

Ureteral Injuries in an Obstetric and Gynaecology Teaching Hospital

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Summary

Between November 1994 to May 1996, there was a total of eight ureteric injuries out of 2495 major gynaecologic operations and one ureteric injury out of 4146 caesarean sections at the Kandang Kerbau Hospital, giving the incidence to be 0.3% and 0.02% respectively. Antecedent operations were four abdominal hysterectomies, two Werthiem's hysterectomies, one laparoscopic – assisted vaginal hysterectomy and one caesarean section. All operations were performed by qualified specialists. Three patients had previous abdominal operations and five patients had procedures complicated by dense adhesions.

Only one injury was detected intraoperatively and the rest presented with uretero-vaginal fistula. One presented with immediate postoperative anuria. The average time interval for diagnosis ranged between one day and twenty – three days (average 10.7 days). The commonest damage was transection of the ureter. Double J stents were used in all repairs with two cases requiring reimplantation with psoas hitch, and two cases of ureteroneocystostomies and one case of primary reanastomosis. There were no mortality in our series.

Key Words: Gynaecological operations, Ureteric injuries

Introduction

Injury to the ureter is one of the most serious complications of gynaecologic surgery, occurring between 0.5% and 1.5% of all gynaecologic pelvic operations¹⁻⁶. It is a constant threat – a sword of Damocles hanging over every major operative procedure in the pelvis. The risk of damage increases when the normal course of the ureter is altered by the underlying pathology, such as cancer, endometriosis or adhesions. Suffice to say, adequate knowledge of the relevant anatomy, meticulous surgical techniques and visualisation of the ureteral path are vital to prevent ureteral injury.

The serious nature of iatrogenic ureteric damage and its potential for significant morbidity resulting from loss of renal function has prompted this study to look

into the various causes of ureteral injury seen in our hospital and possible steps into its prevention and future management.

Patients and methods

A retrospective survey of all gynaecologic and obstetric procedures that resulted in referrals to two different urological departments serving the Kandang Kerbau Hospital was made between November 1994 and May 1996. It is hospital policy that all ureteric injuries be assessed by a urologist. The patient case records in the eighteen month period were scrutinized with respect to epidemiological biodata, antecedent surgery, clinical presentation, and nature of repair operation.

Our study group consisted of 8 patients with 9 ureteral injuries, all together.

Results

A total of 2495 major gynaecologic operations were performed in our teaching hospital. Eight patients were identified with ureteric injuries during this eighteen month period (see Table I). One patient had bilateral ureteric injury. The incidence of iatrogenic ureteric damage was 0.3%.

The antecedent operations performed for those patients included three for oncological purposes, four for benign gynaecological conditions and one for obstetric indications (see Table II). Out of a total of 4164 caesarean sections, one patient with ureteric injury was identified, giving an incidence of 0.02%.

The age range of the patients was between 28 and 66 years with a mean age of 47.5 years old. The parity ranged from 0 to 9. The average weight of the patients was 59.5 kg.

Three patients had a significant surgical history of previous abdominal operations. These included an abdominal myomectomy, interval ligations and a colposuspension of the uterus. No patient gave a history of ureteral injury or urological surgery. The procedures were performed for benign gynaecological conditions ie. uterine fibroids, in four patients. Another three patients had carcinoma of the cervix for which Werthiem's Hysterectomy was performed in two of them. The other patient had a laparoscopic assisted vaginal hysterectomy for the condition of carcinoma of the cervix Stage 1A₁. The last patient had an emergency caesarean section.

All operative procedures were performed by qualified specialists (Table II). Of the 8 antecedent procedures six of the operative findings depicted complicated dissection of adhesions involving the omentum, large and small intestines, adnexae and bladder. The average

Table I
Patients characteristics

Patient	Age	Weight/ kg	No. parity	Previous operations	Diagnosis	Surgical procedure
1	66	64.0	9	Nil	Carcinoma of Cervix Stage 1A ₁	LAVH/BSO*
2	41	57.0	7	Nil	Carcinoma of Cervix Stage 1B	Radical Hysterectomy & Bilateral Pelvic Lymphadenectomy
3	63	59.9	2	Two	Carcinoma of Cervix Stage 1B	Radical Hysterectomy & Bilateral Pelvic Lymphadenectomy
4	46	47.1	0	Nil	Endometriosis	TAHBSO**
5	42	60.6	0	One	Uterine Fibroid (Broad Ligament)	TAHBSO
6	48	50.9	2	Nil	Uterine Fibroid	TAHBSO
7	46	77.6	5	One	Uterine Fibroid Endometriosis	TAHBSO
8	28	58.7	1	Nil	Cephalo-Pelvic Disproportion	(Emergency) Caesarean Section

* Laparoscopic Assisted Vaginal Hysterectomy / Bilateral Salpingo-oophorectomy

** Total Abdominal Hysterectomy and Bilateral Salpingo-oophorectomy

Table II
Antecedent surgical procedure

Patient	Procedure	Duration of operation	Blood loss	Surgeon	Significant operation recording
1	LAVH/BSO *	550 min	400 ml	Consultant	Bladder Densely Adherent To Anterior Cervix
2	Radical Hysterectomy Bilateral Pelvic Lymphadenectomy	490 min	1100 ml	Consultant	Dense Omental Adhesions
3	Radical Hysterectomy Bilateral Pelvic Lymphadenectomy	570 min	1300 ml	Consultant	-
4	TAHBSO **	370 min	800 ml	Senior Registrars	Severe Endometriosis Dense Adhesions In Pelvis, Obliteration Of Pouch Of Douglas
5	TAHBSO	245 min	1100 ml	Registrar	Dense Omental Adhesions
6	TAHBSO	160 min	200 ml	Senior Registrar	Nil
7	TAHBSO	380 min	1300 ml	Registrar	Severe Endometriosis Dense Adhesions Left Adnexae And Pouch Of Douglas
8	Caesarean Section	40 min	800 ml	Registrar	Extension Of Uterine Tear Laterally

* Laparoscopic Assisted Vaginal Hysterectomy / Bilateral Salpingo-oophorectomy

** Total Abdominal Hysterectomy and Bilateral Salpingo-oophorectomy

blood loss for the operations was 875 ml and the mean operating time was 350 minutes.

Recognition of ureteric damage was made intraoperatively in one patient (Table III). This patient's ureteral injury was noticed after it was inadvertently transected along the left infundibulopelvic ligament. The amount of ureter transected was of significant length (5 cm) that a primary reanastomosis was not possible and a vesico-psoas hitch was required to secure more length of the ureter for satisfactory implantation into the bladder without tension on the line of anastomosis. A double-J stent was inserted and

a in-dwelling Foley's catheter maintained postoperatively.

The rest of the cases were detected postoperatively with referrals to the urologist for confirmation of diagnosis and management. The time interval between the antecedent operation and diagnosis of ureteric damage ranged between one and twenty-three days. The repair procedures performed by the urologists were two cases of reimplantation with psoas hitch, two cases of ureteroneocystomies and one case of primary reanastomosis. Four recovered with just double J stenting. (Table III)

Table III
Presentation/diagnosis/repair of ureteral injury

Patient	Presenting symptom	Time lapse	Diagnostic	Nature of injury	Repair procedure & complications
1	Anuria	< 24 Hours	Cystoscopy *IVU Antegrade Pyelogram	Left Ureter – Complete Transaction Lower 1/3 Right Ureter – Partial Ligation Lower 1/3	Nephrostomy Ureteroneocystostomy ** DJ Stent
2	Urinary Incontinence	12 Days	3 Swab Test IVU	Left Ureterovaginal Fistula Lower 1/3	DJ Stent
3	Urinary Incontinence	13 Days	3 Swab Test IVU	Left Ureterovaginal Fistula Lower 1/3 Partial Transaction	1° reanastomosis DJ Stent
4	–	Intraoperative Diagnosis	–	Left Ureter – Complete Transaction At Infundibulopelvic Ligament Level	Reimplantation With Psoas Hitch DJ Stent
5	Urinary Incontinence With Pain/Fever	6 Days	3 Swab Test IVU	Right Ureterovaginal Fistula Lower 1/3 Transaction	Reimplantation With Psoas Hitch DJ Stent Injury To Right Iliac Vein
6	Urinary Incontinence	8 Days	IVU	Right Ureterovaginal Fistula Lower 1/3 Transaction	Ureteroneocystostomy DJ Stent Wound Infection
7	Urinary Incontinence	12 Days	3 Swab Test IVU	Right Ureterovaginal Fistula Lower 1/3 Ligated	DJ Stent
8	Urinary Incontinence Low Grade Fever	23 Days	3 Swab Test IVU	Right Ureteral – Vaginal Fistula Partial Transaction	DJ Stent

* IVU – Intravenous Urogram

** DJ Stent – Double J Stent

All eight patients are alive and well with no permanent urological damage upon follow up.

Discussion

Ureteral injuries are far more serious and troublesome than injury to either the bladder or the rectum, the other two important sites of potential surgical trauma during pelvic surgery. As compared with other operations such as abdominoperineal resections (3.7%)⁷ and lumbar disc surgery⁸, gynaecological surgery remains the leading cause of ureteral injuries with open and laparoscopic surgery accounting for 60% to 70% of lower urinary tract injuries⁹.

Four of the patients had gynaecologic surgery for benign conditions ie. uterine fibroids and endometriosis. However, in two cases the extent of endometriosis was so severe that adhesiolysis was necessary, and transection of the ureter occurred when the surgeon attempted to divide the infundibulopelvic ligament. In the third case, a large uterine fibroid that filled the pelvis made mobilisation difficult and exposure poor. All four operations were made through Pfannestiel incisions, where exposure may not be as favourable as compared to a midline incision. Intraoperative identification of the ureteric injury was noted in one of these four cases where the cut ends of the ureter were seen in the transected portion of the infundibulopelvic ligament.

Two injuries were sustained during radical hysterectomy for carcinoma of the cervix while dissecting the ureter at its insertion into the bladder. Despite ureteral identification, tissue planes could not be formed and ureteral damage resulted. They were detected postoperatively after approximately twelve days when urinary incontinence presented. Ureteral injuries occurring during Werthiem's Hysterectomy has often been quoted to be between 10% and 30%^{6,10}. In a more recent local study¹¹, the incidence of utero-vaginal fistula formation after a Wertheim Hysterectomy in a teaching hospital in Singapore was 4.7%.

With the increasing utilization of endoscopy, the manipulation of the genitourinary tract by electrosurgery or laser, ureteral injuries may become more frequent. In our patients, dense adhesions were

noted between the bladder and anterior cervix. Both ureters were injured beyond the uterine vessels as the ureter passes through the tunnel in the cardinal ligament to enter the bladder. The diagnosis of bilateral ureteral damage was facilitated when the patient became anuric after the procedure. To quote Orkin¹² "Although other causes may be responsible for anuria, this finding postoperatively should be considered as evidence of bilateral occlusion of the ureters until proven otherwise". Prompt urologic survey was instituted with cystoscopy, antegrade pyelogram and an intravenous pyelogram.

Ureteral damage occurring in caesaren section has been quoted to be about 0.1%¹³. Our study revealed only one out of 4,146 cases. This patient had an emergency caesarean section for cephalopelvic disproportion following a prolonged labour of ten hours. The uterine incision extended laterally and the ureter was accidentally stitched near the base of the broad ligament where it passes beneath the uterine vessels. A double - J stent was inserted after diagnosis was made with an intravenous pyelogram after 23 days when the patient presented with urinary incontinence.

The ureteral injuries sustained through operative trauma can be classified into six types¹⁴: ie. crushing from misapplication of a clamp(s); ligation with suture; transection (either partial or complete); angulation with secondary obstruction (either partial or complete); ischemia that results from stripping the ureteral wall of its blood supply for a short distance and resection of a segment of ureter, usually intentionally in the course of extensive operation for malignant disease. In our cases, transection of the ureters occurred in seven of the nine injuries, and accidental ligation in the other two. The significance of the injury was compounded in our two cases of extensive endometriosis where periureteral fibrosis or ischaemia may have already compromised the integrity of this structure.

The avoidance of ureteral injuries is of paramount importance. The gynaecologist should be familiar with congenital anomalies of the urinary tract, including reduplication of ureters, unilateral or bilateral, which occur in 3% or 5% of individuals¹⁵: solitary kidney, pelvic kidney, and ectopic ureter. In addition, he

should be familiar with dilatation of the ureters and displacements that may be associated with pelvic mass as in one of our patients.

Likewise, the operating surgeon should be aware of the sites where ureteral injury is the commonest:-

1. in the base of the broad ligament where the ureter passes beneath the uterine vessels;
2. beyond the uterine vessels as the ureter passes through its tunnel in the cardinal ligament and turns anteriorly and medially to enter the bladder;
3. at or below the infundibulopelvic ligament; and
4. along the course of the ureter on the lateral pelvic sidewall just above the uterosacral ligament.

In fact most of the injuries seen in patients involved the lowest 3 cm, between the uterine vessels and the bladder, except for one that was transected at the level of the infundibulopelvic ligament.

The usage of intravenous pyelogram before hysterectomy for benign disease has been suggested as a preoperative measure to decrease the incidence of ureteral injuries. However, studies¹⁴ have shown that patients with normal pelvic examinations were found unlikely to have excretory urogram findings of practical importance to the pelvic surgeon. Hence, when proper clinical judgement is used, only those patients who are more likely to have significant abnormalities should be offered a preoperative excretory pyelogram, thereby reducing the number of unnecessary studies, decreasing cost and avoiding some adverse reaction. In our institution, routine usage of intravenous pyelogram is not advocated except as part of the staging procedure for carcinoma of the cervix.

Preoperative ureteral catheterization is controversial at best but most experienced gynaecologists feel that more harm than good is achieved because of the possibility that manipulation of the ureter with a bard catheter in its lumen will cause more damage to the wall of the ureter. Thus, primary prevention includes the maintenance of an appropriate level of consciousness of the risk of injury to the ureter throughout the entire pelvic dissection, especially at certain key points in each operation where careful identification and dissection of the ureter is the most important means to avoid injury¹⁶.

The recognition of ureteral damage in our series was made postoperatively in eight out of the nine injuries. Most of the unilateral injuries were recognised one to two weeks after operation. Only one patient had an accompanying non-specific sign of loin pain and low grade fever. Other signs and symptoms like unusual abdominal or flank pain, distension persistent leukocytosis or stormy post operative events should alert the physician to the possibility of an intraoperative ureteral injury. The most common sign of the compensation remains the development of a urinary fistula to the vaginal after a delayed period. Hence, to ensure that such sequelae be kept to a minimum, it remains prudent for all practising gynecologists to treat every case as a potential for damage and adopt precautionary measures.

It is a regrettable fact that no more than 30% of ureteral injuries are recognised at the time of occurrence during surgery¹⁴ although intraoperative recognition may be improving as suggested by Mann and colleagues⁴. In our study only 11.1% were recognised intraoperatively. Nevertheless, the immediate recognition of damage intraoperatively not only saves the patient other anaesthesia and longer morbidity, it also reduce the possibility of loss of kidney function. In Thompson and Rock's series¹⁴ where 22 ureteral injuries were discovered in the postoperative period six kidneys were lost. Also, Lee and Symmonds's¹⁷ review of 68 ureterovaginal fistulas reported that nephrectomy was necessary in 34 cases (50%)!

Although ureteral injury most commonly occurs concurrently with extensive and strategically located pelvic disease (in our series two patients had severe endometriosis and three had documented dense abdominal adhesions to bladder), of near equal frequency is the advertent trauma to the ureter in the absence of significant pelvic disease (3 patients in our series). In fact, Symmonds¹⁶ who studies 600 patients with genito-urinary fistula referred to the Mayo Clinic from throughout the Western Hemisphere concluded that "the easy hysterectomy or other straightforward gynaecologic operation, not the hazardous and difficult operation, is responsible for most of the genito-urinary tract injuries (and fistulas) in this country". It would be advantageous for the gynaecologist to have a method of tracing

the course and ensuring the integrity of both ureters in all abdominal hysterectomies.

When ureteric injury is found, reconstruction or reimplantation can proceed without delay early definitive repair is proven to be both feasible and safe^{5,9,14,15}. It is believed that the longer the delay, the more difficult the dissection and more dense the fibrosis. In fact in one of our patients, accidental injury to the right iliac vein was made during the reimplantation of the right ureter with a psoas hitch. Double - J stents were used in all cases requiring anastomosis or uretoneocystostomy. Most gynaecologists and urologists believe that stents stabilise and immobilise the ureter during healing, allow orderly regeneration of uroepithelium and smooth muscle, help prevent urine extravasation and prevent stenosis. It also minimise any tendency of the ureter to be angulated. In two cases, psoas hitch was performed to secure more length of ureter for satisfactory implantation into the bladder without tension on the line of anastomosis. This was achieved by suturing the apex of the bladder to the psoas muscle on that side¹⁸. This becomes

necessary when the defect is more than 5 cm long. This procedure avoids the necessity of ureteroureteral anastomosis and is superior to the Boari bladder flap procedure which is frequently associated with reflux.

Conclusion

Ureteral injury is now amongst the most common and serious of all the complications of pelvic surgery. Not only is the danger of permanent loss of kidney function daunting, the threat of medico-legal action can be equally unsettling. It is important that the gynaecological surgeon be "ureter conscious" and develops a routine method of ensuring the integrity of both ureters before concluding a major operative procedure in which there is a risk ureteral damage.

It must be remembered that such injuries can happen in the hands of the most skilled and experienced gynaecologic surgeon and to avoid more dire consequences due to late recognition it remains for us to remember the timeless statement made by Prof Higgins¹⁵ in 1963: "The venial sin is injury to the ureter, but the mortal sin is failure of recognition".

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