RESIDENT'S CORNER

Retroperitoneal fluid collection following anterior spine surgery—differential and management

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Iatrogenic ureteral injuries are rare and must be accurately identified to minimizing the risk for additional complications. Anterior lumbar interbody fusion (ALIF) is a valuable technique utilized in spine surgery, with its own unique set of complications. For example, retroperitoneal fluid collections, following ALIF surgery are rare and may result in back pain, radicular pain, nausea, and even death. It is important to rapidly identify the nature of the fluid collection to clarify appropriate management options. The purpose of this case report is to present a differential diagnosis for a delayed presentation of an extremely large retroperitoneal fluid collection following anterior lumbar surgery, as well as to provide discussion on this rare complication.

Specifically, a 51-year-old female with a history of numerous previous abdominal surgeries underwent an L3-S1 ALIF through a paramedian retroperitoneal approach. Postoperatively, she developed a large retroperitoneal fluid collection heralded by unilateral left lower extremity swelling and paresthesias. Fluid aspiration suggested a urine leak, but no specific injury was identified on retrograde pyelogram, most likely due to hardware obscuration in the area of presumed injury. A presumptive ureteral injury resulted in a ureteral stent placement, with resolution of the fluid collection and hydronephrosis. A high index of suspicion allowed for proper treatment, healing, and ultimately, a satisfactory outcome.

Key Words: iatrogenic ureteral injuries

Introduction

Iatrogenic ureteral injuries are rare (0.5%-1% of abdomino-pelvic surgeries) and are classically associated with urological (42%), gynecological (34%), or general surgical procedures (24%).[1] Treatment options for these injuries are predicated by the timing of diagnosis; either immediate (< 6 days) or most commonly (66%) delayed (> 6 days).[2] Immediate injuries are typically repaired primarily and delayed injuries temporized with drains such as stents or nephrostomy tubes, followed by delayed surgical repair. Missed ureteral injuries often present with the triad of fever, leukocytosis, and generalized peritoneal signs.[3] This is particularly concerning in the orthopedic arena where hardware and other foreign body material are subjected to a potentially infected milieu. As such, every opportunity for ureteral injury needs to be considered, including the rare instances surrounding orthopedic procedures. For instance, anterior lumbar interbody fusion (ALIF) is a valuable technique in the field of spine surgery;[4] however, one which may be fraught with complications. Vessel injury and retrograde ejaculation are rare, but have been described as the most common complications occurring in 1% to 3% of patients.[5] Retroperitoneal fluid collection immediately following anterior lumbar surgery is a more rare, but probably an under-reported complication given its possible asymptomatic nature. Such postop fluid collections represent a potentially debilitating problem that may result in back pain, radicular pain, nausea, and even death—depending upon the etiology. Rapid identification of the nature of the fluid collection and subsequent appropriate management are vital to optimizing patient outcomes.

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Methods

The patient was a 51-year-old female who initially presented with back pain and complaints consistent with bilateral lower extremity radiculitis. After failure of conservative management, she elected to undergo a lumbar decompression and fusion. She had been offered options of a posterior decompression and fusion, or, a combined anterior and posterior spinal fusion. To optimize her chances for a robust fusion, the patient elected the combined approach.

At the hands of an experienced spine surgeon who had performed numerous anterior spinal approaches, the patient underwent what appeared to be an uncomplicated anterior paramedian retroperitoneal approach to L3-S1. The surgical approach was more difficult due to a history of numerous abdominal surgeries, including a total abdominal hysterectomy, a sigmoid resection, and a lysis of adhesions. As expected, the patient had a notable amount of scar present on the approach, but a tissue plane to the spine was developed with identification of the great vessels and the left ureter. No injury was noted at the time of surgery. After successfully placing three anterior lumbar interbody cages, filled with allograft and bone morphogenic protein (BMP), the patient was placed in the prone position and underwent an uncomplicated posterior decompression and pedicle screw instrumentation. She was returned to the orthopedic floor in stable condition.

On postoperative day one (POD #1), the patient reported pain and left lower extremity parasthesias—not following dermatomal distributions. To rule out arterial thrombosis, a CT angiogram was obtained which ruled out an arterial obstruction while demonstrating only minimal retroperitoneal fluid, consistent with the patient's recent surgery. She left the hospital on POD #5, returning 5 days later for persistent left lower-extremity swelling and parathesias. Her examination exhibited asymmetrical swelling in her left lower extremity and a normal comprehensive neurological exam. Doppler studies were then ordered of the left lower extremity that did not show any evidence for deep vein thromboses (DVT).

Twenty-seven days postoperatively, the patient went to the emergency room, complaining of a 3 day history of worsening abdominal pain and swelling. Her work up included a cat scan (CT), Figure 1, and repeat Doppler studies, now showed a large left-sided retroperitoneal fluid collection (causing a mass effect on the left internal iliac vein) with an associated large DVT. Interventional radiology was consulted in order to aspirate the fluid collection, and place both a drain and an inferior vena caval filter. The ultrasound assisted

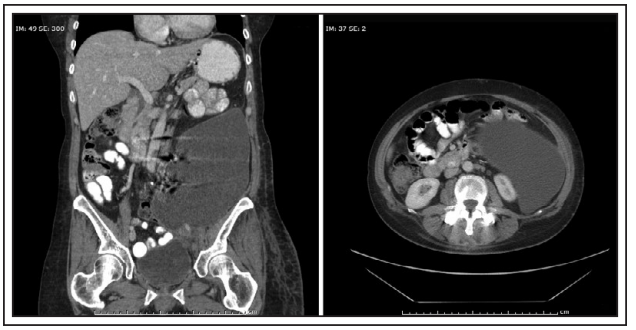

Figure 1. Coronal and axial CT images taken on POD #27 revealing large left-sided retroperitoneal fluid collection.

percutaneous aspiration yielded 2600 mL of yellow colored fluid which consisted of: a creatinine level of 4.4 mg/dL; serum creatinine level of 1.1 mg/dL; a negative result for myelin basic protein; and negative gram stain and culture. This raised suspicion of late ureteral injury which prompted urological consultation.

Despite a CT intravenous pyelogram (CT-IVP) failing to demonstrate evidence for a ureteral injury or leak, the retroperitoneal fluid collection recurred 2 days later. For this reason, the patient went to the OR for a cystoscopy with a retrograde pyelogram. Findings included a medially coursing left ureter with

Figure 2. Retrograde pyelogram showing a small collection of dye adjacent to the left kidney. Also visible are the anterior interbody cages as well as the posterior segmental fixation with pedicle screw.

mild, proximal hydronephrosis and, no evidence for active extravasation. Presumably, the area of leak was obscured by the medially coursing ureter, obscured radiographically by the closely approximated orthopedic hardware. At the conclusion of the procedure, a small collection of contrast had accumulated caudal to the left renal unit on post-drainage fluoroscopic images, Figure 2. For this reason, a double J-stent was placed in the left ureter followed by interventional radiology placing a percutaneous drain into the fluid collection.

The patient had an unremarkable postoperative course following stenting and drainage. Her foley catheter was discontinued on POD # 4 and she was discharged with the percutaneous drain 2 days later. At a 3 week follow up visit, the patient continued to have some mild abdominal discomfort; however, a repeat CT did not demonstrate any recurrent fluid collection. The double J-stent was removed 2 months after placement, following a negative retrograde pyelogram including resolution of hydronephrosis. A subsequent CT-IVP demonstrated a "transition point" in the left ureter at the level of the iliac crest. A subsequent lasix renal scan demonstrated that the stricture had no deleterious effect on the kidney emptying or functioning (t½ = 6 minutes). Shortly thereafter, the patient had a resolution of her abdominal discomfort; and on her most recent follow up, she has been completely asymptomatic for 6 months with no complaints of abdominal pain or leg swelling. We have obtained the written informed consent of the patient for the publication of this case report.

Discussion

Iatrogenic ureteral injuries are rare; yet need to be considered after abdominal/pelvic surgical cases. Unfortunately, 66% of ureteral injuries go unnoticed with subsequent suspicion stemming from a patient presenting with pain, fever, and leukocytosis.[2] Further delay may result in infection, fistulae, and even the need for an ipsilateral nephrectomy. Thankfully, ureteral injuries following anterior approach spinal surgeries are rare (less than 1%), yet a higher level of suspicion is required as orthopedic hardware may compromise visualization of a subtle ureteral extravasation.

This case posed a difficult clinical challenge. The patient had a number of risk factors for a complication associated with the anterior approach including multiple previous abdominal surgeries, as well as, the multilevel nature of her anterior lumbar spine surgery,[6] and the use of BMP.[7] Despite the difficult technical aspects of the approach, no obvious injury was noted intraoperatively to the nearby structures during the procedure. When the patient underwent an abdominal CT scan with contrast the day following surgery, there did not appear to be a large fluid collection or a vascular injury. The CT scan demonstrated a minimal fluid collection—an expected finding following a paramedian approach. The fluid collection appeared to have accumulated at some point between 24 hours and 4 weeks postoperatively. The differential diagnosis for such a fluid collection includes: ureteral injury, either acutely during the approach or sub acutely in the weeks following the procedure; sub acute vascular injury; lymphocele; seroma; or cerebrospinal fluid leak.

In this case, the most likely etiology of the fluid collection is a urinoma resulting from a ureteral injury. Although an intraoperative ureteral injury would have likely revealed a more extensive fluid collection on the early CT scan, this can certainly not be ruled out. Furthermore, the pathophysiology of the injury would potentially include ureteral wall necrosis from blunt trauma or traction occurring during the surgical dissection, which although not previously described, could theoretically lead to a sub acute leakage of ureteral contents. Identification of such an injury is more difficult due to hardware-based imaging limitations such as scatter on CT and opacification on fluoroscopic imaging. The relatively low creatinine in the abdominal fluid does go against this potential diagnosis, but the fact that her retroperitoneal collection resolved after drainage and replacement of a double J-stent does favor this diagnosis. Also supporting this diagnosis were the results of the cystogram and retrograde pyelogram which was concerning for contrast collecting just inferior to the left kidney.

When considering other differential diagnoses, the most unlikely complication would have been a vascular injury as the primary cause of the fluid collection. Vascular structures at risk during the anterior lumbar approach include the great vessels, segmental vessels, and numerous anomalous veins. Inamasu and Guiot[8] provided a review of vascular injury during ALIF concluding that vascular injury was most common when operating on the L4-5 level and the most common injury was venous laceration. Despite our patient being at a high risk for vascular injury, it was unlikely the cause of fluid collection in this case since a large vascular injury would likely have been identified immediately following the procedure. The CT scan performed roughly 12 hours after the procedure did not show a hematoma. Moreover, the aspirated fluid was not consistent with acute or chronic hematoma based on the color of the fluid and lack of red blood cells or hemosiderin found on analysis.

A cerebrospinal fluid leak is another possibility. This is, however, also unlikely due to a lack of both positional headaches and beta 2 transferatin (indicative of CSF) on the aspirated fluid.

The use of BMP has been found in some studies to be associated with an increase in the incidence of complications in spine surgery.[7] BMP has been known to produce large fluid collections that may mimic infection. In a large multicenter study performed by Williams et al in a subset of patients who underwent a combined anterior and posterior thoracolumbar approach, there was a higher rate of deep wound infection if BMP was used (1.1% versus 0.2%, $p < 0.001$)[7] most likely resulting from an inflammatory host response. However, this is dissimilar to our case in which a discreet fluid collection accumulated. Furthermore, aspiration of the fluid collection in our patient was found to be aseptic; and therefore, deep infection was not the cause. Seroma cannot be ruled out definitively.

Patel first described lymphatic injury resulting in a large lymphocele in 2008.[5] Prior to this, it was usually described as a complication following kidney transplant, where it can occur in roughly 3% of renal transplantations.[9] In Patel's case report, the lymphocele first became symptomatic 6 weeks postoperatively, and similar to our case was found to be very large, measuring 20 cm x 22 cm x 23 cm in size. Ultimately 8.5 L of fluid was aspirated under ultrasound. Patel indicated that in order to make the diagnosis of lymphocele, fluid analysis should include: gram stain, culture, cell count with differential, creatinine, amylase and lipase. Lymphatic drainage can be identified by its milky appearance, specific gravity of > 1.012, high triglyceride content, > 3% protein, high leukocyte count, and positive staining with Sudan III reagent.[5] Our fluid was not consistent with any of these findings.

Complications from anterior spinal approaches may manifest in a delayed manner. On one hand, surgeons should maintain a high index of suspicion and warn patients about signs and symptoms of a delayed surgical complication—prompting them to seek immediate medical attention. On the other hand, in an attempt to further minimize the risk for ureteral injury, it has been suggested that all anterior lumbar revision surgeries be approached using ureteral catheters (to assist with intraoperative identification), along with a dedicated, high volume vascular surgeon to access the lumbar vertebrae.[10] □

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