

Delayed Detection and Immediate Repair of Iatrogenic Ureteral Injury in Laparoscopic Anterior Resection with Partial Cystectomy: Lessons Learned

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ABSTRACT

Objective: This video intends to illustrate the pitfalls during laparoscopic anterior resection with partial cystectomy, causing ureteral injury, and why a delayed detection occurred.

Material and Methods: A 72-year-old male with T4 rectosigmoid colon cancer involving the bladder underwent laparoscopic anterior resection with partial cystectomy. Postoperatively, urinary leakage raised concern for bladder leakage, prompting conservative management for 2 weeks. Persistent leakage led to further investigation. A CT scan with cystography revealed an iatrogenic left ureteral injury without bladder leakage. The patient immediately underwent repair in the third postoperative week. This video highlights the operative challenges encountered during our review.

Results: The diagnosis of ureteral injury was initially obscured by the suspicion of bladder leakage following a partial cystectomy. The delayed diagnosis occurred due to the initiation of conservative management. After detecting the injury, the patient immediately underwent left ureteric re-implantation and experienced an uneventful discharge in the second postoperative week. A video review revealed challenging aspects that could provide vulnerable insights for future procedures.

Conclusion: During concomitant partial cystectomy, the ureters must be identified clearly. The suspicion of bladder leakage post-cystectomy can obscure iatrogenic ureteral injury. Delayed diagnosis of ureteral injury can be promptly repaired in cases where the preceding operation utilizes a laparoscopic approach, which is associated with less intraabdominal adhesion.

Keywords: delayed diagnosis; iatrogenic ureteral injury; laparoscopic colorectal surgery; T4 colon cancer

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INTRODUCTION

The management of locally advanced colorectal cancer invading adjacent organs presents challenges. It often necessitates multi-visceral resections to achieve oncologic clearance¹. In such complex colorectal surgery, laparoscopic techniques offer advantages, including reduced postoperative pain, shorter hospital stays, and potentially faster recoveries^{2,3}. However, these procedures carry inherent risks; including iatrogenic injuries to neighboring structures. Here, we present a case study of a 72-year-old male with T4 rectosigmoid colon cancer invading the bladder that underwent laparoscopic anterior resection with partial cystectomy, subsequently experiencing a delayed diagnosis of ureteral injury. This case underscores the importance of meticulous surgical techniques, intraoperative vigilance, and timely intervention in preventing and managing such complications.

Colorectal surgeries, particularly those involving the bladder, pose a risk of ureteral injury⁴, necessitating careful preoperative planning and intraoperative precision. Despite the enhanced visualization provided by laparoscopy¹, inadvertent injury to adjacent vital organs remains a potential complication. In our case, despite the meticulous planning of a laparoscopic anterior resection with partial cystectomy, the delayed diagnosis of a ureteral injury highlights the complexities inherent in these procedures. This case emphasizes the critical need for heightened awareness of potential complications, clear identification of anatomical structures, and prompt recognition of intraoperative injuries to optimize patient outcomes.

Furthermore, our experience underscores the importance of multidisciplinary collaboration and comprehensive postoperative evaluation in identifying and managing iatrogenic injuries. Despite the delayed diagnosis, our prompt consultation with a urologist facilitated timely repair, minimizing additional morbidity. Delay in diagnosing and treating iatrogenic ureteral injury can adversely impact the patient's oncological outcome by postponing adjuvant treatment⁵. This case serves as a reminder of the ongoing

need for continuous refinement of surgical techniques, intraoperative vigilance, and interdisciplinary communication to ensure optimal outcomes in complex colorectal surgeries.

Content of the clip (Click here for VIDEO presentation) <https://drive.google.com/file/d/1lloKWNE2g5YyD4LH5F0uOqQjmrzfANK9/view>

Patient information

A 72-year-old male presented with alterations in bowel habits, leading to the discovery of a tumor at the rectosigmoid colon junction following a colonoscopy. Histological analysis confirmed the presence of moderately differentiated adenocarcinoma. Subsequent staging with computed tomography (CT) revealed infiltration of the rectosigmoid colon cancer into the dome of the urinary bladder, accompanied by significant pericolic lymphadenopathy without distant metastasis. This constellation of findings indicated stage cT4bN1M0, suggesting locally advanced disease. The patient's medical history included type II diabetes, hypertension, and dyslipidemia, with no prior abdominal surgeries. Physical examination yielded unremarkable results, with a body mass index (BMI) of 24.6 kg/m² recorded at the time of operation.

Operative procedure

Operative intervention was planned as a laparoscopic anterior resection (AR), with partial cystectomy of the bladder. The surgical procedure followed standard protocols, employing a laparoscopic approach with a five-port incision. Upon reaching the dome of the bladder, a partial cystectomy was performed. Subsequent rectal transection was performed, followed by a continuous repair of the urinary bladder defect using an absorbable barbed suture, with a single-layer closure technique followed by interrupted sutures. To confirm the integrity of the repair, a methylene blue solution was utilized, revealing no defects upon testing. The operation proceeded uneventfully, without intraoperative complications.

Postoperative period

Following the surgical procedure, the patient exhibited appropriate postoperative recovery. Oral intake was initiated on the 3rd day post-surgery. However, notable drainage of clear fluid from the Jackson–Pratt (JP) drain, approximately 1 liter per day, was observed. Subsequent laboratory analysis of the drain contents on the 5th postoperative day confirmed urinary leakage. A suspicion arose regarding potential urinary bladder leakage from the previously repaired defect. Without signs of peritonitis, immediate conservative measures were implemented, including the insertion of a 20 Fr. urinary catheter to ensure adequate drainage, continued close suction drainage from the intra-abdominal region, provision of adequate nutrition, prevention of sepsis through the administration of intravenous antibiotics and close monitoring for signs of peritonitis.

Despite two weeks of conservative management to address the suspected urinary bladder leakage, the JP drain continued to yield approximately a liter of fluid daily, which was with urinary leakage upon laboratory analysis. Given this persistent drainage, further imaging studies were warranted. Cystography was conducted; however, it failed to identify any urinary bladder leakage. This prompted consideration of a potential missed ureteral injury during the initial operation.

Subsequently, a comprehensive CT scan, encompassing the kidneys, ureters, and bladder (KUB), was performed. The KUB CT scan, conducted during the third postoperative week, revealed a previously undetected left ureteral injury, highlighting a delayed ureteral injury that was recognized postoperatively. The KUB CT scan revealed a lower third transection of the left ureter with mild proximal hydronephrosis. The urinary bladder had a normal contour without contrast leakage: minimal ascites were noted.

Upon confirming the delayed diagnosis of the ureteral injury immediate consultation with a urologist was arranged. A collaborative discussion involving a

multidisciplinary team culminated in the decision to proceed with urgent repair of the ureteral injury, despite its delayed identification. Subsequently, the patient underwent an exploratory laparotomy with left ureteral reimplantation in the 3rd postoperative week. Intraoperative findings revealed a complete transection of the left ureter at its distal portion, accompanied by mild proximal hydronephrosis. Following mobilization of the left ureter and urinary bladder by our urologist, extravesical re-implantation of the left ureter into the urinary bladder was successfully performed utilizing the Modified Lich–Gregoir technique. Post-surgery, the patient experienced a smooth recovery without further complications. The Foley catheter was removed two weeks after the ureteral reimplantation. Subsequent removal of the JP drain followed laboratory confirmation of the absence of intraabdominal urinary leakage. At the two-month postoperative mark, the double J stent was removed without incident. Additionally, the patient received adjuvant chemotherapy in a timely manner, initiated eight weeks following the operation as per the appropriate treatment protocol.

What we learned?

Upon identifying the suspected, delayed diagnosis of the ureteral injury, a comprehensive review of the recorded surgical video was promptly undertaken. Meticulous scrutiny of the footage revealed a crucial moment during the rectal dissection, at 01:23 in the video, where an inadvertent injury to the ureter occurred. Specifically, we recognized the creation of a faulty lateral dissection line during this phase. This lateral dissection line seemed to have been aimed at achieving an adequate circumferential resection margin, a critical aspect of oncologic resection.

This experience prompted key learnings for future operations. Firstly, in cases where a multi-visceral resection is planned, especially with partial cystectomy, clear identification of both ureters prior to cystectomy is imperative to ensure their safety. Understanding the

appropriate dissection line is crucial to prevent ureteral injury while still achieving an adequacy circumferential resection margin.

Secondly, we acknowledge the significance of appropriate traction and counter-traction during surgery to avoid compromising exposure during dissection. If the adequacy of exposure is compromised, it is essential to promptly realign assistant graspers, ensuring the safety and precision of the procedure.

Thirdly, the concurrent nature of partial cystectomy alongside the primary operation may obscure the diagnosis of ureteral injury, potentially leading to suspicion of urinary bladder defect-related issues. Hence, when diagnosing urinary leakage, consideration of ureteral injury should also be included in the differential diagnosis.

Lastly, we recognize that the laparoscopic approach, despite its advantages in lower adhesion formation, allows for prompt repair of the ureter even in cases where the diagnosis is made late; such as in the 3rd postoperative week as in this case. This underscores the benefits of the laparoscopic technique in facilitating timely interventions despite delayed identification of complications. However, if the ureteral injury is identified intraoperatively, we encourage surgeons to attempt to complete the operation laparoscopically but not hesitate to convert to open surgery if necessary. It is crucial to prioritize preventing further complications once an initial complication occurs.

DISCUSSION

Although relatively rare, iatrogenic ureteral injury can occur in 0.3% to 1.1% of colorectal surgeries; notably in procedures like AR and low anterior resection (LAR)⁶. Various preoperative strategies aim to mitigate this risk, including meticulous evaluation of preoperative imaging, selective use of ureteric stents, adherence to precise surgical techniques,^{7,8} and intraoperative visualization of ureters using fluorescence dyes, like methylene blue or indocyanine green (ICG)⁹.

Prompt diagnosis and management of intraoperative ureteral injury are crucial to minimize additional morbidity; including the potential need for conversion to an open approach¹⁰. However, a significant proportion of intraoperative ureteral injuries remain undetected, possibly up to 50–70%⁶. Delayed diagnoses often arise due to mechanisms, like extended devascularization, particularly from thermal injuries caused by electrical instruments¹¹, as opposed to the transection mechanism observed in our case. The association between delayed diagnosis of iatrogenic ureteral injury and laparoscopic surgery has been reported to occur at a rate of approximately 11 times higher than in open surgical approaches¹². In our specific instance, the diagnosis of iatrogenic ureteral injury was initially missed, primarily due to suspicion being directed towards urinary bladder defect-related leakage following the partial cystectomy. Consequently, we did not promptly investigate the underlying cause of the high-output intraperitoneal urine leakage and continued conservative management for two weeks to allow for potential healing¹³. We advocate maintaining a high index of suspicion for ureteral injury when encountering urinary leakage subsequent to partial cystectomy. Following a partial cystectomy, any suspicion of urinary leakage from the bladder should prompt an early investigation without waiting for the expected two-week healing period. As observed in our case, prolonged urinary leakage can lead to complications; such as the formation of an enterovesical fistula. Fortunately, our case did not result in such a complication.

The timing of definitive repair for delayed diagnoses after 2 weeks post-injury remains controversial¹⁴. Standard management typically involves deferred surgery, a repair performed three to six months after the initial lesion^{15,16}. However, the delayed diagnosis led to our patient undergoing more procedures while awaiting deferred surgery compared to immediate diagnoses¹⁴. Immediate repair of delayed diagnoses has been reported, often involving ureteroneocystostomy^{14,15}. However, not all

cases demonstrate successful outcomes, occasionally necessitating additional procedures; such as chronic ureteral stenting or nephrectomy¹⁵. The decision to opt for immediate repair depends on the patient's condition, injury specifics, and surgeon preferences^{15,17}. In our case, after extensive consultation with a urology specialist, the decision was made to proceed with immediate repair through ureteroneocystostomy. The patient underwent the repair without encountering any other complications.

From our perspective, an imperative rationale advocating immediate repair for our patient is rooted in a prior laparoscopic approach. Studies have consistently demonstrated that adhesion formation subsequent to laparoscopic interventions is notably lower in comparison to open approaches¹⁸. The disparity between these approaches lies in the significant elevation of abdominal wall adhesion following open procedures versus laparoscopic ones. Conversely, no substantial differences in visceral adhesion have been observed between these approaches¹⁹. This distinction underscores the potential advantage of considering immediate repair for delayed diagnoses of iatrogenic ureteral injury. Moreover, the proficiency of a skilled laparoscopic surgeon in managing postoperative complications from laparoscopic colorectal surgery has been established as a safe and effective modality^{20,21}. Notably, successful reimplantation of the injured ureter, whether detected immediately or with a delay, has been documented using the laparoscopic approach^{22,23}. In our specific case, initial attempts at repair via re-laparoscopy revealed unexpected levels of visceral adhesion at the 3-week postoperative mark, leading our urologist to opt for an open repair surgery to ensure patient safety.

We underscore the necessity for heightened awareness of ureteral injuries in multi-visceral resection colorectal surgeries, warranting inclusion in preoperative planning and intraoperative awareness. Detecting ureteral injuries during surgery is highly preferred; however, in cases where such detection is delayed, maintaining a high index

of suspicion for ureteral injury becomes crucial, particularly when intraabdominal urinary leakage occurs, especially post-partial cystectomy. Timely and appropriate decisions regarding immediate repair of delayed iatrogenic ureteral injuries hinge upon patient condition, injury specifics, and the surgeon's expertise.

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CONFLICT OF INTEREST

All authors have no disclosures or conflicts of interest.

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