CASE REPORT

Laparoscopic ureteral repair for iatrogenic ureteral injury following lumbar disc surgery

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Summary  Iatrogenic ureteral injury is a rare yet severe complication in lumbar disc surgery. In our hospital we encountered only one such incident in 1946 prior to this case. We hereby present a novel approach in which laparoscopic end-to-end ureteral anastomosis was adopted for the repair of ureteral injury after lumbar disc surgery. A 60-year-old female underwent minimal invasive transforaminal lumbar interbody fusion (TLIF) for spondylolisthesis of the L4–5 level in 2012. Two days after the surgery, the patient complained of progressive right flank pain and a persistent lack of stool passage. An abdominal computer tomography showed right retroperitoneal urinoma and injury to the proximal ureter, which was revealed by contrast extravasation. Retrograde ureteroscopy confirmed complete avulsion of the ureter. Using a double-J catheter as the stent, we laparoscopically repaired the severed ureter, using the end-to-end anastomosis method. Although the operation lasted for 180 minutes, the estimated blood loss was only approximately 50 mL. The double-J catheter was removed 1 month after the surgery. Commonly encountered urological complications, such as obstructive uropathy, loss of renal function, or the subjective flank pain did not occur in the 6-month follow-up. Although the probability of occurrence is low, however, TLIF surgery is potentially capable of causing ureteral injury. The key to the successful execution of safe spinal surgery with a significant risk of ureteral damage would be the careful use of a curette instead of a rongeur.

Conflicts of interest: All authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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However, in the unforeseen situation where the ureteral damage has occurred, laparoscopic ureteral repair would be an option that could result in a good surgical outcome. 

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1. Introduction

Iatrogenic ureteral injury is a rare but severe complication of lumbar disc surgery. Historically, only 16 such cases have been reported. Although minimal invasive transforaminal lumbar interbody fusion (TLIF) is a modern approach and a good choice for lumbar spondylolisthesis, it does carry a certain surgical risk and can cause complications. Among the serious complications of minimal invasive TLIF is retroperitoneal ureteral injury. The management of such injury includes a ureteral stent, open ureteroureterostomy, hand-assisted laparoscopic ureteroureterostomy, renal autotransplantation, ileal ureteral reposition, and nephrectomy. We hereby report a new approach for the repair of such ureteral injury after lumbar disc surgery.

2. Case report

A 60-year-old female presented in 2012 with persistent lower back pain that radiated bilaterally to her posterior thighs and legs for 2 months. The body mass index of this patient was 24. The patient reported no previous history of surgery. Minimally invasive transforaminal lumbar discectomy and TLIF were performed to correct her spondylolisthesis of the L4 level. During the operation, the patient was placed in a prone position. Two small longitudinal surgical incisions were made in the left paraspinal region. The patient’s spinal disc was then removed using a pituitary rongeur. The anterior longitudinal spinal ligament was inadvertently ruptured during the surgery. Thereafter, a small piece of soft tissue was accidentally gripped and removed with the disc tissue. The interbody cage was placed in the newly created interveteral space and the wound was closed.

One day after surgery, the patient reported right flank pain and a lack of stool passage. The patient also developed fever and gross hematuria. An abdominal computer tomography (CT) scan revealed contrast extravasation in the right retroperitoneal space (Fig. 1). Retrograde ureterorenoscopy discovered a totally severed ureter at the proximal section. Pure transabdominal laparoscopic ureteral repair was performed. Both ends of the severed ureter were seen at the L4–5 level through the laparoscope (Fig. 2). After removing 2 L of urinoma in the retroperitoneal space, a gap of approximately 3 mm was found at the proximal end of the ureter. After ureterolysis and the placement of a double-J catheter, end-to-end ureteral anastomosis was performed to unite the spatulated ureteral ends using interrupted stitches. The overall operative duration was 180 minutes. However, the estimated blood loss was only 50 mL. The postsurgical recovery was uneventful. The kidney, ureter, and bladder X-ray showed one well-located right double-J catheter (Fig. 3). The patient was discharged 6 days later.

Four weeks after the surgery, the double-J catheter was removed during a routine outpatient visit. After a 6-month follow-up, the Tc-99m diethylenetriamine pentaacetic acid radionuclide renographic study demonstrated that the glomerular filtration rate of the right kidney was 24.5 mL/minute and that of the left kidney was 28.3 mL/minute, showing no evidence of obstructive uropathy in either kidney. The kidney ultrasound examination also showed no sign of hydronephrosis at 3 months and 6 months after surgery.

3. Discussion

Anatomically, each ureter lies retroperitoneally on the psoas muscle. Horizontally, the common iliac artery and vein cross the ipsilateral ureter at the L4–5 level. However, positional variation may make the ureter run medial to the psoas muscle and become closer to the vertebral body than usual. Although iatrogenic ureter injury is uncommon, it is a serious complication. Such injury occurs most commonly in the gynecologic and the colorectal surgeries. Other than the delayed diagnosis of ureter injury, loss of kidney function or even nephrectomy could be the unwanted consequences. To date, only 16 cases with such a complication of lumbar disc surgery have been reported. With regard to minimal access posterior lumbar surgery, such an incident has never been mentioned prior to this report.
Based on the previous reviews and reports and our experience, we hereby propose a few predisposing factors to the surgical injury of the ureter with attainable measures to avoid such an incident. First, a fundamental knowledge of the anatomy of the ureter and the adjacent structures should be the bare minimum. In lean patients placed in a prone position, the lumbar portion of the ureter would be pressed much closer to the vertebral body, and could possibly be pushed into the intervertebral space upon removal of the spinal disc. Second, for the removal of intervertebral disc, a curette is likely to be safer than a rongeur. Rongeur instruments could effectively remove the desired hard tissue by its powerful biting and snapping function. However, in a deep and narrow surgical field such as that in the removal of an intervertebral disc, it is difficult to clearly identify the barely visible soft tissue that is intended to be removed. If blindly snapped using the rongeur, unwanted soft-tissue damage may lead to severe consequences like those in our case. By contrast, the curette removes the tissue by scooping. Even if unintentionally gripped, the nature of the curette combined with the scooping movement still allows the captured floating soft tissue to escape the instrument damage. Third, in some population, the structure of the annulus fibrosus is less robust than usual, and renders patients prone to develop herniated discs at a lower lumbar level. During surgical manipulation of the intervertebral disc with such a structural abnormality, unintentional rupture and laceration of anterior longitudinal ligament (ALL) are likely to occur. In addition, collateral damage of contralateral retroperitoneal organs may accompany the rupture of ALL. Therefore, careful evaluation and thorough consideration of the surgical approach of such a structurally defected intervertebral disc would be likely to reduce the comorbidity of lumbar disc surgery.

In general, the early signs and symptoms of iatrogenic ureter injury are nonspecific, and the immediate detection of such damage within 24 hours is difficult. It has been reported that the interval time in the diagnosis of such injury could range from 3 days to 6 weeks after spine surgery. The patients would present with progressive flank or abdominal pain contralateral to the incision point, ileus, hematuria, and fever in 1 day or 2 days with leukocytosis. An abdominal CT scan as well as an anterograde and retrograde pyelogram would help in confirming the diagnosis and location of ureter injury. Endoscopy could further ascertain the extent of ureteral damage. The combined diagnostic results would provide clues to the best course of action in the management of the disrupted ureter.

A ureteral stent, open ureteroureterostomy, hand-assisted laparoscopic ureteroureterostomy, renal autotransplantation, ileal ureteral reposition, and nephrectomy...
are among the approaches adopted for the management of the damaged or disrupted ureter. A prolonged delay in the repair of a damaged or injured ureter may lead to local inflammation and fibrosis, which can ultimately cause the atrophy and shrinkage of the ureter. Some authors approved immediate repair of all iatrogenic ureteral injury upon confirmative diagnosis irrespective of the interval between injury and diagnosis. Such handling would reduce the incidence of subsequent complications such as ureteral stricture, fistula, and urinoma formation. Moreover, it is reported that the delay between diagnosis and management would significantly elevate the rate of complications from 10% to 40%. Although the optimal management approach for the proximal ureteral injury remains inconclusive, it is our opinion that immediate repair upon confirmation of the diagnosis is the best course of action. The simplicity of surgical management and the shortened interval between injury and repair would benefit the patients significantly. When performing the end-to-end ureteral anastomosis, certain principles should be followed. First, as the vessels supplying the ureter are tenuous, it is advised to perform careful dissection of the periureteral soft tissue that preserves the integrity of the adventitia prior to connecting the interrupted ureter. Second, it is advised that the connection of the ureteral ends by spatulated anastomosis should include a luminal stent, while the newly created connection should be water tight and tension free. Finally, an omental wrap may be performed on the repaired ureter to increase the possibility of its survival. Some additional advantages could also be gained while performing all the aforementioned procedures by pure laparoscopy. The patient does not need to go through yet another open surgery, thus shortening the recovery duration. In the aforementioned case, all the negative findings in the 6-month follow-up would confirm the effectiveness of such a managing strategy.

In recent years, minimal access posterior lumbar surgery is gradually gaining popularity among neurosurgeons. The surgical field of such a procedure is generally deep and narrow, and because of less than ideal visibility associated with this approach, the chance of inadvertent injury to the retroperitoneal ureters and vessels at the L4–5 intervertebral space will be considerably increased. However, a fundamental knowledge of regional anatomy, the proper use of suitable surgical instruments, and careful surgical maneuvering will significantly reduce the risk of iatrogenic damage to the ureter. In the unforeseen circumstance where ureteral injury has occurred, prompt and direct surgical management upon confirmation of the diagnosis is recommended. Repair of the minimal invasive TLIF-damaged ureter with a pure laparoscopic approach as reported earlier may prove an option with added benefit to the patients.

References