

# Traumatic Uretero-Pelvic Junction Disruption

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## Abstract

We present a case of left ureter transection secondary to blunt abdominal trauma. While this is an uncommon injury, a high index of suspicion and the routine use of either excretory phase CT examinations or possibly pre-bolus contrast protocols would provide accurate diagnosis and prevent unnecessary diagnostic delays.

## INTRODUCTION

The vast majority of traumatic injuries to the genitourinary system involve the renal parenchyma. Rarely, blunt force abdominal trauma results in injuries to the ureter at the ureteropelvic junction (UPJ). Complete dissociation of the ureter at this point is referred to as UPJ avulsion whereas incomplete separation is termed a laceration. This injury has been described most often in children involving the right UPJ with only a few dozen cases reported in adults [1, 2]. A history of rapid deceleration injury secondary to falls from greater than 20 feet or motor vehicle accident are the most common causative factors [3,4,5]. Urgent management of life-threatening injuries results in a delay in diagnosis greater than thirty-six hours in about half of all reported cases. Even when imaging studies are performed, UPJ disruption may not be identified when examinations lack an excretory phase component [1]. UPJ avulsions are treated surgically; whereas, a more conservative approach (stent insertion) has been successful in lacerations.

## CASE REPORT

A 19 year-old male was referred to our institution after being involved in a motor vehicle accident. The patient was standing out of the sunroof of the vehicle when the vehicle collided with a tree. He complained of pain across the upper abdomen at presentation. There was no LOC, GCS 15/15 and vital signs were normal. He had abdominal pain greater on the left than the right but no peritoneal signs. Initial investigations were unremarkable aside from the presence of gross hematuria.

An initial contrast enhanced CT examination revealed fractures of the transverse processes of the left second and

third lumbar vertebrae. There were small lacerations to the inferior aspect of the spleen and the midpole of the left kidney with a large perinephric fluid collection extending into the pelvis (Fig. 1 and 2). Of note, no delayed images were obtained to assess the renal collecting system.

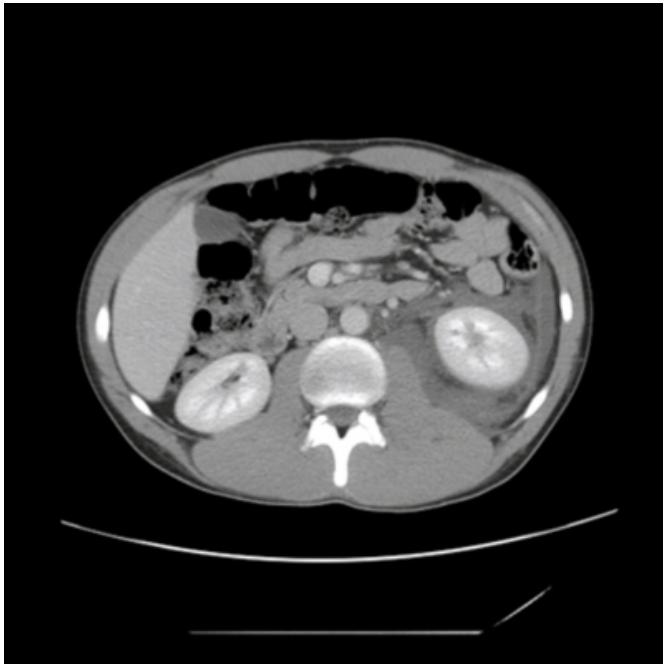
## Figure 1

Figure 1: Axial image from the initial contrast enhanced CT reveals laceration to the midpole of the left kidney.



**Figure 2**

Figure 2: Image from the initial contrast enhanced CT scan reveals moderate sized circumferential perinephric fluid collection.

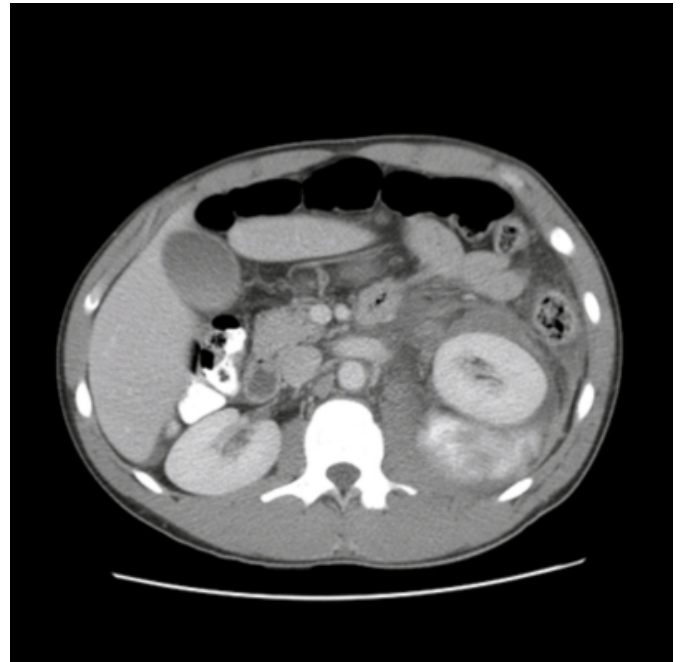


The patient was admitted to hospital for observation. The next day, the patient experienced increasing abdominal pain and an ileus developed. Nasogastric tube insertion provided little relief of his pain and overnight the patient's condition worsened. At this time, the patient was writhing in pain, febrile with a WBC count of 18.4, and his creatinine had risen to 157umol/L. On examination the patient exhibited rebound tenderness. A second CT scan was performed.

Initial contrast enhanced images revealed a heterogeneous, circumrenal fluid collection with regions of high density that had increased in size (Fig 3).

**Figure 3**

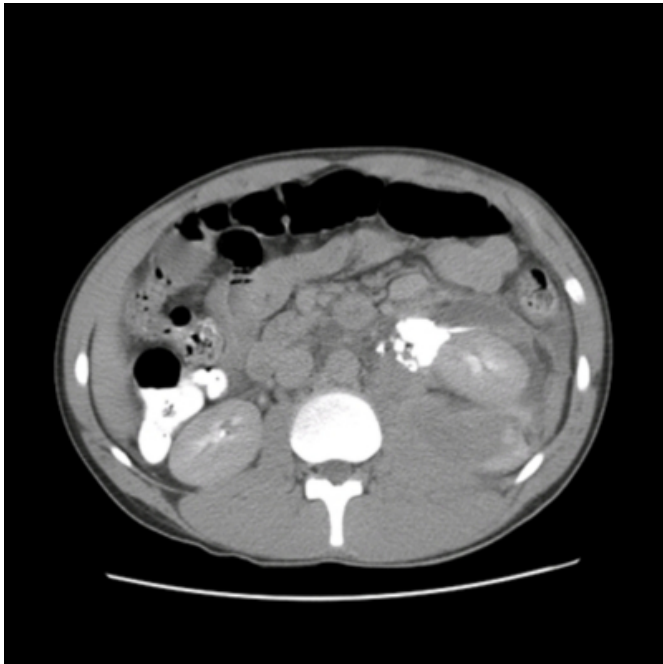
Figure 3: Contrast enhanced image taken two days after admission displays a heterogeneous circumrenal fluid collection, with regions of high density, that had increased in size.



Delayed intravenous contrast enhanced images show contrast extravasation from the proximal ureter just distal to the expected location of the UPJ (Fig 4). The contrast accumulated in the medial aspect of the left anterior perirenal space. No other changes were evident.

**Figure 4**

Figure 4: Delayed contrast enhanced CT image shows contrast extravasation into the medial aspect of the anterior perirenal space.



Retrograde pyelography showed contrast extravasation from the proximal ureter and no continuity with the renal pelvis (Fig 5). Laparotomy revealed ureteric transection at the UPJ. Stented ureteroureterostomy was performed. The patient spent six days in hospital without complication and was discharged home. The stent was removed 6 weeks post-operatively.

**DISCUSSION**

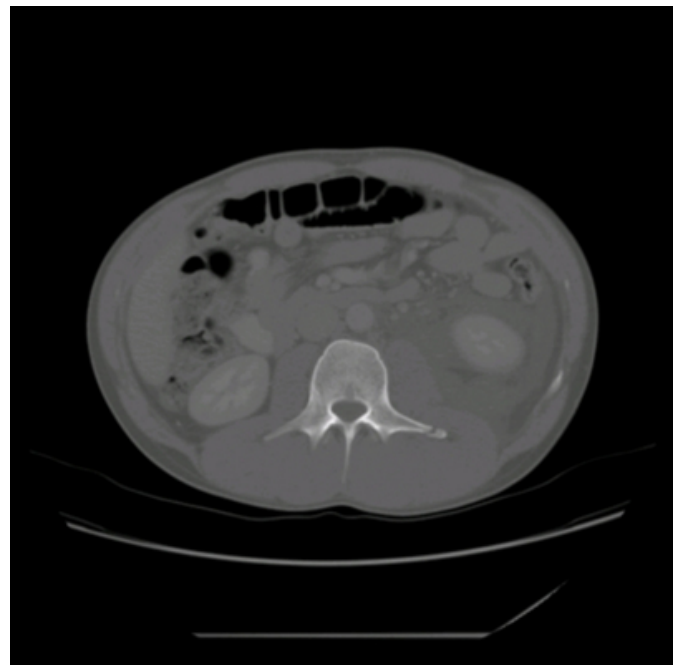
Ureteric injury accounts for about 1% of all trauma to the genitourinary system. Less than 5% of these injuries result from blunt trauma. Injuries to the UPJ and upper ureter occur more frequently as the bony pelvis and psoas muscles provide protection to the distal collecting system [2]. The UPJ can suffer complete dissociation or partial disruption; the former injury is termed UPJ avulsion and the latter UPJ laceration. Traditionally, UPJ disruption has been reported more frequently in childhood [1, 2,6] with a right-sided predilection [1, 7]. This may simply be due to the small number of reported cases as a recent series found the injury more prevalent in adults and with a strong left side predilection [8].

The majority of UPJ disruptions result from rapid deceleration injuries secondary to either falls from greater than 20 feet or motor vehicle accidents [3,4,5]. The proposed

mechanism of injury involves hyperextension of the trunk which stretches the ureter. This is followed by a rapid deceleration that compresses the ureter against the vertebral column, which may contain a fracture [3]. As in this case, the presence of transverse process fractures of the lumbar vertebrae should raise suspicion for ureteral injury [3, 9,10,11]. This case provides a mechanism consistent with the above hypotheses. The patient was standing through the sunroof of a moving vehicle and a rapid deceleration caused direct trauma to the left flank compressing the ureter. Fractures of the transverse processes of the left second and third lumbar vertebrae provide support for this mechanism (Fig 5).

**Figure 5**

Figure 5: CT image viewed with a bone window displays a fracture of the transverse process of the second lumbar vertebra.



Patients with UPJ disruption often experience a delay in diagnosis of their genitourinary injuries. In fact, in the majority of patients with this injury diagnosis was not made in the first 36 hours [5, 8, 9]. The presence of life threatening injuries and hemodynamic instability often preclude radiologic studies of the collecting system. In addition, finding a palpably intact kidney at laparotomy is insufficient to diagnose many of these injuries [5]. Additionally, in up to one third of patients there is no evidence of hematuria and imaging studies specifically directed to the genitourinary system are not obtained [5, 8]. This realization resulted in the recommendation that the initial criteria for imaging the genitourinary system following blunt abdominal trauma to

be updated. Nicolaisen proposed that imaging exams be undertaken in the presence of gross hematuria or shock accompanied by microhematuria. Using these criteria, only 53% of cases with UPJ injury would have been imaged. To reduce the number of missed cases it has been suggested to add the presence of flank tenderness/ecchymoses or associated injuries such as hemoperitoneum or spinal fractures as risk factors for this injury [1, 12, 13]. Using these criteria over 95% of UPJ injuries would have been imaged [5].

UPJ disruption occurs secondary to rapid deceleration injury. In this context an abdominal contrast enhanced CT scan is often the first exam to evaluate the kidneys. Kenney reported that contrast extravasation predominantly in the medial perirenal space was an important finding in UPJ disruption. Additionally, the presence of intact renal parenchyma, the absence of ureteral opacification as well as the absence of a perirenal hematoma should suggest ureteric injury [4]. Kawashima further defined the imaging findings by adding that a circumferential urinoma, when present, strongly indicates UPJ injury [8].

In a minority of cases, such as our own, renal parenchymal injury coexists with UPJ disruption. This produces more complex imaging findings. In these instances the findings of medial perirenal contrast extravasation, an absence of contrast near the parenchymal laceration site and an unopacified distal ureter suggests ureteric injury [4, 8]. Most importantly, with the rapid image acquisition of modern helical scanners it is imperative to acquire delayed excretory phase images to assess the integrity of the collecting system. Up to 2/3 of UPJ disruptions will not be seen on initial arterial phase images [1, 4]. Of further benefit, in the presence of combined injury to the renal parenchyma and the UPJ, the source of perinephric fluid can be assessed by identifying the area of contrast extravasation and an unopacified distal ureter [1, 4].

Alternatively, it has been suggested that the use of a pre-bolus of 20 ccs of intravenous contrast, given 5 minutes prior to the abdominal CT examination can enhance the renal pelvis in 100% of patients, and in the majority of cases (78%) the ureters as well [14]. This protocol would provide two obvious advantages. First, a pre-bolus of contrast that adequately enhanced the collecting system would eliminate the need for dedicated excretory phase images thereby reducing the radiation dose. Furthermore, if adequate visualization of collecting system injuries could be attained

without the need for delayed images, therapeutic intervention could be employed without the time delay needed to obtain excretory phase images. Further evaluation, in the form of a prospective trial, on the accuracy of this protocol for the diagnosis of collecting system injuries is needed before its routine use in this regard can be mandated.

With respect to this case, diagnostic delay was secondary to excretory phase images not being performed on the initial CT examination. In the presence of a renal laceration, the perinephric fluid was attributed to a hematoma. After the patient's condition worsened the CT examination was repeated and excretory images were obtained displaying a circumrenal urinoma with contrast extravasation predominantly in the medial perirenal space and an unopacified distal ureter. It is almost certain that the addition of excretory phase images or possibly the use of a pre-bolus protocol to the initial exam would have prevented this delay.

The treatment of UPJ avulsion is surgical. Delay in diagnosis may increase morbidity. In one series the nephrectomy rate was >30% in those that experienced a delay in diagnosis compared to <5% for those diagnosed early [15]. Furthermore, a review on the subject found that the complication rate, including but not limited to primary nephrectomy, was four times greater (52% vs. 13%) in those that experienced a delay in diagnosis greater than twenty-four hours [5]. Of course, delayed diagnosis also results in undue patient suffering and increased hospital expenditures awaiting definitive treatment of the injury.

## CONCLUSIONS

In conclusion, UPJ disruption is an uncommon clinical entity resulting from rapid deceleration injuries. It poses a diagnostic dilemma for several reasons. First, the presence of more serious injuries can delay imaging studies of the genitourinary system. Also, the traditional criteria for obtaining dedicated genitourinary imaging studies (the presence of shock and microscopic hematuria or gross hematuria) missed approximately half of reported cases. As such, the criteria for obtaining images have been expanded to include the above as well as any patient with a history of rapid deceleration with associated injuries including vertebral fractures as well as those with flank pain or ecchymoses. Furthermore, the rapidity in which a trauma CT series can be obtained on a helical scanner makes excretory phase imaging essential to identify contrast extravasation. Delayed images are especially useful in instances where renal parenchymal injuries and ureteric injuries co-exist.

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