



Mini Review

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# Ureteral Injuries in Gynaecological Surgeries: An Updated Review and Key Management Issues



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## Abstract

**Introduction:** Ureteral injuries are rare but not insignificant in high-volume centres. The main cause is iatrogenic, especially in gynaecological surgery, which accounts for 52-82% of iatrogenic injuries.

**Discussion:** Despite technical progress, subspecialisation and development of minimally invasive techniques, the rate of ureteral injury in gynaecological surgery has not been significantly reduced over the last decades. In these cases early recognition is crucial as primary repair leads to more successful outcomes and significantly reduces the associated morbidity. The election of an adequate repairing surgical depends mainly on the location and size of the lesion. Distal third ureteral lesions are the most common, in which cases ureteral reimplantation is preferred to ensure good vascular support. Proximal and mid-ureteric injuries, if shorter than 2-3 cm, can be managed with a primary uretero-ureterostomy. Intraoperative haemodynamic instability is an indication to terminate the surgery and to consider a repair at a later stage.

**Conclusion:** Early diagnosis of ureteral injuries requires a high index of suspicion. Knowledge of the anatomy and preoperative planification are essential for their prevention. Visual identification of the ureters allows careful intraoperative dissection in their vicinity. If complex surgery is planned, prophylactic preoperative ureteral stenting may aid intraoperative diagnosis although it does not reduce the likelihood of ureteral injury.

**Keywords:** Ureteral injury; Upper urinary tract lesions; Iatrogenic injury; Pelvic surgery; Reconstructive urology

## Introduction

Injuries to the ureter are relatively rare due to its characteristic retroperitoneal anatomical location. It is also a mobile structure and is surrounded by adjacent musculoskeletal and visceral structures, which helps to protect it from external damage in cases of both trauma and abdominal surgical injury.

The ureter is a structure located in the retroperitoneum, comprising the upper urinary tract of men and women. It originates from the renal pelvis as the most posterior element in the renal hilum. Caudally, the ureter is anatomically related to the anterior surface of the psoas muscle, posterior to the colon mesentery and lateral to the gonadal vein. In the pelvis, the gonadal vein crosses over the ureter. Then, the ureter crosses anterior to the common iliac vessels, which is considered one of the easiest places to identify it. In its final segment it passes above and laterally to the internal iliac vessels, and then turns medially, where, in women

it is crossed by the uterine artery. Finally it penetrates into the posterior wall of the bladder [1].

## Aetiology and Epidemiology

Ureteral injuries are divided into two categories according to their aetiology: traumatic or iatrogenic. Ureteral trauma accounts for only 1-2.5% of urinary tract trauma [2]. Among the ureteral traumas, approximately 65% are due to penetrating external trauma, led by gunshot wounds in recent records [3]. Blunt trauma accounts for the remaining 35%, mostly due to road traffic accidents [2]. However, iatrogenic injury is responsible for the majority of cases [1]. Improvements in technique, technology, surgical instruments, training methods and preventive measures have led to a significant reduction in urological iatrogenic trauma over the last two decades [4].

Gynaecological interventions are a frequent cause of significant iatrogenic trauma, ranging from 52-82% of all injuries depending on published case series [5-7]. Overall, there are lower rates of ureteral injuries during robotic-assisted procedures [7]. However, with the exception of these cases, minimally invasive techniques in pelvic procedures have not further reduced the ureteral injury rate compared to open approaches in gynaecological surgery [8-10]. We therefore consider that this review may be of interest to all clinicians involved in this type of surgery.

The distal third of the ureter is the most commonly affected area as it crosses the uterine artery in the lower part of the ureter [1]. In terms of specific procedures, the ureter is more commonly injured in abdominal (2.2%) than vaginal (0.03%) hysterectomy, especially when the approach is open rather than laparoscopic (1.3%) [11,12]. It is important to consider that there may be a selection bias in the published data, as an open transabdominal approach is more likely to be used in complex cases of infection or malignancy [1]. Risk factors to consider include uterine enlargement, pelvic organ prolapse, retroperitoneal fibrosis, previous history of radiation and previous pelvic surgery [11].

In cases of caesarean section, 69% of all ureteral injuries occur during emergent procedures, making this aspect the main risk factor [13]. Special attention must be paid to the lateral extension of the myotomy towards the broad ligament of the uterus. Inspection in these cases is more complicated due to three main factors: enlarged uterus, bleeding from engorged pelvic vessels and distal ureters that are difficult to access.

### Management and Treatment Options

The first step in proper management is to limit the damage as quickly as possible. This includes early diagnosis, which requires a high index of suspicion. Inspection of the retroperitoneum leads to a correct diagnosis in up to 89.3% (33-100%) of cases [14]. In case of doubt, ureteral stenting or percutaneous nephrostomy is recommended, with re-evaluation by pyelography in the following 48-72 hours [4]. Intra-operative placement of an intra-abdominal drain may also aid in early detection if analysis of the fluid obtained is compatible with urine. Early recognition of injury and, if possible, repair at the time of primary surgery results in a more successful outcome and easier repair [15]. However, up to 33% to 87.5% of ureteral injuries are not suspected at the time of surgery and can result in significant morbidity [16,17].

If the ureteral injury is not recognised and consequently not repaired during surgery, it may lead to late complications such as upper urinary tract obstruction, abdominal distension, sepsis and genitourinary fistula [18]. These complications may present as clinical features such as flank pain, urinary incontinence, vaginal or urethral leakage, haematuria, fever and urinoma. It is important to note that haematuria is an unreliable and poor indicator of ureteral injury, being present in only 50-75% of cases [1]. Impaired renal function can also be detected by blood tests.

If ureteral injury is suspected postoperatively or during follow-up, computed tomography urography (CTU) is the test of choice [19]. Several signs may be seen on this imaging test: Delayed phase contrast extravasation may be the most obvious, but other common signs to consider include hydronephrosis or urinoma. If the findings are not diagnostic, a retrograde or antegrade urography can be performed [4].

In the case of iatrogenic accidents identified in the operating theatre and with a view to immediate surgical repair, aspects to be considered include patient stability, surgical position and the approach chosen. Haemodynamic instability or coagulopathy, often associated with pre-eclampsia or eclampsia, necessitates withdrawal of anaesthesia and rapid and efficient urological assessment [13].

Management options depend on the aetiology, severity and location of the injury. Iatrogenic ureteral trauma can result from ligation with a suture, which can be managed by ligation and stent placement. Partial transection due to an inadvertent scalpel incision can be repaired immediately with a stent or urinary diversion via a nephrostomy tube. Other common mechanisms of injury include thermal injury or ischaemia due to devascularisation [20]. In the case of complete ureteral transection, immediate repair is advisable as it significantly reduces the need for secondary or tertiary procedures compared to delayed repair [21].

Distal injuries, which are the most common, are best treated by ureteroneocystostomy (ureteral reimplantation). This approach ensures a better blood supply, which is not always preserved as collateral damage in these cases. Other possible techniques in cases of extensive mid-lower ureteral injury are a psoas hitch technique or a Boari flap, which help to decrease the distance between the bladder and the uninjured distal ureter but are long, time-consuming operations and unsuitable for the acute setting [22].

Proximal and mid-ureteric injuries, if shorter than 2-3cm, can be managed with a primary uretero-ureterostomy [1]. For large ureteral injuries or previous failed reconstructions, other techniques such as transureteroureterostomy, buccal mucosal ureteroplasty, ileal interposition graft and autotransplantation should be considered.

Despite the variety of techniques mentioned above, the best method to avoid such accidents is preoperative planning in surgeries that are expected to be complex or potentially involve urinary structures. The best way to prevent ureteral injury is to know the anatomy of the ureter and to be able to visually identify these structures in order to perform a careful intra-operative dissection in their vicinity [20]. It is known that the use of prophylactic preoperative ureteral stenting may aid in intraoperative diagnosis [23], but is not associated with a reduction in the likelihood of ureteral damage [24].

It should also be considered that prophylactic preoperative ureteral stenting is not without collateral damage, as it has potential complications such as pain and urinary tract infections, increases surgical time and cost, and more importantly, a stent may alter the location of the ureter and reduce its flexibility [23]. A recent review of patients undergoing endometriosis surgery showed that ureteral stenting should not be part of routine preoperative preparation, as there is no statistical significance in reducing ureteral injury. It should only be performed in specific cases of ureteral endometriosis, ureteral obstruction, hydronephrosis or extensive pelvic wall endometriosis [25]. Therefore, European urological guidelines strongly recommend the use of preoperative prophylactic stents, preferably in high-risk cases.

### Conclusion

Ureteral injuries are rare but not negligible in high-volume centres. The main cause is iatrogenic during gynaecological surgery. Intra-operative diagnosis is essential as delay in treatment increases morbidity. The best way to prevent it is to identify the anatomical structures at their typical anatomical landmarks and to be extremely careful in critical areas. If the diagnosis is made intraoperatively, immediate repair is recommended, whereas if it is delayed, the first approach should be endoscopic with ureteral stenting or nephrostomy before definitive repair.

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