

Laparoscopic Repair of Ureteral Injury in Gynaecologic Surgery

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Abstract

Iatrogenic ureteral injury is a potentially serious complication of pelvic surgery. It worries all professionals who deal with the pelvis, such as gynaecologists, general surgeons and urologists. Even though it is a rare surgical complication, occurring in 1- 10% of pelvic surgery, it is estimated that half of these injuries occur in gynecological surgery. While it is important that professionals who perform gynaecologic pelvic surgery know how to recognize and treat iatrogenic ureteral injuries, most have difficulty in the field of technique. The recognition and treatment of these lesions during surgery contributes to a significant reduction in morbidity rates.

Keywords: Endometriosis; Laparoscopy; Ureter; Ureteral injury; Ureteral repair

Introduction

Iatrogenic ureteral injury is a potentially serious complication of pelvic surgery and worries all professionals who deal with the pelvis, such as gynaecologists, general surgeons, and urologists. Even as a little common surgical complication occurring in 1-10% of pelvic surgery, it is estimated that half of these injuries occur in gynecological surgery [1,2]. The ureteral injury may be associated with significant morbidity, with an increase in hospitalization time, a greater number of surgical interventions, reduced kidney function and impairment of quality of life. It is the non-obstetric complication that leads to more lawsuits against obstetricians and gynaecologists [3].

The ureters can be injured due to their close anatomical association with female reproductive organs. The key is to identify the ureter in the pelvis. Ureteral injury consequences include acute ureteral obstruction, acute renal failure and if not recognized early, chronic ureteral obstruction with ureteral necrosis, fistulas and urinary extravasation [3].

While it is important that professionals who perform gynecologic pelvic surgery know how to recognize and treat iatrogenic ureteral injuries, most have difficulty in the field of art. The recognition and treatment of these lesions during surgery contribute to a significant reduction in morbidity rates. About 70% of the lesions are not recognized during surgery, being diagnosed postoperatively, with a mean time between surgery and diagnosis of 5-20 days [3,4].

Incidence

Ureteral injury is among the most worrying surgical complications. Although uncommon, it is estimated that most of these injuries occur in gynecologic surgery (50%); the urological procedures are responsible for 30% of injuries, and colorectal surgery, for 5-15% of cases [1,2].

Laparoscopic surgery has come up with many advantages for the patient, as smaller incisions, shorter surgical and post-operative pain, among others. However, the high number of laparoscopic surgeries led to rising numbers of ureteral complications [1,5]. According to recent studies, the rate of ureteral injuries during laparoscopic surgery varies between 0.0013% and 1.8% [6]. The incidence of ureteral injury is usually related to the complexity of the procedure. The incidence in gynecologic surgery is from 0.03 to 2% in abdominal hysterectomy,

0.02 to 0.5% in vaginal hysterectomy, 0.2 to 6% in laparoscopic hysterectomy, 1.7 to 3% in urodynamic procedure and 4.4% in the total expanded hysterectomy Wertheim-Meigs [7].

Some conditions increase the chance of ureteral injuries, particularly conditions that alter the anatomy and architecture of the ureters [8]. Risk factors: cancer, congenital anomalies, previous surgeries, pelvic inflammatory disease, endometriosis, infections and pelvic organ prolapse [2]. The main sites of ureteral injury are in the pelvic cavity, in the region of infundibular- pelvic and uterosacral ligaments, points of increased vulnerability of the ureter [9].

Diagnosis

The diagnosis of ureteral injury can occur during surgery or postoperative (early and late). According Ostrzenski, there are five different methods of identification: Retrograde ureteral dye injection, intravenous dye injection, intraoperative ureteral catheterization, intravenous pyelography and ureteral dissection [10]. The dyes are generally used; Indigo carmine of methylene blue [11]. The most sensitive diagnostic method for diagnosis of ureteral injury is excretory urography [2].

During surgery

Ureteral injury must be confirmed at the time suspected. In the past, solution with carmine of indigo dye or associated with furosemide methylene blue was the most used method to locate the damage and prevent further dissection. Currently, identification under direct visualization is the form most suitable for diagnosis [12]. By exploring the ureter, the surgeon must identify it from the bifurcation of the iliac vessels distally to dissect the area of interest. The ureters can also be investigated endoscopically with cystoscopy/ureteroscopy and ureteral

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catheter passage retrograde [2,12]. Recent meta-analysis has described that the proportion of ureteric injuries detected intraoperative in surgeries for benign diseases in gynecology without routine cystoscopy are approximately 18% and when cystoscopy is performed, the proportion of ureteric or bladder injuries detected intraoperative increases to approximately 95% [13].

Post-operatively

The undiagnosed ureteral injuries can lead to complications such as fistulas, urinomas and abscess formation. When a ureteral injury is identified in the postoperative period, the most common signs and symptoms are abdominal pain with peritonitis, leukocytosis and fever. Flank pain may or may not be present depending upon the nature of the lesion and the presence of occlusion or fistula into the peritoneal cavity and retroperitoneal space. Cystoscopy or excretory urography should be performed for diagnosis of suspected ureteral injury and assessing the possibility of stent implantation. If cystoscopy and urography are not possible, CT with intravenous pyelography (CT-IVP) can be performed [2].

Anatomy

In order to prevent ureteral injury, pelvic surgeon should be familiar with the anatomical features of the ureter and areas that are more susceptible to trauma [14].

The ureters are cored retroperitoneal structures, measuring about 25 to 30 cm in length, extending from the renal pelvis to the urinary bladder. The right ureter is about 1cm longer in length than the left ureter [14].

The ureter is divided into three anatomical segments, based on the view position in the abdominal radiographs. They are proximal ureter, which extends from the ureteropelvic junction to the top edge of the sacroiliac joint; middle ureter, which runs on the sacrum; distal ureter, which follows the bottom edge of the sacroiliac joint to ureterovesical junction, bladder [1].

The ureter originates after the renal artery in the ureteropelvic junction, previously covering the psoas muscle. Gonadal vessels cross the proximal ureter. The ureter then passes anterior to the iliac vessels usually in the common iliac bifurcation location [1].

In women, the ureter crosses dorsal to the ovary, broad ligament below 2 cm of uterine vessels and through the bladder wall obliquely to prevent backflow of urine [1].

Surgical Techniques

Ureteral reimplantation

The ureteral reimplantation allows the treatment of 4-5 cm lesions in the distal ureter. Most surgical injuries occur in the distal ureter. The distal ureter is usually injured during attempts to connect branches of internal iliac vessels, and its normal blood supply can be reduced after these maneuvers. As the blood supply may be interrupted, reimplantation is the ideal choice for ureteral distal repair [2].

When preparing the ureter to reimplantation, it should be thoroughly debrided back to viable tissue and spatulate [15]. Intact location must be in the anterior or posterior bladder dome and not on the sides, which are prone to squirm during bladder filling [16]. Reimplanted in the ureter, a stent and a Foley catheter must be placed in the bladder to be kept together in the perioperative a Jackson-Pratt drain (JP) near the anastomosis. The Foley catheter can be removed after one week and the JP drain removed as soon as it is determined

that repair is not leaking. The stent should be removed after 6 weeks [16].

Psoas hitch

This technique generates about 5 cm of additional length to facilitate reimplantation. It is a simple technique with few complications. When a large defect in the distal ureter is discovered, to the extent that the realization of a simple reimplantation result in tension on the anastomosis, this distance can be solved with the technique of Vesico-psoas hitch. The bladder is mobilized in the Retzius space and pedicle ligation of the contralateral bladder assists in positioning the bladder near the psoas muscle. The detrusor of the bladder is then fixed to the psoas muscle with monofilament suture non-absorbable. Care is needed to avoid genitofemoral nerve that is in the anterior surface of the psoas muscle. The ureter is then reimplanted in the bladder repositioned [2].

Ureter ureteral anastomosis

Often with small defects (2-3 cm) in medial and proximal portion, it is possible to perform primary reconstruction of the ureter [17]. You should try not to create tension at the anastomosis site. The distal and proximal end is debrided to the viable tissue and a continuous or separate point anastomosis is performed. In the anastomotic lumen, a stent must be positioned and, if possible, cover it with peritoneum or other tissue [2].

Boari flap

When an average lesion and the distal segment is not suitable for anastomosis, the path of the ureter, the Boari technique may be an alternative, may cover defects 12 to 15 cm. The bladder is mobilized, and then a flap debridement is created from the bladder wall, within the superior vesical artery or one of its branches. The width of the flap base must be at least three times greater than the length of the flap to ensure adequate vascular supply, and the length needed to reach the injured ureter. This flap is attached to the tendon of the psoas muscle and is made anastomosis with the ureter. It then performed a flap tunnel with absorbable suture [2].

Transureteroureterostomia (TUU)

In cases where it is not possible anastomosis between the injured ureter and bladder, the large distance between them, one option is to carry this ureter to the contralateral ureter.

This technique is carried out by mobilizing the damaged ureter until it reaches the contralateral ureteral without promoting stress. A medial incision is made in the healthy ureter and it is an anastomosis performed with ureteral stump [2]. A donor ureter should be extensively mobilized, being careful not to disrupt the blood supply in their adventitia. A little of the recipient ureter must be mobilized, so that the anastomosis area maintain sufficient supply of donor ureter must pass under the sigmoid colon through the mesentery, ureter to meet the recipient. The donor ureter is then, tooled to 2 cm and the recipient ureter is opened to correspond to opening of the donor ureter [18]. The anastomosis is then, performed. The donor ureter stent can receive through the distal portion of the recipient ureter to the bladder. An attempt should be made to recover ureteral anastomosis if possible [2]. It was emphasized by the authors, rarity in opting for TUU due to the high risk of complication and concern damage the contralateral ureter [19].

Kidney self-transplant

Very extensive lesions, with loss of almost all of the ureter, one can think of renal change. A technique is considered as the contralateral

kidney has poor operation or longer is no longer functioning, making it essential to maintain the kidney that had urethral loss. To do this, cut the rim of your site with great length of their vessels and restores vascular integrity anastomosing them with the iliac vessels. Thus, the sound segment of the ureter anastomosed to the bladder [2].

It is rarely mentioned during the intraoperative iatrogenic injury. If the self-transplant is considered, the ureter should be connected and a percutaneous nephrostomy should be installed for drainage. Renal self-transplantation requires a broad discussion as a patient about potential complications and options for elective repair [2].

Ureteral replacement

Faced with an extensive ureteral defect in which the bladder does not allow its reconstruction, should consider using a substitute for the ureter. The use of gastrointestinal segments, such as ileus, for ureteral replacement, became popular in 1950, with Goodwin et al. [20]. Other authors reported use of other tissues for ureteral replacement, as an appendix, colon, and stomach tunnel [2].

The most common substitute is the ileum, to present an excellent blood supply, be easily accessible and have good mobilization. Another advantage of the ileal segment is to prevent stone formation, as the large-diameter segment allows the passage of the calculation [2]. However, it is not without complications such as chronic infections, urinary stasis, reflux of urine absorption by the intestinal mucosa and mucus production obstructing urine flow. To perform the technique, the ileal segment must be within 15 cm from the ileocecal valve and must have adequate blood supply [2].

Laparoscopic treatment and minimally invasive urethral injuries: Surgeries laparoscopic and minimally invasive have transformed the modern surgical care. As a consequence, treatment of ureteral lesions can occur laparoscopically are less invasive treatments of iatrogenic ureteral injury cystoscopy and ureteral stent placement retrograde [2].

In a retrospective review, we compared patients undergoing laparoscopic surgery or open surgery to ureteral. Patient reimplantation underwent distal ureteral reimplantation laparoscopic required less pain medication, had fewer hospital stay and less blood loss [21].

As the ureteral reconstruction often requires corporeal suturing, the use of robotics in ureteral reconstruction is an area that has aroused great interest. Schimpf and Wagner described a series of 11 patients who underwent robotic assisted laparoscopy, with a distal ureteral reimplantation. The authors reported no perioperative complications and follow-up imaging revealed patency of all the ureters in a follow-up of 24 months [22].

Discussion

Ureteral injuries can be a cause of serious and permanent problems for the patient. Knowledge of methods for identification of the damage and the various treatment options is critical to getting a good result with the correction of the lesion [23].

There several factors that can promote distortion of pelvic anatomy favoring ureteral injury and among them malignant neoplastic diseases, endometriosis and pelvic inflammatory diseases are the most important [2].

The point of greatest vulnerability of the ureter is when he goes deeper into the pelvis at the level of infundibular- pelvic and uterosacral ligaments [9].

Park reported that perioperative occurs in less than 30% of cases,

and surgical exploration with careful dissection of the pelvis is probably the best method for diagnosing lesion [8]. However, cystoscopy after dye administration or Retrograde ureteral catheterization are also good choices for diagnosis of the lesion [11].

The way to approach the ureter injury, as already mentioned, depends on its cause, location and extent. Minor injuries, such as bandages, should be conducted with stent placement and affected area drainage. Partial transects can be fixed with sutures (absorbable suture) or resection of the affected area. Injuries in the middle or distal ureter can be repaired with ureter ureteral anastomosis, after release of the ureter tensions peritoneal attachments. With greater extent of injury, the ureter requires a more extensive repair, as the Psoas-Hitch, which adds several centimeters to ureteral length. Injuries occurred distally near the bladder, they could be corrected redeploing the ureter into the bladder [14].

Typically, a double-J catheter is placed within the lumen to prevent leakage ureteral and allow a better positioning of the cut ends to assist in carrying the suture [11].

In a review of studies on the time of the double stent J stay, there was a variation between 4 to 6 weeks for withdrawal [9,11]. The excretory urography was performed in all cases after stent removal in order to check the integrity of the urinary tract. Despite the stent length of stay was an arbitrary choice; there were no significant changes in the success rate of correction after its withdrawal. Interestingly, equivalent cure ureteral stent was achieved in residence for 1, 3 to 6 weeks for animal studies [9].

Traditionally, the correction of iatrogenic ureteral injury was performed by laparotomy. In recent years, however, the laparoscopic approach has been widely advocated, with increasingly promising results; not only when the lesion is diagnosed intraoperative as well as postoperatively. Similar results were found when comparing the laparoscopic treatment to reimplantation of ureter through laparotomy, with or without psoas-hitch [23]. However, considering the reduced invasiveness of laparoscopy, this has become the preferred technique for lacerations and transects [24].

In a study, laparoscopic surgery was compared to open surgery, showing lower hospitalization time and less significant intraoperative bleeding in the laparoscopic technique, although it has not been demonstrated significant difference in the success rate of the ureter correction [25].

The literature also discusses the degree of ureteral impairment caused by the delay in diagnosis of iatrogenic injury. It is expected that the delay in diagnosis for several weeks cause inflammatory reactions, increased risk of adhesions and possibly interfere with the results of ureteral anastomoses or reimplantation [7].

A gynecological surgeon with specific training and knowledge of possible complications has the ability to perform the ureteral reconstruction effectively. However, several sources emphasize the importance of a multidisciplinary team approach for ureteral injury for the better outcome of the complication [6].

Despite iatrogenic ureteral injuries are uncommon in gynecological surgeries, their involvement concerned to dealing with this type of procedure, especially in the case of complex surgeries such as in the treatment of endometriosis and cancer surgery. Performing cystoscopy selectively in any cases in which there is suspicion of ureteric or bladder injury can help surgeon's precocious diagnostic of injury. The described literature review shows the importance of familiarizing the gynecologic surgeon with the diagnosis and techniques for correction of iatrogenic

ureteral injury in order to improve the care given to the patient and their clinical outcome.

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