomy in the rate of 0.2 injuries per 1000 cases (or 0.02%), and 1.3 injuries per 1000 cases (0.13%) for total abdominal hysterectomy. The incidence increases to as high as 11% in bladder neck suspension, urethropexy, sacrocolpopexy, and vaginal vault suspension surgeries.In this study caesarian section is responsible for 13 (56.5%), hysterectomy in 7 (30.4%), and myomectomy in 3 (13.1%). This is contrary to the findings of Oboro *et al.* at Ile-Ife, who found, abdominal hysterectomy and salphingo-oophorectomy responsible for 83% and 17% respectively in the 12 patients reviewed. Tijjani et al. in Lagos University Teaching Hospital (LUTH) also observed that hysterectomy was the predominant offending surgery, in 75% of their patients that had ureteric injuries. The reason for the differences may not be unconnected with the frequency of late presentation and complicated labour requiring emergency caesarian section in the North-Western part of Nigeria where this study was conducted.

Intra-operative recognition of injury was possible in six patients in this study (26%) and 17 (74%) in the post-operative period, which seem to agree with the findings of Oboro et al. who observed 42% and 58% for intra-op and post-op recognition respectively. Tijjani et al. in the setting of Lagos, had six (30.0%) cases of intra-op recognition, and 70.0 % recognized post-operatively, which is in keeping with our findings in this study.

Many studies from other parts of the world also supported the findings of a larger percentage of these injuries being discovered post-operatively.[7] This may not be unconnected with the fact that a larger proportion of these cases occurred in secondary health centers (in both public and private settings) which are managed by medical officers without specialist training or sufficient experience.

The majority of cases recognized early or intra-operatively were in the tertiary setting. The six patients whose ureteric injuries were discovered intra-operatively were in our center, and this underscores the significance of expertise and experience, thus the observed lower incidence of ureteric injuries in the tertiary hospital settings where surgeries are usually carried out by a specialist or under specialist supervision. Sharfi et al. propose that postoperative anuria, though uncommon, should prompt urgent evaluation. This was also what prompted urgent evaluation of two patients with anuria in our study within 24 hours post-hysterectomy.

Some commonly identified risk factors are the anatomic factors, which include abnormal course of blood vessels supplying the genital system, anatomic variation in the ureteric course,previous pelvic fracture and difficult surgeries. Other factors include previous surgery, radiotherapy, endometriosis, pelvic organ prolapse, technical difficulties such as poor lighting, bloody fields, poor suctioning, sloppiness on the side of surgeon, skill and experience of the surgeon, pelvic cancer surgery, and massive pelvic haemorrhage.' In our study caesarian section is the predominant risk factor followed by hysterectomy in 13 and 7 patients, respectively. This may appear similar to the findings of Tijjani et al. who discovered that the major risk factors were excessive intra-operative bleeding and emergency surgeries which characterize caesarian section and caesarian hysterectomy which is coincidentally the bulk of the offending surgery in our study.

The site of injury may vary with the type of surgery and the primary disease. However, in obstetric and gynecologic surgeries injury predominantly occurs at the distal third of the ureter. These are the findings of all the patients studied in this center. Tijjani et al. also found that all injuries occurred in the distal ureters and the most common location being the region of the uterine artery underneath the broad ligament, at infundibular ligament, and the ureterovesical junction in 17 patients (77.2%).In endourological procedures and some radical retroperitoneal surgeries injuries could occur at any point along the entire length of theureter.

Typical symptoms occur in about 50% of women. In our study, all were recognized by specific symptoms predominantly anuria and uterovaginal or uretero-cutaneous fistula in early and late recognition, respectively. Oboro et al. and Obarisiagbon et al. reported similar presenting symptoms of urine leakage per vaginum being the most common in 41.7% and 75% respectively.' About two-third of these injuries are missed intra-operatively. In this study, 74% were recognized postoperatively, Oboro et al.: 58%, and Tijjani et al.: 66.7%, respectively.'

Urine leakage was the single largest pattern of presentation that called for attention and swift search for ureteric injury in this study in 13 patients (57%). This is also in keeping with the findings of Tijjani et al. who found urinary ascites, leakage in the surgical wound, uretero-vaginal fistula in a total of 11 (55%) of his patients diagnosed postoperatively. He also documented findings of urinary extravasation into the peritoneum (or operation field) intra-operatively which prompted intra-operative recognition in 6 patients (30%). This is similar to the findings of this study where six cases or 24% had bilateral injuries causing anuria, urinary extravasation into the operating field following transection of one ureter, and ligation of the contralateral ureter resulting in zero urine volume in the bag. This, however, slightly differed from Oboro et al. in whom direct observation, methylene blue injection, cystoscopy visualization, or failed retrograde passage of ureteral stent after cystostomy prompted their early recognition.

It is a good practice in obstetrics and gynaecologic surgeries to always examine the urine bag at intervals or before wound closure for the volume of urine made and the color of urine for blood in the urine. Anuria or small urine volume which is not commensurate with the volume of fluid given in the face of absent significant blood loss or straight away blood in urine almost invariably translates to injury to the urinary system.

A late presentation with the development of hypertension secondary to obstructive uropathy has also been observed by Sharfi et al. This was not observed in this study. However, intravenous urography was carried out in one patient who presented with abdominal pain in a previous caesarian section and concurrent findings of dilated collecting system on ultrasound suggesting unilateral obstructed system. It is possible that many more cases of unilateral obstructions with anormal contralateral system are there but have not yet presented from our end.

It has been noted that typical symptoms might occur in only 50% of women with ureteric injuries. In suspected cases, investigations are needed to establish the renal function, rule out hydronephrosis, and evaluate continuity in the ureter. This may suggest that many of these victims are out there with their pathologies undetected.

Women may occasionally present with retroperitoneal urinoma, which could be confirmed by an ultrasound scan. In this study only one patient presented with urinoma that was detected by ultrasound.

The types of injuries observed include ligation, kinking, transection (partial or complete), devascularization, and crush injuries. Oboro et al. noticed transection (58%), Ligation (33%), Crushing (8%). In this study transection and ligation injuries constitute 40% and 32%, respectively. Excision and ureteral loss were seen in five cases (or 20%), and no clear-cut mechanism was reported in two (8%). This suggests almost a similar mechanism of injury in the two independent studies.

Bilateral injuries occurred in two patients (or four ureters) 16.0% of total ureteral injuries in our study, Oboro et al. reported none, Obarisiagbon et al., 18.75% Tijjani et al., observed in three patients as suggested by onebilateral injury in the group recognized intra-operatively and tworecognized in the early postoperative period (15.0%)." This shows the rarity of bilateral injuries. While Obarisiagbon et al. reported that ureteral injury is more common on the left (44%), Oboro et al. noted that it was more common on the right (58%). In this study, the right is 52.0%, slightly higher than the left.'

A significant ureteral loss was noted in six ureters (24.0%) of 25 ureteral injuries, whose re-operations required some critical maneuvers including psoas hitch in four (16.0%) and reconstruction with Boari flap in two (8.0%), suggestive of >5cm loss of ureteral length. Oboro et al. also recorded ureteroneocystostomy in 25%, Boari flap in 16.7%, Psoas hitch in 16.7%, and ureteroureterostomy in 25%. De-ligation was accomplished in one patient in this study. One study in India has reported successful de-ligation in four patients on one side, and managed by only ureteral stent placement prophylactically. Tijjani et al. reported ureteroneocystostomy (76%), ureteroureterostomy (18%), and nephrectomy (6%). There was no indication for nephrectomy in our studies. The need for nephrectomy may be a fall-out of complications of pains, renal swelling, and/or hypertension in a setting of a non-functioning renal system.

A high index of suspicion is essential for early recognition. Missed ureteric injuries were reported in eight (4.9%) patients who presented with prolonged ileus, fever, frank pain, anuria, haematuria, and elevated serum creatinine. Investigations usually aim to establish the renal function, rule out hydronephrosis and determine ureteral continuity.

Ureteric injury can be detected by visual inspection for ureteric contusion or injected dye spillage or grossly distended ureter. Cystoscopy to see a bubble or blood-tinged urine through a ureteric orifice is also carried out in some settings. The use of intraoperative cystoscopy in a urogynecological (stress incontinence) operations revealed an incidence of urologic organ injury in 2.6-8 %. Whereas in a major benign gynecological operations intraoperative cystoscopy found otherwise undetected injury in only 0.4% cases. They propose that since cystoscopy is cost-effective it should be considered in complex cases. Cystostomy and retrograde passage of ureteral catheter and retrograde pyelogram or IVU are also good practice. Good knowledge of surgical anatomy of the ureter, supervised surgeries, good surgical exposure, meticulous ureteric dissection, clear identification of the ureter occasionally aided by cystoscopically inserted ureteric stents, open bladder cannulation, and avoiding blind ligation of blood vessels will profoundly improve these pitfalls. Chou et al. however, in a randomized trial comparing preoperative ureteral catheterization *versus* no catheterization for major gynaecologic operations, found a rate of injury of less than 1% in each group and no statistical difference observed between the two. It has been thought that preoperative stenting may increase the chance of ureteral injury by catheter displacing the ureter into an ectopic anatomical position and may increase the likelihood of intraoperative injury.

Lighted stents have also been proposed as a solution to identifying the ureters during laparoscopic procedures. A recent review of experience with lighted stents used for complex laparoscopic cases reported no ureteral injuries in the 145 patients for whom lighted ureteral stents were placed preoperatively. Although the cost of stent and stenting may be expensive and require special equipment, the authors think that the benefit outweighed the cost of even a single ureteral injury over a surgeon's career.

There were no mortalities recorded and no significant morbidity observed in this study. No patient required a redo surgery or urine diversion, nephrectomy, or other means of treatment. All patients fared well postoperatively.

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