

# Renal Calyceal Rupture following Ureteral Injury after Total Laparoscopic Hysterectomy

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## Abstract

Ureteral injury (UI) complicates 0.1%–2.5% of total laparoscopic hysterectomies (TLHs). Renal calyceal rupture (RCR) is predominantly seen in patients with ureteral stones causing ureteral obstruction. Iatrogenic (surgical and nonsurgical) causes are responsible for only 3.5% of RCR. A 45-year-old gravida 4, para 2 female with a body mass index of 20 and no previous abdominal surgeries underwent a TLH due to hypermenorrhea and secondary anemia in the presence of a myomatous uterus. Intraoperatively, pelvic endometriosis and an isthmic myoma, 4 cm in diameter, were documented. On the 2<sup>nd</sup> postoperative day, the patient reported right-sided loin pain. The computed tomography scan revealed a right-sided RCR with urine extravasation and a retroperitoneal and intra-abdominal urinoma. The patient was treated with a transitory nephrostomy for 6 months, and subsequently finally with ureteroneocystostomy (psoas hitch). This case extends the spectrum of iatrogenic RCR causes as well as UI manifestations after TLH.

**Keywords:** Calyx rupture, gynecological surgery, hysterectomy, laparoscopy, renal pelvis, ureteral injury

## INTRODUCTION

Ureteral injury (UI) complicates 0.1%–2.5% of total laparoscopic hysterectomies (TLH).<sup>[1-3]</sup> Enlarged uterus, high body mass index (BMI), endometriosis, pelvic adhesions, and intraoperative hemorrhage are the main risk factors for UI.<sup>[1]</sup> Renal calyceal rupture (RCR), also reported as “forniceal” or “renal pelvis” rupture, is predominantly seen in patients with ureteral stones causing ureteral obstruction. Iatrogenic causes are responsible for only 3.5% of RCR.<sup>[4]</sup> Among iatrogenic causes, prostatic surgery and protrusion of the urinary Foley catheter into the ureter were described. Singular cases of RCR were reported after vaginal, abdominal, and robot-assisted radical hysterectomy.<sup>[4-6]</sup> To the best of our knowledge, RCR after TLH has not been reported yet.

## CASE REPORT

A 45-year-old gravida 4, para 2 female with a BMI of 20 and no previous abdominal surgeries underwent a total laparoscopic

hysterectomy (TLH) with prophylactic salpingectomy due to hypermenorrhea and secondary anemia in the presence of a myomatous uterus (postoperative specimen of 293 g). The medical history included a cervical conization. The TLH was performed in a standardized way, as described by Hohl and Hauser.<sup>[7]</sup> The patient was placed in the lithotomy position. The abdominal cavity was entered through four ports, one umbilical 10 mm port for the laparoscope and three ancillary ports: two on the left side (one at the level of the umbilicus and one at the level of anterior iliac spine) and one medially to the right iliac crest. The optical and surgical equipment was provided by Karl Storz® (Tuttlingen, Germany), except a single-use instrument called PowerBlade™ (LiNA Medical, Glostrup, Denmark), a combination of bipolar forceps and bipolar cutting electrode. For uterine fixation and manipulation, the reusable Hohl manipulator (Karl Storz, Tuttlingen, Germany) was applied.

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### Article History:

Submitted: 16 April 2019  
Revised: 14 February 2020  
Accepted: 11 March 2020  
Published: 1 August 2020

### Access this article online

#### Quick Response Code:



Website:  
www.e-gmit.com

DOI:  
10.4103/GMIT.GMIT\_28\_19

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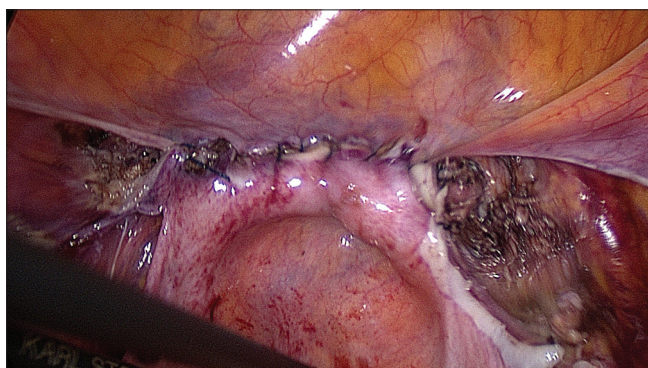
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**How to cite this article:** Watrowski R, Babbel B, Fisch D. Renal calyceal rupture following ureteral injury after total laparoscopic hysterectomy. *Gynecol Minim Invasive Ther* 2020;9:166-9.

All hemostatic maneuvers were performed using thermal bipolar energy. The hysterectomy was technically demanding due to a laterally protruding, right-sided isthmic myoma, 4 cm in diameter. In addition to the hysterectomy, a sharp excision of peritoneal endometriosis from the left side of the pouch of Douglas was documented. The uterus was evacuated vaginally, and the vaginal stump was closed laparoscopically with an absorbable, barbed suture V-Lock® (Medtronic/Covidien, New Haven, CT, USA). At the end of the procedure, the transperitoneal visualization of the right ureteric passage appeared inconspicuous [Figure 1]. The cystoscopy was not performed, as a bladder- or ureter-related complication was not suspected during surgery. On the 2<sup>nd</sup> postoperative day, the patient reported right-sided loin pain. On ultrasound, a right-sided hydronephrosis Grade 2 was observed. The hemoglobin was 8.6 g/dl, the serum creatinine was 1.0 mg/dl, and the C-reactive protein was 46.0 mg/l. The computed tomography (CT) scan with intravenous administration of contrast medium revealed a right-sided RCR with urine extravasation and a retroperitoneal and intra-abdominal urinoma [Figure 2a-d]. In addition, a hematoma beneath the right distal ureter and suspicion of a distal ureteric injury were described. The patient was transferred to a urological department, and retrograde ureterography confirmed an injury of the right ureter 3–4 cm cranially from the bladder as well as the secondary RCR. On the 3<sup>rd</sup> day following TLH, the patient received a transitory nephrostomy. After an interval of 6 months, she was subsequently finally treated with a ureteral reimplantation (psoas hitch) and insertion of a temporary double-J catheter, which was removed 4 months later (10 months after TLH). Immediately after nephrostomy, the serum creatinine dropped to 0.5 mg/dl and remained constantly between 0.6 and 0.7 mg/dl during the whole observation period.

## DISCUSSION

Gynecological surgeries are responsible for 65%–75% of iatrogenic UI.<sup>[2]</sup> The clinical presentation of UI reaches from

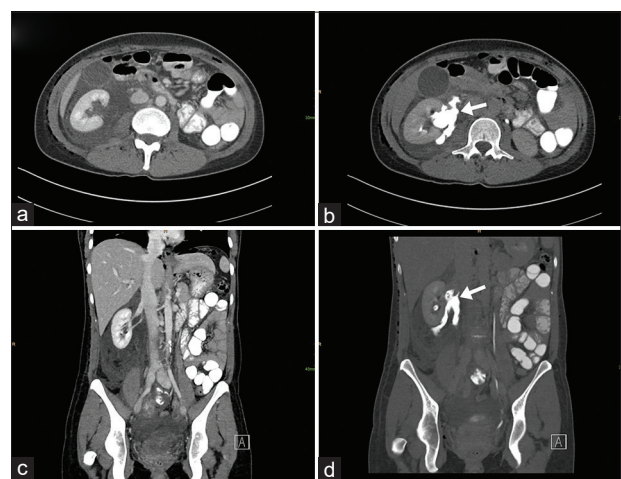


**Figure 1:** Intraoperative situs at the end of the procedure

complete transection, thermal damage with delayed tear off or fibrosis, and temporary or chronic stricture caused by swelling, scarring, or suture. A late sequel of UI is a ureterovaginal fistula with a reported incidence of 2.4%.<sup>[1]</sup> Intraoperatively, UI can be detected (e.g., transection) or suspected (dilatation and lack of vermuculation) by direct visualization or by use of cystoscopy (hematuria or lacking urine jet from the ureteral ostium). Unfortunately, whereas bladder injuries are diagnosed at the time of surgery in 52%–87% of cases, intraoperative diagnosis of UI is recognized in only 4%–12%.<sup>[1]</sup> The delayed diagnosis of UI typically occurs on the 7<sup>th</sup>–10<sup>th</sup> postoperative day.<sup>[3]</sup> Postoperative symptoms of UI are nonspecific, for example, abdominal or flank pain, nausea, hematuria, or watery vaginal discharge.<sup>[3]</sup> On ultrasound, ascites can usually be seen. The definitive diagnosis is made by a pyelography or CT scan with contrast medium.<sup>[3]</sup>

Most UIs occur at the level of cervix, where the ureter passes by dorsally and caudally. They result from the anatomical proximity of the ureter to the cervix – the ureter runs 2.3 ± 0.8 cm (range, 0.1–5.3 cm) laterally to the cervix.<sup>[8]</sup> On the right side, its adjacency is even 3–4 mm closer.<sup>[9]</sup> However, in 70%–80% of cases, the injury occurs on the left.<sup>[9]</sup> Notably, in 12% of women, this distance is <0.5 cm, which could predispose these women to UI during hysterectomy.<sup>[8]</sup>

Secondary renal pelvis rupture resulting from the obstruction of the distal ureter is an infrequent urological emergency. In the majority of cases (74%), it is diagnosed in patients with ureteral stones, followed by ureteric obstruction due to pelvic mass (10%).<sup>[4]</sup> Our literature search revealed three singular RCR cases after hysterectomy, one after vaginal,



**Figure 2:** Computed tomography with intravenous contrast medium – axial (a and b) and coronal (c and d) reconstructions. (a and c) Venous phase: Accumulation of free fluid around the right kidney and the renal pelvis. (b and d) Urographic phase: Leakage of contrast medium from the right renal pelvis indicating fornix rupture (arrowheads)

abdominal, and robotic hysterectomy, respectively.<sup>[4-6]</sup> Summarizing these few published reports (Gershman *et al.*'s study<sup>[4]</sup> contained no clinical details), the usual manifestation of RTR was ipsilateral loin pain occurring early after surgery or progressively increasing during weeks. The most suitable diagnostic modality was CT showing contrast medium leak from the renal calyx and distal ureteral obstruction. The surgical treatment consisted of immediate percutaneous nephrostomy followed by ureteroneocystostomy, resulting in full symptom resolution.<sup>[5-6]</sup>

The obstruction of the distal ureter and the cumulating backup of urine increase renal pelvis pressure and cause the subsequent rupture of one or more renal fornices (calyces) and perirenal urine leak.<sup>[4]</sup> Since RCR is a complex pathology comprising both perirenal urinary extravasation and distal ureteric obstruction, the radiographic imaging is indispensable for the diagnosis. Gershman *et al.* outlined the diagnostic radiographic criteria for RCR as the presence of any one of the features: "irregularity of a single renal calyx; loss of the ability to discern renal sinus fat; asymmetrically-distributed perinephric stranding; and a discreet perinephric fluid collection."<sup>[4]</sup>

Laparoscopic hysterectomy is a common and generally safe procedure. As compared to the abdominal approach, laparoscopy is associated with less postoperative pain, lower perioperative blood loss, lower postoperative morbidity, shorter hospital stay, better cosmetic outcomes, and faster resumption of normal activities.<sup>[1]</sup> Despite this, a higher risk of UI between 0.1% and 2.5% as compared to vaginal or abdominal routes has traditionally been reported for laparoscopic hysterectomy.<sup>[8]</sup> Fortunately, in the past decade, the reported rates declined to 0.02%–0.4%,<sup>[1]</sup> a trend parallelizing the popularization of the TLH technique, the development of surgical instruments, or both.

Among common types of laparoscopic hysterectomies, TLH and laparoscopic-assisted vaginal hysterectomy (LAVH) are associated with a higher proportion of bladder injuries in comparison to ureteral injuries (bladder vs. ureter: 75.5% vs. 37.3% for TLH and 97.1% vs. 2.9% for LAVH, respectively). In contrast, laparoscopic supracervical hysterectomy harbors a higher risk of ureteral instead of bladder injuries (70.5% vs. 29.5%, respectively).<sup>[1]</sup>

Our report extends the spectrum of RCR causes and, in turn, that of UI presentations after TLH. The initial UI occurred primarily to the distal ureter but subsequently affected the kidney, causing a high disease burden. The advantages of the initial laparoscopic approach were minimized by subsequent surgeries and prolonged convalescence time. The treatment encompassed restoration of the renal pelvis (in the present case achieved through nephrostomy),

maintenance of urine drainage (double-J catheter), as well as reconstruction of the distal ureter (ureteroneocystostomy with vesicopsoas hitch). The early CT scan facilitated the correct diagnosis because the symptoms (ascites and loin pain) were unspecific.

The prevention of UI is essential, but difficult. The fact that the vast majority of UI is detected postoperatively indicates that UI is mostly not obvious intraoperatively. The routine use of intraoperative cystoscopy during TLH, as recommended in 2012 by the American Association of Gynecologic Laparoscopists, could improve the detection of the bladder and ureteral injuries up to 95%.<sup>[2]</sup> In contrast, cystoscopy does not play a role in the postoperative diagnosis of UI.<sup>[2]</sup> Summarizing, in our opinion, the knowledge about anatomical variety of ureter localization (a proximity of <5 mm to the cervix in 1 out of 10 women), recognition of risk factors, cautious use of thermal energy, and considering the use of hemostatic agents (as powders, gels, or patches easily applicable also in difficult surgical fields), could help avoid UI.<sup>[1,8,10]</sup>

### Ethical approval

The study was approved by the institutional review board of St. Josefskrankenhaus, Teaching Hospital of the University of Freiburg, Freiburg, Germany (IRB number RKK-SJK.GYN.20190918).

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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