

A six-year retrospective clinical review of iatrogenic injuries repaired in a resource- deprived setting

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Abstract

Introduction: Ureteric injuries resulting from iatrogenic causes is over 70% with about 75% of these cases diagnosed in the post-operative period with complications that increase morbidity and treatment cost.

Objective: The purpose of the study is to identify risk factors for iatrogenic ureteric injuries(IUI) from open surgical procedures and the clinical outcome of interventions.

Patients and methods: Clinical records of patients with IUI between 2015-2021 who were repaired at the urology units, MMCH and HTH were retrieved. Important data extracted included patients' demographics, clinical presentation, primary surgery details, time from surgery to injury types of ureteric injury, complications, and interventional outcomes data were extracted and analysed using the Statistical package for social scientists (SPSS version 24).

Results: Twelve patients with 19-injuries aged between 24 - 54 years were treated. Injuries resulting from hysterectomy 83.3%, Caesarean section, and hernia repairs resulted in other 16.7%. Most were post-operative diagnoses after 48-hours(7/12). Bilateral injuries occurred in 7 cases(14/19 injuries) performed entirely by non-surgeon clinicians. Intra-operative recognition was related to unilateral damage and surgeries performed by surgeons. Ureteroneocystostomy(14/19), uretero-ureterostomy(1/19), and open suture release were the procedures

Discussion:

Open hysterectomy(83.7%) was the single surgery with many IUI. Outcome indicators related to major presenting complications, frequency, bilateral and late recognition of injuries, were those performed by general physicians on mostly elective cases. This pattern is a pre-operative predictive factor of the worst IUI occurrence.

Conclusion:

Mishaps during hysterectomies by none-surgeon clinicians are the single dangerous risk factor for complicated open surgery IUIs in the Volta region.

Introduction

Iatrogenic Ureteral Injury (IUI) is a potentially devastating complication of open surgery as it often encounters unnoticed particularly the pelvis where recurrent operations, inflammatory diseases, structural similarity, and tumours occur most. IUIs occur in about 75% of pelvic surgeries which is over 1.5% of all the pelvic open surgical procedures and 1.3 per 1000 gynaecologic surgery^{1,2,3}. Immediate diagnosis often poses a challenge as intraoperative haemorrhage, adhesions and abnormal course of ureters may obscure injury prediction signs or prevent direct ureteral exploration leading to over 70% diagnosed after surgery^{4,5}. In addition, the lack of endourological set-ups in most resource-deprived facilities for standard intraoperative ureteric delineation after major pelvic surgery makes damage diagnosis difficult. Delayed injury diagnosis precludes immediate repair and predisposes the patient to develop intra-abdominal sepsis, flank pains, leucocytosis, kidney damage, and or ureteral stricture formation with potential medical litigation⁶. The limited kidney replacement therapy and ureteral re-constructive centres, the high treatment cost especially in low-income areas further predispose these patients

to higher mortality from complications. To reduce these complications and subsequent morbidities associated with IUIs, identifying preventive factors or factors that enhance early recognition is very important. Analysis of these injuries will give clinicians a detailed understanding of factors that led to the unintended damages or influenced delayed diagnosis.

We present a retrospective study over six years of open surgery IUIs that was surgically repaired. Open pelvic surgery is performed frequently in low resource centres where laparoscopic services are often lacking and is a definitive way of diagnosing, classifying, and repairing most of these injuries. We believe the findings in this study will help shape practice and minimise ureteral injuries.

Methodology

Study design

This was a two centres retrospective study involving the retrieval and analysis of medical records of IUI patients who were managed at the Margaret Marquart Catholic Hospital (MMCH), Kpando, and Ho Teaching Hospital (HTH), Ho in the Volta Region of Ghana between January 2016 to October 2021. These two hospitals had urologists stationed over the study period who received and managed IUIs from most parts of the Volta Region of Ghana.

Patient records that were included in the study satisfied the following criteria:

1. The patient had open surgery at a primary facility
2. The ureteral injury was confirmed and had been repaired
3. Information on biodata, indications for the first surgery, diagnosis of IUI, repair, and complication required for the study is complete

Ureteral repairs for patients with congenital anomalies, other trauma, and patients with inadequate information were excluded. The study was approved by the Ho Teaching Hospital Research and Ethical Committee with reference No. HTH/RPPME/E-1 and approval identity HTHREC (15) FC-2022. Verbal and written informed consent was sought from all patients and both institutional for the extraction of data and use for publication.

Data extraction

The data extracted from patients' folders included age, sex, primary surgery records and any pre-operative imaging of ureters, clinical presentation, resuscitation required, types of injuries, evidence of previous adhesions separated (previous surgical history, raw areas, fibrous tissues at points of dissection recorded), multiple suturing at vascular areas for bleed, postoperative blood loss, wound infection, re-laparotomy, renal function, deep vein thrombus formation and days spent in the hospital. There was no mortality. The source of information included the emergency registers, theatre, and ward records. The data was analysed using SPSS version 24.0 and descriptive statistics presented using frequencies and percentages

Results

Characteristics of Cases Under Reviewed

Table 1 shows the characteristics of all the cases diagnosed and managed with iatrogenic ureteric injuries within the period under study. A total of 12 cases were identified aged between 24 to 59 years (mean age 37.5 ± 9.3 years). Twenty-five percent (21% injuries) of the cases were within the age 20–29 years and 41.7% (42.2% injuries) were between 30–39 years. Almost all injuries (94.7%) occurred in females (11/12). Elective abdominal hysterectomy for uterine fibroid was the main indication for primary surgery in 8 (66.7%) cases or 68.4% of total injuries while emergency hysterectomy due to abnormal uterine bleed or postpartum haemorrhage resulted in 2(16.7) cases or 21% of total injuries and 5.3% related to Caesarean section for obstructed labour. One injury resulted from an emergency inguinal hernia procedure out of 919 (0.1%) repairs at the centre where the injury occurred. None of the patients had ureteric imaging or delineation before primary surgery

Table 1
Characteristics of Cases Reviewed

Variables	Case frequency (N = 12)	Injury freq. (%) (total = 19)
Age		
20–29	3(25.0)	4(21.0)
30–39	5(41.7)	8(42.2)
40–49	2(16.6)	3(15.8)
50–59	2(16.6)	4(21.0)
Sex		
Male	1(8.3)	1(5.3)
Female	11(91.7)	18(94.7)
Primary Diagnosis		
Fibroid(ultrasound scan diagnosis)	8(66.7)	13(68.4)
Abnormal uterine bleeding	1(8.3)	2(10.5)
Postpartum haemorrhage	1(8.3)	2(10.5)
Obstructed labour (solitary kidney)	1(8.3)	1(5.3)
Right obstructed inguinal hernia	1(8.3)	1(5.3)
Primary surgery that resulted in the ureteric injury		
Hysterectomy(abdominal)	10(83.3)	17(89.4)
Caesarean section	1(8.3)	1(5.3)
Herniorrhaphy	1(8.3)	1(5.3)

Table 2 presented the analysis of the number of cases and iatrogenic ureteral injuries (IUIs) classified by the primary surgeon level of training. Majority (58.3%) of the primary surgeries that resulted in IUI were performed by general physicians (MCh.B and Equivalent certification or medical officers) with only a quarter (25%) of the cases being performed by either an obstetric gynaecologist or general surgery specialists (surgeon specialist). The surgeries of two out of the twelve cases (16.7%) were performed by a public health specialist. Regarding the IUIs, the majority (68.4%) occurred through surgical procedures performed by the medical officers with 92.7% of such injuries being bilateral IUIs. Furthermore, 2 out of the 3 IUIs (66.7%) caused by the public health specialists was bilateral IUIs. No bilateral IUIs resulted from surgeries performed by obstetric gynaecologist.

Table 2
Descriptive statistics of IUIs and primary surgeon level of training

Level of Training	No. of cases n = 12(%)	Total IUIs n = 19(%)	Unilateral IUIs n = 5(%)	Bilateral IUIs n = 14(%)
Medical officer	7 (58.3)	13 (68.4)	1(7.7)	12 (92.3)
Specialist surgeon	1 (8.3)	1(5.3)	1 (100)	0 (0)
Specialist OBGY	2 (16.7)	2 (10.5)	2 (100)	0 (0)
Specialist Public Health	2 (16.7)	3 (15.8)	1 (33.3)	2 (66.7)

Table 3 shows a summary of the individual case presentation, estimated time taken to make the diagnosis of injury, treatment administered at our centre, type of ureteral injury detected, the procedure performed, and post-repair complications. Anuria, renal derangement (obstructive uropathy), and Urine peritonitis were the common post-operative presentation for most of the patients while urine leakage during the surgery was the common sign for intra-operative diagnosis. The majority of cases (7/12) were post-surgery diagnoses with 5/7 and 2/7 detected 72 and 48 hours respectively. Five out of the 12 cases were detected intraoperatively either by suspicion of the surgeon or detection of urine leakage. Regarding the ureteral injury detected during surgery, a total of 19 ureteric injuries were repaired from June 2015 to May 2021 through open surgeries. Thus, 7 out of the 12 cases had bilateral ureteral injuries making a ratio of approximately 2:3 patients for unilateral to bilateral injuries. All 7 (73.2% total injuries) patients with bilateral injuries (14) resulted from hysterectomy of which 6 cases (63.2% of total injuries) were related to uterine fibroid surgery, 12.5% related to postpartum haemorrhage. Two unilateral injuries resulted from hysterectomies due to multiple uterine fibroids. All bilateral and one unilateral injury were operated by non-specialist surgeons at the primary level. The left ureter was frequently injured in unilateral cases. The common injuries were transection injury, 9/19 (47.4%), and ligation, 7/19(36.8%) of the ureters. Traction injury occurred in 3 out of 19 cases. Most injuries occurred on the left distal ureter 11/19 (57.9%).

Table 3
Summary of cases diagnosed and managed

Patient ID	Sex	Presentation	Time lag/hr	ureteral injury detected at surgery	Procedure done	Complications	#
1 ^s	F	Anuria -Anaemia -obstructive nephropathy	72 - transfused	Lt Traction in a Unilateral kidney	Release of traction suture + stenting	reactionary haemorrhage	12
2 ^s	M	Urine leakage	Intra-op	Rt. transection	Uretero- Ureterostomy & stenting	∩ Wound infection	21
3 ^{ns}	F	Anuria, Urine peritonitis	48	Lt. transection Rt. ligation	Bil. Uretero- neocystostomy (Lt. Boari-flap + Psoas Hitch) & stenting	∩ Wound infection	21
4 ^{ns}	F	Anuria, Urine peritonitis	72	Bil. transection	Bil. Uretero- Neocystostomy + stenting	∩ Re-lap for leak ∩ Wound infection ∩ Ileus	32
5 ^{ns}	F	Anuria	48	Bil. Ligation	Bil. Uretero- Neocystostomy + stenting	∩ Ileus ∩ Wound infection	14
6 ^{ns}	F	Anuria, Urine peritonitis	72	Lt. transection Rt. ligation	Bil. Uretero- Neocystostomy + stenting	∩ Wound dehiscence	21
7 ^{ns}	F	On table suspicion	Intra-op	Lt Traction	Release of a traction suture	∩ Bleeding ∩ Wound infection	21
8 ^{ns}	F	On table	Intra-op	Bil. Ligation	Bil. Uretero- Neocystostomy – stenting	∩ Wound infection	21
9 ^s	F	Urine leakage	Intra-op	Lt. transection	ureteroneocystostomy	none	14

Lt = left; Rt = right; Bil = bilateral; # = mean duration of hospital stay (days) = 18.7; s = specialist rank of primary surgeon (obstetric gynaecologist or general surgery specialists); ns = non-specialist rank of primary surgeon (medical officer); re-lap = relaparotomy

Patient ID	Sex	Presentation	Time lag/hr	ureteral injury detected at surgery	Procedure done	Complications	#
10 ^{ns}	F	Anuria Urine peritonitis	72	Right traction, left transection	Release of right traction stitch left ureteroneocystostomy + stenting	1 Wound infection	14
11 ^{ns}	F	Urine peritonitis Renal failure anaemia	72	Lt transection Rt ligation	Bil. Ureteroneocystostomy + JJ stenting	1 Wound infection	21
12 ^s	F	Urine peritonitis	Intra-op	Lt transection	Ureteroneocystostomy + JJ stenting	1 Wound infection	14
Lt = left; Rt = right; Bil = bilateral; # = mean duration of hospital stay (days) = 18.7; s = specialist rank of primary surgeon (obstetric gynaecologist or general surgery specialists); ns = non-specialist rank of primary surgeon (medical officer); re-lap = relaparotomy							

Regarding the surgical procedure performed, most of the patients had ureteroneocystostomy done with few having had the release of traction suture (Table 3). Wound infection was the commonest postoperative complication that occurred in 7 out of the 12 patients reviewed. Only two patients had no postoperative complications, and one patient suffered urine leakage that resulted in a long hospital stay (32 days). Relaparotomy was carried out in one patient and another had a reactionary bleed. The average duration of the hospital stay was 18.9 days.

Discussion

Anatomically, ureters are approximately 25 cm long tubular structures that extend from the renal pelvis to the bladder trigone and are in the retroperitoneal space^{7,8}. The abdominal ureter initially lies on the anterior surface of the psoas muscle, then descends posterolaterally cross over the iliac vessels, and descend with varied relationship to the pelvic brim. The ovarian vessels cross over the ureters anteriorly as they approach the pelvis. As the ureters enter the pelvis, the right crosses the external iliac artery and the left ureter crosses over the common iliac artery. They continue their course medial to the anterior division of the hypogastric artery and lateral to the peritoneum of the cul-de-sac into the midplane of the pelvis. The uterine arteries then cross them anteriorly before they tunnel into the cardinal ligaments. This point is approximately 1.5 to 2.0 cm lateral to the internal cervical os and vaginal fornices before it enters the trigone of the bladder^{7,8}. The relationship of the ureters with these vessels especially the distal third makes it venerable to damage during surgical procedures in the pelvis.

Ureteral injury may occur when suturing an extended incision aimed to control bleeding within the broad ligament or in performing a hypogastric artery ligation⁸. Other common site includes the pelvic brim, over the iliac arteries, within the cardinal ligament, and at the anterolateral fornix of the vagina. Damage related to haemostatic sutures and dissection can be prevented by knowing that the renal artery, ovarian artery, common iliac artery, and aorta contribute blood supply to the ureter medially in the pelvic segment medial and laterally in the abdominal segment⁷. The peritoneum and interstitial/serosa layers too should always be preserved during ureteral dissection. The choice of management and outcome is worse in late diagnosis, coagulation, and devascularisation aetiologies, longer length damage, and in the woman.

This study reviewed IUI resulting from open surgeries that were managed by the urology units of two hospitals with the expertise of open ureteric reconstructive surgery in that rural part of Ghana. Open abdominal hysterectomy was the most common surgery (10/12) due to uterine fibroid, uterine fibroid with infertility or bleeding in the elective and postpartum haemorrhage in the emergency patients. This trend is similar to the literature review by Abboudi et al 2013 and tertiary hospital reviews in Ghana but differ from reported causes in Nigeria where mishaps during caesarean section led to 60% of the injuries^{9,10,11,12}.

Injury to the left ureter was frequent (57.9%) in our study. The variable course of the left ureter that brings it close to pelvic structures and the right-handedness of surgeons have been considered predispositions to the frequent damage observed even though there is no proof to that¹³.

The risk factors reported by primary surgeons as a predisposition to these complications were adhesions from previous pelvic surgeries and haemorrhage during dissection. These factors are well published predictive factors for a difficult hysterectomy as reported with recommended guidance during the procedure^{10,9}. Even though Primary surgeries conducted by both specialists and non-specialists resulted in ureteric injuries, Practical applications of the discussed anatomy and the proposed protocols appears better followed by a specialist surgeons.

Transection, ligation, devascularization, crush, and perforation are the types of injuries that occur. Transection (9/19) and ligation(8/19) were the commonest injuries recorded in the study. This may be due to lack of vigilance to identify the ureter during dissection or transection of the ligated uterine artery or blind transfixing bites leading to obstruction of the ureter as the injuries occurred in the pelvic part. This trend reveals the lack of sufficient art in the hysterectomy procedure. The Committee of the American Association for the Surgery of Trauma classified these injuries for better management into Grade I – hematoma, contusion or hematoma without devascularization, Grade II – laceration; <50% transection, Grade III – laceration; 50% transection, Grade IV – laceration; complete transection with < 2 cm of devascularization and Grade V – laceration; avulsion with > 2 cm of devascularization¹⁴. In this study, the transection and ligation injuries counted for the urine peritonitis and the obstructive nephropathy with the late clinical presentation of anuria(60%) which is similar to other studies. Anuria may delayed diagnosis in patients with peri-operative hypovolaemia or a unilateral injury in bilateral functioning kidneys.

Majority of the missed cases were diagnosed 48–72 hours postoperatively. In neglected cases, urine peritonitis, septicaemia, and obstructive uropathy, fistula, and ureteric stricture may occur later which poses both a challenge to management and carry a poor prognosis after surgery with higher chances of patients developing renal hypertension, renal failure, fistula, and or urinoma formation and recurrent ureteral stricture¹⁵. The

diagnosis was based on the presenting clinical symptoms, supported by blood urea nitrogen and creatinine elevation, neutrophilia or hydronephrosis, and free peritoneal fluid on ultrasound scan diagnosis and confirmed by exploration findings. The lack of advanced imaging and endourological investigation may potentially exclude minor injuries indicated in the classification

Patients with Urine peritonitis, obstructive nephropathy responded well to the intervention as was a single case of acute renal failure that was dialysed. Aside from their immediate complications none of the feared long-term complications was noticed during their follow-up period.

In the present study, all the cases with bilateral injuries were performed by non-specialised surgeons. This raises the question of the level of surgical mishaps in hysterectomy which is a common procedure and the true incidence of ureteric injuries since unilateral injuries potentially could show equivocal symptoms or show negative findings during ultrasound imaging.

It was however noted the patients with deranged renal function and had re-laparotomy did not fare worse than those with normal renal function.

Options of treatment include percutaneous urinary diversion for obstructive injuries, in patients not fit for exploration, the release of the stitch and double pig-tail stenting is optimal for traction injury without ischaemia or open surgical repair.

Aside from the endoscopic approach, options available for the distal segment injuries include ureteroneocystostomy with psoas hitch, a Boari tubularized bladder flap, transureteroureterostomy, and in rare cases renal autotransplantation or ureteral substitution with gastrointestinal segment. In this study, patients were treated with open surgery modality satisfactorily most of whom were refluxing ureteroneocystostomy(14/19), Boari tubularised flap(1/19), and ureteroureterostomy for a mid-segment damage and suture release all with stenting. The minimum and maximum hospital stay were 14 days and 32 days respectively with an average of 18.7 days. All of them had resolution of symptoms and normal renal function before discharge. The common complication was wound infection that resolved with antibiotics in 10/12 cases. In addition, we recorded 2 post-operative haemorrhage, 1 wound dehescence, and the need for a second repair operation in one. There was no mortality

Limitation

This is a retrospective study with case selection criteria that might have led to low incidence. Our diagnosis of injuries was based on investigations of a referred case which may not capture cases that were primarily repaired without the need to refer. Conservatively managed cases were elsewhere or referred cases without clinical signs necessary for open diagnosis and repair were not included and could affect the numbers

Conclusion

In this 6-year IUI review, high frequency of injury, bilateral ureteric involvement, delayed diagnosis, and major complications were noticed in hysterectomies performed by non-surgeon clinicians in mostly elective cases.

This established an adverse trend where patients with high morbidity resulted from mishaps of none-surgeon clinicians which requires an urgent competence code of conduct for hysterectomy.

Abbreviations

IUI- Iatrogenic ureteric injury

Declarations

Ethics approval and consent to participate

Ethics and approval was obtained from the Ho Teaching Hospital Research and Ethical Committee with reference No. HTH/RPPME/E-1 and approval identity HTHREC (15) FC-2022. Written informed consent was obtained from patients to participate and permission was obtained to extract data from the facilities. All methods were performed in accordance with the relevant guidelines and regulations.

Consent to publish:

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflict of interest:

None to declare

Funding:

No external funding was received

Authors contribution

Conception, patient management, and data collection by Mahamudu Ayamba Ali, Mawueyo Oyortey, and Kekele Adanu. Study design, manuscript write-up, and data analysis by Mahamudu Ayamba Ali, Raymond Maalman, Yaw Donkor, and Mathew Kyei. Manuscript review by all authors

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