

URETERAL INJURIES IN COLORECTAL SURGERY - BIBLIOGRAPHIC REVIEW

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Abstract: Introduction: Iatrogenic ureteral injuries (UII) are surgical complications associated with high morbidity, with an incidence ranging from 0.3% to 1.5%, and most commonly observed in gynecological and colorectal surgeries. Objective: To evaluate the factors that influenced LUI in colorectal surgeries and their history of diagnosis and treatment performed. Method: Bibliographic review carried out on the PubMed platform, 29 articles were selected, published between 2005 and 2021. Results: LUI were more frequently observed in the distal ureter and in women. Among the risk factors, the anatomical ones stand out (adherence of the ureter to the peritoneum, similarity with the ovarian ligaments and uterine artery and its proximity to important pelvic structures), anatomopathological (congenital anomalies, pelvic tumors, colorectal cancer, previous surgery and irradiation). pelvic, endometriosis, inflammatory/infectious processes and inflammatory bowel disease) and technical (bleeding in the operative field, advanced tumor, malnutrition and surgeons on a learning curve). As protective factors, right and transverse colon colectomy and, in some studies, videolaparoscopic surgery were identified, the latter not being a consensus. The indication of prophylactic ureteral catheter is not clear in the literature. They are usually indicated in reoperations, large pelvic tumors, laparoscopic surgeries, previous radiotherapy, diverticulitis, occurrence of fistulas, Crohn's disease and obesity. In the immediate suspicion of LUI, careful intraoperative visual inspection and use of retrograde or anterograde ureteropyelography were reported. In late diagnosis, computed tomography with intravenous contrast was the most used exam. In the treatment of LUI, the type of surgical correction depended on the severity and location of the lesion. Conclusion: Colorectal cancer, neoadjuvant radiotherapy

and chemotherapy, pelvic recurrence, malnutrition and surgery performed in teaching hospitals were important risk factors for LUI. The use of an adequate and judicious surgical technique and the early diagnosis of ureteral lesions were more decisive factors than the surgical approach used.

Keywords: Colorectal surgery; ureter; iatrogenics.

INTRODUCTION

Iatrogenic ureteral injuries (UII) are important and uncommon surgical complications in abdominal and pelvic surgical procedures, but associated with high morbidity (PALANIAPPA et al., 2012). LUI are responsible for approximately 75% of all ureteral injuries, with an incidence ranging from 0.3% to 1.5% (PALANIAPPA et al., 2012), with emphasis on gynecological surgeries (AL-AWADI et al., 2005). ; MAHENDRAN et al., 2012) and colorectal, the latter occupying the second position in the literature, with an incidence ranging from 0.24% to 1.95% (DWIVEDI et al., 2002; PALANIAPPA et al., 2012; WILHELM et al., 2012; WILHELM et al., 2006). This may be explained by the proximity of the ureter to the dissection areas of the female reproductive system and the rectosigmoid, in addition to its difficult identification due to the intimate adhesion to the peritoneum of the posterior abdominal wall (ESPARAZ et al., 2015). An increase in the incidence of LUI has been observed from the period between 1986-1992 to 2000-2006, which can be attributed to changes in surgical practice (PARPALA-SPARMAN et al., 2008).

The objective of this literary survey was to establish in which clinical and surgical conditions LUI occurred and its history of diagnosis and treatment. With this, it is possible to build the profile of the patient who suffered LUI and identify the risk factors for the occurrence of the injury and help in

the elaboration of protocols to reduce LUI in surgeries.

MATERIAL AND METHOD

The bibliographic survey was carried out on the PubMed platform and articles from 2005 to 2021 were selected. The exclusive choice of the base was made due to the refinement found in the research, which allowed the grouping of a significant amount of articles. The characteristics and location of the lesions, underlying disease, predisposing factors, surgical approach, treatment performed and associated morbidity and mortality were analyzed.

As keywords for the research, the terms “ureteral injuries” and “iatrogenic ureteral injury” were used separately with the diagnoses: colon cancer; rectal cancer; colonic polyps; rectal polyps; familial adenomatous polyposis; diverticular disease, Crohn’s disease and ulcerative colitis. The terms “ureteral injuries” and “iatrogenic ureteral injury” were also used with the following procedures: right hemicolectomy; transverse colectomy; left hemicolectomy; sigmoidectomy; previous resection; abdominoperineal resection; partial/total colectomy and ileal anastomosis.

Figure 1 shows the complete selection process of articles for the bibliographic review:

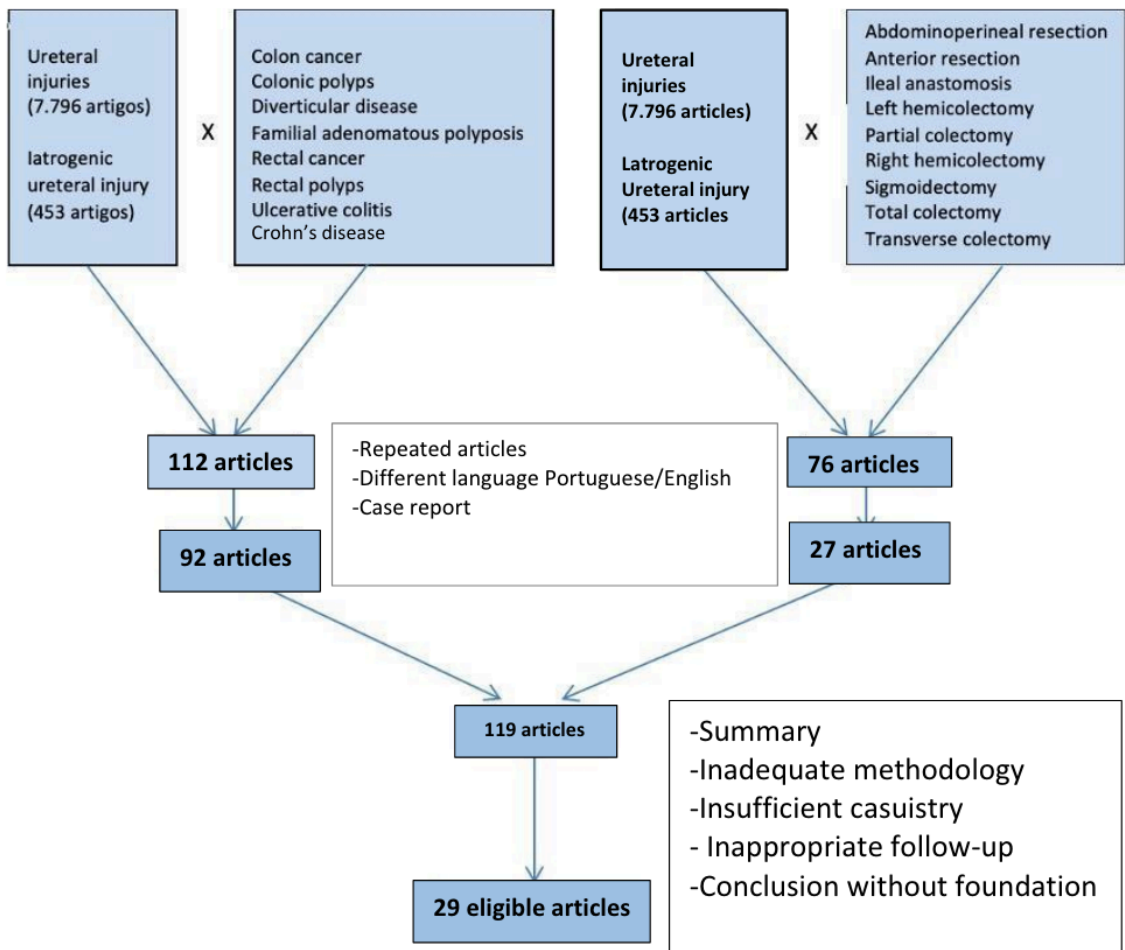


Figure 1: Flowchart for selection of studies for literature review.

RESULTS AND DISCUSSION

Most of the studies evaluated highlighted that ureteral injuries are rare complications in colorectal surgeries (PALANIAPPA et al., 2012). However, its incidence has increased in the last 20 years, as has the total number of days of hospitalization and hospital cost (HALABI et al., 2014; MAHENDRAN et al., 2012; PAPPALAPPA et al., 2008). Although it is difficult to determine the exact reasons for this trend, the increasing incidence of LUI seems to be associated with the increase in the complexity of operated cases (ZAFAR et al., 2014).

Among the articles researched, the anatomical, anatomopathological and technical risk factors stood out (BAŠIĆ et al., 2015). Anatomical circumstances, such as the adherence of the ureter to the peritoneum and its similarity to ovarian ligaments and the uterine artery, increase the chances of inadvertent transection or ligation (BAŠIĆ et al., 2015; ELAWDY et al., 2021). Although the ureter is located deep in the retroperitoneal space, protecting it from external traumatic injuries, the structure is more prone to iatrogenic injuries due to its proximity to important pelvic structures such as the uterine artery, cervix, vagina, colon, rectum, and vessels. iliac (BAŠIĆ et al., 2015; ELAWDY et al., 2021). Thus, more LUI were identified in women, which can be explained by the anatomical particularities of the female sex (PALANIAPPA et al., 2012). The distal ureter was the most vulnerable region for iatrogenic injury, accounting for more than 90% of all occurrences (BURKS & SANTUCCI, 2014; ELAWDY et al., 2021; ESPARAZ et al., 2015).

Pathological risk factors included retroperitoneal congenital anomalies, pelvic tumors, uterine prolapse, pelvic surgery and irradiation, endometriosis, inflammatory/infectious processes, and inflammatory bowel disease (IBD) (ESPARAZ et al., 2015;

FERRARA & KANN, 2019). Numerous technical factors have been related to the risk of ureteral injury such as bleeding in the operative field that makes it difficult to identify the ureter, blind clamping for hemostasis, presence of advanced tumors and surgeons on a learning curve (BAŠIĆ et al., 2015; ELAWDY et al., 2021). Furthermore, the ureters are vascularized by terminal arterial branches and therefore are vulnerable to ischemic injuries during surgical dissection that can lead to tissue necrosis (ESPARAZ et al., 2015; FERRARA & KANN, 2019; SAUER et al., 2004).). The protective factors for LUI were transverse colon colectomy and right colectomy, with some studies mentioning laparoscopic surgery (DA SILVA et al., 2012; ELLIOTT & MCANINCH, 2006; HALABI et al., 2014).

However, there is no consensus in the literature that laparoscopic surgery and, more recently, robotic surgery, have altered the rate of urological complications. Zafar et al. (ZAFAR et al., 2014) observed a reduction in the incidence of LUI in laparoscopic surgery compared to open procedures, unlike other authors (BAŠIĆ et al., 2015; ELLIOTT & MCANINCH, 2006; PALANIAPPA et al., 2012). Locke et al. (LOCKE et al., 2021) argue that the laparoscopic approach promotes delay in the identification of the lesion, making subsequent repair difficult.

In relation to the underlying disease, colorectal cancer (CRC) stands out in ureteral lesions (ESPARAZ et al., 2015; FERRARA & KANN, 2019). Halabi et al. highlighted rectal cancer, adhesions, metastatic disease, previous chemotherapy and radiotherapy, degree of malnutrition of the operated patient and surgery performed in teaching hospitals with the participation of resident physicians in the team as conditions predisposing to LUI. In locally advanced extraperitoneal rectal cancer, neoadjuvant treatment with

chemotherapy and radiotherapy can make surgery more difficult due to adhesions and tissue fragility, increasing the chances of LUI in the dissection of these tumors (ESWARA et al., 2015; HALABI et al., 2014). Surgeries related to benign polyps, diverticular disease and IBD are also related, but to a lesser extent (HALABI et al., 2014; MAYO et al., 2021; SPEICHER et al., 2014).

The indication for the use of a ureteral catheter is not clear in the literature (BURKS & SANTUCCI, 2014; CROGHAN et al., 2019; MEROLA et al., 2018; WILHELM et al., 2006). Its use is reported in cases of reoperation, bulky pelvic tumors, previous radiotherapy, diverticulitis, fistulas, Crohn's disease and obesity (ESWARA et al., 2015). Other authors also recommend the use of a catheter with light at the tip or the use of fluorescence devices with the intravenous injection of methylene blue for better identification of the ureters intraoperatively (BERALDO et al., 2013; SPEICHER et al., 2014). The use of a ureteral catheter during colorectal surgery, especially in laparoscopic access, where palpation of the ureters is not possible, can help in their identification (HIRD et al., 2021; MEROLA et al., 2018; SMITH & KACHNIC, 2017). Despite the ease offered, the procedure was associated with increased surgical time and expenses, as well as adverse events such as the ureteral obstruction and urinary tract infection (BURKS & SANTUCCI, 2014; ELAWDY et al., 2021; HIRD et al., 2021). In most studies in the literature, there was no decrease in LUI in patients with catheter placement, and the rates of acute kidney injury, urinary tract infection, sepsis, length of stay and mortality were similar in relation to those who did not use the catheter (BERALDO et al., 2013).

The clinical manifestations of LUI usually occur 48 to 72 hours after the primary procedure and are very varied: fever, abdominal pain, nausea and vomiting (symptoms related to

hydronephrosis, urinoma or ureteral fistula), hematuria, anuria, low back pain, peritonitis, urinary incontinence or even leakage of urine through the vagina (ELLIOTT & MCANINCH, 2006; EPARAZ et al., 2015). Laboratory tests can identify increased levels of urea and creatinine (ESPARAZ et al., 2015). In the late follow-up, patients may experience complications such as urinoma, peritoneal abscesses, sepsis, ureteral stenosis, ureterocutaneous fistula and potential loss of the ipsilateral kidney (ABBOUDI et al., 2013; ESPARAZ et al., 2015).

As for early intraoperative diagnosis and consequent correction of the lesion in primary surgery, the articles agree that there is a decrease in morbidity, ease of repair and improved results (ANDERSEN et al., 2015; ESPARAZ et al., 2015; LOCKE et al., 2015; LOCKE et al., 2015; LOCKE et al., 2021). Only a third of the injuries were diagnosed in the primary procedure, with a postoperative period generally without major sequelae (ESPARAZ et al., 2015). For the diagnosis of lesions, it has been reported from a careful visual inspection in the intraoperative period to the use of retrograde or antero-grade ureteropyelography in the suspected postoperative ureteral lesion (AL-AWADI et al., 2005; ANDERSEN et al., 2015; ESPARAZ et al., 2015). Computed tomography with intravenous contrast was the most used exam in late diagnosis, with high sensitivity (AL-AWADI et al., 2005; EPARAZ et al., 2015; FERRARA & KANN, 2019; WEIGAND et al., 2018). Minimal ureteral lesions can heal without clinical manifestations or sequelae; however, significant injuries, if not identified and corrected early and properly, lead to relevant signs and symptoms (ELLIOTT & MCANINCH, 2006).

The intraoperative diagnosis can be made in different ways according to the type of ureteral lesion investigated.

The most commonly requested tests are retrograde ureteropyelography, ureteroscopy and cystoscopy with bilateral retrograde ureteropyelography, the latter being the gold standard for the identification of ureteral narrowing and contrast extravasation. Ureteroscopy allows direct visualization of the ureters if retrograde ureteropyelography is inconclusive (ESPARAZ et al., 2015).

If the ureteral lesion is not identified in the primary surgery, clinical manifestations may raise the suspicion of LUI, which must be investigated with specific tests. In the postoperative period, intravenous urography (IVU) is a classic and accurate method to identify lesions, including small and recent ones. However, computed tomography urography (CT urography) is currently the most commonly used test for the diagnosis of LUI. Computed tomography with the use of three-phase contrast in conjunction with the nephrographic and excretory phases must be performed for the detection of ILU by contrast extravasation, hydronephrosis, ureteral obstruction, urinary ascites and localized fluid collection, such as urinoma (ESPARAZ et al., 2015). If these tests are inconclusive, bilateral retrograde ureteropyelography can be performed, which is quite accurate in identifying these lesions.

In turn, bilateral retrograde ureteropyelography is the best imaging test for the diagnosis of LUI, by accurately determining the type of lesion, its location and extent. Although it is not the first choice in acute situations due to its execution time, it is the method of choice for postoperative diagnosis in the face of inconclusive venous urography and/or CT urography (ESPARAZ et al., 2015).

With regard to the treatment of LUI, the type of surgical correction depends on the severity and location of the lesion (ABBOUDI et al., 2013; AL-AWADI et al.,

2005; AMBANI et al., 2020; HALABI et al., 2014; MAHENDRAN et al., 2012; SPEICHER et al., 2014). Factors that influenced the decision were the vascularization of the lesion site, the patient's clinical condition and the urologist's experience (AMBANI et al., 2020; HALABI et al., 2014). The intervention aimed at preserving the renal unit with adequate drainage by ureteral catheter or nephrostomy and minimizing surgical morbidity (ESPARAZ et al., 2015). Regardless of the intraoperative or post-surgery diagnosis, the repair must be performed as soon as possible for the clinical improvement of the patient (BAŠIĆ et al., 2015; MAHENDRAN et al., 2012).

Distal ureter injuries were treated with ureteroneocystostomy in most cases (BERALDO et al., 2013; SPEICHER et al., 2014). If the distal segment of the ureter was not suitable for anastomosis, other techniques were employed, such as the Boari technique and transureteroureterostomy (AMBANI et al., 2020; ESPARAZ et al., 2015; FERRARA & KANN, 2019; WEIGAND et al., 2018). In very few situations, when extensive injury to the entire ureter occurred, interposition of a gastrointestinal organ segment, renal autotransplantation or nephrectomy was necessary (ESPARAZ et al., 2015; WEIGAND et al., 2018). In left-sided ureteral lesions, the presence of colorectal cancer with previous radiotherapy and chemotherapy treatments increased the incidence of future complications after correction and the need for secondary intervention (ESWARA et al., 2015).

Although there are discrepancies in the literature, minimally invasive endoscopic techniques are justified in the treatment of LUI diagnosed late, with the condition that the placement of a ureteral catheter would make the affected area permeable and with adequate caliber (ABBOUDI et al., 2013; ESPARAZ et al., 2015; PALANIAPPA et al., 2012; ZAFAR

et al., 2014). Due to the relative rarity of such lesions, it was difficult to develop randomized controlled trials or even prospective studies to elucidate the role of minimally invasive treatments in surgical management. However, advances in the application of percutaneous renal surgery, laparoscopic and robotic techniques, and the important role of interventional radiology, have offered options to avoid major reconstructive procedures with high surgical morbidity (ESPARAZ et al., 2015; PALANIAPPA et al., 2012).

In cases where the injury occurred in an area with a previously placed ureteral catheter, delayed treatment using minimally invasive laparoscopic and robotic percutaneous techniques aided by interventional radiology has been reported (ESPARAZ et al., 2015; WEIGAND et al., 2018).). In addition, preoperative placement of the catheter did not guarantee the identification of LUI during surgery (PALANIAPPA et al., 2012).

CONCLUSIONS

LUI were more commonly seen in women and in the distal ureter. CRC, neoadjuvant radiotherapy and chemotherapy, and pelvic recurrence were considered important risk factors. There was no consensus regarding the prophylactic use of the ureteral catheter in its prevention. There has been an increase in minimally invasive endoscopic procedures for the correction of LUI, even in the treatment of lesions identified later. The use of an adequate and judicious surgical technique, and the early diagnosis of ureteral lesions were more decisive factors than the type of route used, whether laparoscopic, robotic or conventional open.

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