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Original Article

Our Experience with Iatrogenic Ureteric Injuries Following Obstetric and Gynaecological Surgery at a Tertiary Care Center

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ABSTRACT

Objective: To study the pattern of presentation, diagnosis and management outcome of ureteric injury sustained during obstetric and gynaecological surgery.

Study Design: Case series.

Place and Duration of Study: Armed Forces Institute of Urology Combined Military Hospital, Lahore Pakistan, from Nov 2010 to Nov 2020.

Methodology: Eighty-three patients satisfying inclusion criteria (suspected ureteric injury after gynaecological/obstetric intervention) were included. Demographic details, primary surgeon, presenting features, diagnostic workup, treatment instituted, complications, and success were recorded and analyzed.

Results: The study analyzed 83 patients with a mean age of 44.6±10.8 years and a mean parity of 3.4±1.4 children. The ovarian tumour was the most common cause of primary surgery (32, 38.6%), and the majority (64,77.1%) involved less experienced gynaecologists. Flank/abdominal pain was the main presentation (56, 67.5%), followed by oliguria. The left ureter was affected in the majority (58, 69.9%). Ureteric re-implant (37, 44.5%) and JJ stenting (33, 39.8%) constituted major urological interventions. Only three patients (3.6%) had surgical failure; two of them died, while one had redo surgery.

Conclusion: Iatrogenic ureteric injury mostly follows radical gynaecological procedures and must be suspected in case of pain in the abdomen or vague constitutional symptoms after pelvic surgery. Management is dictated by location, time interval, diagnosis, and available surgical expertise.

Keywords: Caesarean section, Flank pain, Gynaecological surgical procedures, Hysterectomy, Iatrogenic disease, Oliguria, Ureter, Urinary incontinence.

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INTRODUCTION

Iatrogenic ureteric injury is the most serious potentially devastating complication of modern pelvic surgery due to the proximity of the ureter with pelvic structures vis-a-vis variable anatomical course, the commonest cause being total abdominal hysterectomy.[1] The quoted incidence in the literature swings between 0.2 and 1 per 1000 cases, which is higher for minimally invasive and gynaecological surgeries.[2]

The ureters are most vulnerable to injury at the pelvic inlet underneath the infundibulopelvic ligament while securing ovarian vessels, at the level of internal os during ligation and division of uterine arteries and near the uretero-vesical junction at anterolateral fornix of the vagina when cervix and upper vagina is separated from the bladder during hysterectomy.[3]

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These injuries are observed in a wide array of clinical presentations, with 50-70% having delayed diagnosis, unfortunately, keeping in view the prognostication of time of injury to time of recognition and repair on successful clinical outcome.[4] Clinical features are dictated by the type of injury and transaction presenting within 24-48 hours post-surgery, while ligation or thermal damage may take considerable time (nonfunctional kidney after years).[5] The most common complaints observed are urinary incontinence, leak per vagina, flank pain, fever with chills, loss of appetite, anuria and urine in the drain.[6] Diagnosis revolves around meticulous history, detailed physical examination, clear communication with the operating surgeon and timely investigations; commonly performed are ultrasound abdomen (US), intra venous urogram (IVU), CT or MR urography (CTU or MRU), cystoscopy with retrograde pyelography (RPG) and drain fluid analysis.[7,8] Cystoscopy / RPG is the most sensitive modality, offering dual benefits, such as diagnosing the injury and allowing placement of the

ureteric stent in the same sitting. A strong grip on anatomy, careful depiction of ureters intra-operatively and high index of suspicion post-surgery are the linchpins warranting timely diagnosis/repair, thus avoiding crippling morbidity and mortality in the long run.[9,10]

Successful treatment of these uncommon but potentially debilitating injuries is an important and unique aspect of urological services; little is reported regarding them in our part of the world. The current study analyzed our centre's presentation, diagnosis, and management outcome pattern over the last decade.

METHODOLOGY

The case series targeted gynaecological and obstetrics cases referred to AFIU Rawalpindi/CMH Lahore Pakistan, from November 2010 to November 2020 after approval from Hospital Ethical Review Board (Certificate # Uro-Adm-Trg-1/IRB/2010/115),

Inclusion Criteria: Patients with suspected ureteric injury after during obstetric and gynaecological surgery were included.

Exclusion Criteria: Patients with ureteric injury secondary to trauma, radiation therapy, non-obstetric/gynaecological pelvic surgery and pre-existing urogenital abnormalities were excluded.

Over the past decade, a non-probability consecutive sampling technique was used to enrol 83 patients who met the inclusion criteria. Parameters like demographic details, intraoperative difficulty, indication of primary surgery, operating pelvic surgeon, time from injury to diagnosis, presenting complaints, diagnostic workup, nature and site of injury, urological treatment extended, postoperative complications and intervention success were recorded on a structured proforma. Written informed consent was obtained from all the participants.

Our protocol for managing patients with suspected ureteric injury involves a detailed history, thorough physical examination, baseline investigations and examination under anaesthesia along with an operating gynaecologist if available in day case theatre. Cystoscopy and RPG were performed, and a JJ stent was placed where possible. C-arm confirmed the success of proper stenting. Patients underwent a complete battery of investigations, including US, CTU or MRU, as deemed appropriate to confirm the diagnosis and help with proper surgical planning through patient counselling and the level of expertise required. All surgeries were performed under general anaesthesia, and the site and the nature of the injury dictated the procedure. All anastomosis fashioned were stented and protected with a Foley catheter. Patients were nursed in intensive care, and the catheter was removed on day 21 after performing a retrograde cystogram and re-assessed at eight weeks.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test and Independent sample t-test were applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

The study analysed 83 patients (85.6% of a total 97 reported, 14(14.4%) excluded) with a mean age of 44.6±10.8 years and a mean parity of 3.4±1.4 children. The majority were unskilled, having a mean BMI of 32.5±3 kg/m^2. The ovarian tumour was the most common cause of primary surgery (in 32 patients, 38.6%), while intraoperative bleeding was encountered in 55 patients (66.3%). More than two-thirds of surgeries involved gynaecologists with less than ten years of experience. Flank/abdominal pain was the main presentation (56, 67.5%), followed by decreased urine output, and the average delay in diagnosis was 12.5±26.7 days. US was the most common diagnostic modality, and rigid cystoscopy was performed in 72 patients (86.7%) (Table-I). The left ureter was affected in the majority (58, 69.9%), the transaction being the most common injury (41,49.4%), while uterine artery crossing was the most common site (38, 45.8%). Only 08 patients (9.6%) had bilateral ureteric damage (Table-II). Ureteric re-implant (37, 44.5%) followed by JJ stenting (33, 39.8%) constituted major urological interventions performed (Table-III). Most patients had a smooth postoperative recovery, while 12(14.4%) had Clavien-Dindo IV/V complications. Only three patients (3.6%) had surgical failure; two of them died, while one had redo surgery (Table-IV). Data on gynaecological and obstetrical cases was also compared. Among women whose injuries followed obstetric procedures, ten patients (47.6%) had emergency C-sections, while 07 (33.3%) presented with placenta previa. All gynaecological procedures were hysterectomies, the majority being abdominal (47, 75.8%). Obstetric injuries occurred in significantly younger patients (28.5±3.9 vs 49.9±5.8 years, p .001)

having lower BMI (31±3.7 Vs 33.1±2.5, p .005) being performed by inexperienced operators (p .012) and were diagnosed early (4.6±2.5 vs 15.2±30.5 days, p .009) (Table-V).

Table-I: Demographic Data of the Patients Having Iatrogenic Ureteric Injuries (n=83)

Parameters	n (%)
Mean Age (Years)	44.6±10.8
Mean Parity (number of children)	3.4±1.4
Profession	
Skilled	31(37.3)
Unskilled	52(62.7)
Mean BMI (Kg/m2)	32.5±3
Intraoperative Difficulty Previous Abdominal / Pelvic	
Surgery	46(55.4)
Large pelvic Mass	35(42.2)
Massive Pre /Intra Operative bleed	55(66.3)
Indication of Primary Surgery	
Ovarian Tumor	32(38.6)
Fibroid Uterus	12(14.5)
Emergency LSCS	10(12)
Endometriosis	09(10.8)
Placenta Previa	07(8.4)
Cervix Carcinoma	06(7.2)
Elective LSCS	04(4.8)
Uterovaginal Prolapse	03(3.6)
Hysterectomy	
Abdominal	56(67.5)
Vaginal	15(18.1)
Operating Pelvic Surgeon	
>10 Yrs. Experience	19(22.9)
5-10 Yrs. Experience	23(27.7)
<05 Yrs. Experience	41(49.4)
Mean Time from Injury to diagnosis (days)	12.5±26.7
Clinical Presentation	
Decreased Urine Output	51(61.4)
Flank/abdominal pain	56(67.5)
Feeling of being Unwell	46(55.4)
Fever	45(54.2)
Ileus	40(48.2)
Vaginal discharge / Leakage	37(44.6)
Urinary Incontinence	37(44.6)
Smell/ Urine in drain	17(20.5)
Urine wound discharge	11(13.3)
Anuria	05(06)
Diagnostic Workup	
Mean Serum Creatinine (µmol/L)	130.9±42
Drain fluid Creatinine (Higher than serum value)	17(20.5)
US abdomen/Pelvis	80(96.4)
CT Urogram	44(53)
Rigid Cystoscopy	72(86.7)
Retrograde Pyelogram	49(59)
Pre-Op Percutaneous Nephrostomy (PCN)	36(43.4)

Table-II: Intra-Operative Findings of Patients Having Iatrogenic Ureteric Injuries (n=83)

Parameters	n (%)
Laterality of the Injury	
Right Ureter	17(20.5)
Left Ureter	58(69.9)
Both Ureter	08(9.6)
Methylene Blue to identify Ureter	13(15.7)
Nature of Injury	
Partial Transaction	22(26.5)
Crush Injury	20(24.1)
Complete Transaction	15(18.1)
Diathermy damage	15(18.1)
Inadvertent Tie	07(8.4)
Transaction & Tie	04(4.8)
Site of Ureteric Injury	
Uterine artery Crossing	38(45.8)
Entry into the bladder	22(26.5)
Pelvic Brim	16(19.3)
Infundibulo-pelvic ligament	07(8.4)
Surgical Management	
DJ Stenting	33(39.8)
Ureteric Re-Implant & Boari Flap	21(25.3)
Ureteric Re-Implant	08(9.6)
Ureteroureterostomy	06(7.2)
Untying of Ureter	04(4.8)
Ureteric Reimplant & Untying of Ureter	04(4.8)
Ureteric Reimplant & Ureteroureterostomy	04(4.8)
Nephrectomy	03(3.6)

Table-III: Surgical Procedures Undertaken in Patients Having Iatrogenic Ureteric Injuries (n=83)

Surgical Procedure Performed	n(%)
Ureteric Reimplant	
Ureteric Reimplant + Boari Flap	21(25.3)
Ureteric Reimplant	08(9.6)
Ureteric Reimplant & Untying of Ureter	04(4.8)
Ureteric Reimplant & Ureteroureterostomy	04(4.8)
DJ Stenting	33(39.5)
Ureteroureterostomy	06(7.2)
Untying of Ureter	04(4.8)
Nephrectomy	03(3.6)
Total	83(100)

Table-IV: Post-operative data of Patients having Iatrogenic Ureteric Injuries (n=83)

Parameter	Frequency n (%)
Mean Hospital stay (days)	5.8±4.2
Surgical Complications	
None	38(45.8)
Clavien Dindo I	12(14.5)
Clavien Dindo II	18(21.7)
Clavien Dindo III	03(3.6)
Clavien Dindo IV	10(12)
Clavien Dindo V	02(2.4)
Surgical Success	
Cured	73(88)
*Healed	07(8.4)
Failure	03(3.6)
Total Morbidity/Mortality	
Morbidity	08(9.6)
Mortality	02(2.4)
Re-Operation	01(1.2)

**Residual Lower urinary tract symptoms (LUTS)*

DISCUSSION

This study reviewed the clinical factors associated with ureteric injury in patients managed at a tertiary care setup. The majority underwent tumour surgery; the commonest cause was ureteric transaction or ligation, mostly at the crossing of the uterine artery. Securing hemostasis while encountering torrential bleeding in patients having morbid surgical factors coupled with inexperienced surgeons was the raison deter found. The urological intervention was exercised promptly, and the injury was recognized and managed appropriately. Overall surgical results revealed complete cure in 88%, some residual LUTS in 8.4% while 3.6% failed, morbidity at 9.6%, and mortality at 2.4%.

Table-V: Comparison of Demographic, Clinical, Diagnostic, Operative Variables Between Obstetric and Gynecological patients who Underwent repair of Ureteric Injury(n=83)

Parameter	Gynecological Patients (n=62)	Obstetric Patients (n=21)	*p*-value
Mean Age (Years)	49.9±5.8	28.5±3.9	0.001
Parity (No of children)	3.6±1.4	2.7±1.1	0.014
BMI	33.1±2.5	31±3.7	0.005
Intraoperative Difficulty			
Previous Pelvic Surgery	34 (54.8%)	12(57.1%)	0.85
Massive Pre /Intra Operative bleed	41 (66.1%)	14(66.7%)	0.96
Operating Pelvic Surgeon			
>10 Yrs Experience	18(29%)	01(4.8%)	.012
5-10 Yrs Experience	19(30.6%)	04(19.1%)	
<05 Yrs Experience	25(40.3%)	16(76.2%)	
Time from Injury to diagnosis (days)	15.2±30.5	4.6±2.5	.009
Clinical Presentation			
Flank/abdominal pain	40	16	0.32
Feeling of being Unwell	37	09	0.18
Fever	32	13	0.41
Anuria	03	02	0.44
Vaginal discharge / Leakage	28	09	0.85
Urinary Incontinence	28	09	0.85
Urine leakage from wound	07	04	0.37
Smell/ Urine in drain	12	05	0.66
Ileus	29	11	0.66
Decreased Urine Output	34	17	0.03
Diagnostic Workup			
Serum Creatinine	128.7±42.6	137.4±40.4	0.41
Drain fluid Creatinine (Higher than serum)	12	05	0.66
US abdomen/Pelvis	59	21	0.31
CT Urogram	34	10	0.57
Rigid Cystoscopy	53	19	0.56
Retrograde Pyelogram	41	08	0.02
Methylene Blue	12	01	0.11
Pre-Op Percutaneous Nephrostomy (PCN)	28	08	0.57
Laterality of the Injury			
Right Ureter	12	05	0.91
Left Ureter	44	14	
Both Ureter	06	02	
Nature of Injury			
Complete Transaction	07	08	0.15
Partial Transaction	17	05	
Crush Injury	17	03	
Diathermy damage	12	03	
Inadvertent Tie	06	01	
Transaction & Tie	03	01	
Site of Ureteric Injury			
Uterine artery Crossing	31	07	0.14
Entry into the bladder	15	07	
Pelvic Brim	13	03	
Infundibulo-pelvic ligament	03	04	

Surgical Management			
DJ Stenting	22	11	0.53
Ureteric Re-Implant & Boari Flap	18	03	
Ureteric Re-Implant	07	01	
Ureteroureterostomy	03	03	
Untying of Ureter	03	01	
Ureteric Reimplant & Untying of Ureter	03	01	
Ureteric Reimplant & Ureteroureterostomy	03	01	
Nephrectomy	03	00	
Mean Hospital stay	5.6±4.2	6.1±4.5	.63
Surgical Complications			
None	30	08	0.56
Clavien Dindo I	07	05	
Clavien Dindo II	13	05	
Clavien Dindo III	03	00	
Clavien Dindo IV	08	02	
Clavien Dindo V	01	01	
Surgical Success			
Cured	54	19	0.75
Healed	06	01	
Failure	02	01	

Our results are comparable to literature quoted locally as well as internationally.[11] Gynaecological surgeries were mainly responsible for the iatrogenic injury (62 patients, 74.7%) in our study, as was also found by Durrani et al. at IKD Peshawar,[12] (46.5% due to hysterectomy), Nawaz *et al.* at Agha Khan hospital,[13] (56.3%) and Matani *et al*. in Saudi Arabia,[14] (68% due to gynaecological procedures). However, studies conducted by Raassen *et al*.[15] and contradicted our findings; they found obstetric operations more commonly injured ureters (67.4% and 80%, respectively).

The ovarian tumour was the most common cause of primary surgery (32 patients 38.6%) we encountered, followed by fibroid uterus and LSCS. Morbid surgical anatomy and inexperience led to injury in 70% of cases. Patil *et al*.[16] Lawal *et al*.[17] studied factors and concluded that proper surgical training could avoid such catastrophe.

Our patients presented with flank or abdominal pain followed by decreased urine output and lassitude (67.5%, 61.4%, and 55.4%, respectively). The same trend was shared by Matani et al.14 (70.6%, 12 out of 17 patients).

The urological armamentaria are equipped with various treatments and approaches. DJ stenting resolved the issue in 33 patients (39.8%), thus avoiding additional major undertakings. Endourological procedures are now being performed increasingly to tackle such injuries, and the same is followed at our centre. Li X[10] studied 46 patients who underwent ureteric stenting and concluded that endoscopic surgery is an effective modality to treat such injuries, having the advantage of being reliable, effective, minimally invasive and readily acceptable. Patil *et al*. [16] also conferred similar findings and found stenting effective in 68.75% of their cohort in India.

The surgical success achieved in our series (73, 88%) was comparable to data worldwide, varying between 80-95%.[17,18] We compared complications as per Clavien-Dindo and found our results comparable with literature. Ten Patients had grade IV complications that required prolonged care in intensive care, while two of our patients died of multiorgan failure. One patient had a recurrence and was later repaired successfully. Our series found obstetrical injuries in younger patients undergoing emergency interventions, earlier presentation and inexperienced operators, which confers to figures reported by various authors.[19,20]

CONCLUSION

Iatrogenic ureteric injury is a grave complication, the majority occurring after radical gynaecological procedures, while LSCS was the leading culprit in obstetric patients who were younger. The majority of the surgeons were less experienced and struggled when faced with torrential bleeding in the wake of morbid surgical risk factors. Endourological approaches offer dual benefits, while ureteric re-implant offers a high chance of cure.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MRZ & NM: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MTS & QM: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

ST & OFR: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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