Ureteropelvic junction disruption and distal ureter injury associated with a Chance fracture following a traffic accident: a case report

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ABSTRACT

A 10-year-old girl sustained a ureteropelvic junction disruption and distal ureter injury associated with the Chance fracture following a traffic accident. She was sitting on the rear seat of a car wearing a lap belt. Extensive small bowel mesenteric trauma was noted. Radiography revealed a left haemothorax with mediastinal shift and an unstable flexion-distraction vertebral fracture at L2 (Chance fracture). Subsequent intravenous pyelography demonstrated proximal extravasation from the right kidney without continuity to the upper and mid ureter, indicating a ureteropelvic junction avulsion or necrosis. Definitive surgery was delayed until day 33 because of urosepsis. Due to extensive small bowel resection, ischaemia of the ureter, and the history of urosepsis, a right subcapsular nephrectomy (rather than ureteral reconstruction) was considered the safest option for minimising further complications. It is important that trauma specialists recognise additional injuries after major trauma. Early use of a multidisciplinary approach is recommended to reduce morbidity and mortality.

Key words: accidents, traffic; seat belts; spine; ureter

INTRODUCTION

Although traffic accident fatalities have decreased since the introduction of mandatory seatbelt use,1 a special injury pattern caused by seatbelts has emerged. The ‘seatbelt sign’ describes ecchymoses and abrasions seen across the chest or abdomen. The ‘seatbelt syndrome’ is associated with lumbar spine injuries and concomitant intestinal or mesenteric injuries.2 The association can be as high as 78% in the paediatric population with a 21% concurrence of flexion-distraction fractures of the spine (Chance fractures).3 Of intra-abdominal injuries associated with Chance fractures, 64% were to the jejunum and ileum. Injuries to the genitourinary tract are less common. We report a case of ureteropelvic junction disruption and distal ureter injury associated with a Chance fracture following a traffic accident: a case report.
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CASE REPORT

In December 1994, a 10-year-old girl wearing a lap belt in the rear seat of a car was involved in a high-speed collision. The vehicle was struck head-on and then rear-ended. On presentation, the patient was conscious, with a blood pressure of 100/64, heart rate of 158, and respiratory rate of 24. On examination, abdominal wall ecchymoses and abrasions were observed. Her abdomen was tense and guarding was present. Numbness and decreased movement were noted in both legs. Gross blood was discovered on diagnostic peritoneal lavage. Radiography revealed a left haemothorax with a right mediastinal shift and no evidence of rib fractures; it was presumed the haemothorax was caused by sudden deceleration of the soft tissues. An aortogram revealed no aortic arch injury. Spinal radiography demonstrated an unstable flexion-distraction vertebral fracture at L2 (Chance fracture) [Fig. a].

A laparotomy revealed extensive small bowel mesenteric trauma; the damaged ascending colon, ileum, and distal jejunum were removed; the remaining 50 cm of the jejunum was anastomosed to the transverse colon. A right renal contusion and right diaphragmatic rupture were also identified. No obvious signs of hepatic, splenic, or pancreatic injury were seen.

The Chance fracture was treated on day 3 with fusion of the L1, L2, and L3 vertebrae using posterior instrumentation (Fig. b). On day 6, an ultrasound revealed a right perinephric fluid collection that was managed conservatively. The fluid was drained on day 10 and found to be urine. Intravenous pyelography demonstrated proximal extravasation from the right kidney without continuity to the upper and mid ureter, indicating a ureteropelvic junction avulsion. Cystoscopy, retrograde pyelography (Fig. c), and ureteroscopy revealed a devascularised, stenotic segment 2 cm proximal to the ureterovesical junction with no continuity with the proximal ureter. This was complicated by candida urosepsis, and she was not stable enough for further surgical intervention until day 33.

Given the extensive ureteral injury, previous bowel resection, adjacent spinal implants, and the history of Candida urosepsis, a right subcapsular nephrectomy was considered the best means of minimising the risk of further complications. Although the substantial devascularisation of and disruption to the right ureter indicated total ureteral replacement, ileal replacement of the right ureter was contraindicated. A psoas hitch and Boari flap were considered, but they would not have achieved total replacement of the ureter.

This patient was discharged 3 months later. She had paraplegia and short gut syndrome. The Chance fracture healed uneventfully and her renal function remained stable.

DISCUSSION

The standard seatbelt does not fit small children well, resulting in the shoulder restraint traversing the face or neck and/or the lap belt being placed directly across the abdomen. The improperly positioned lap belt creates an axis of rotation near the level of the umbilicus during a collision. The abdominal organs are subjected to compressive forces between the belt and spinal column, as well as increased intraluminal pressure and shearing forces. The hyperflexion of the upper body over the lap belt produces the flexion-distraction forces and causes a Chance fracture of the spine. Nonetheless, 40% of these injuries occur while wearing a combined shoulder and lap belt.

In children, the head-to-body ratio is larger, providing a higher centre of gravity and larger relative force about the rotation axis. The relatively narrow immature pelvis and rib cage provide less protection for the abdominal organs and mesentery. Parents need to be aware of the correct positioning of the seatbelt. The lap belt should be placed across...
the upper thighs, against the anterior superior iliac spines; the shoulder belt should cross the clavicle, through the chest between the breasts. The use of a booster seat can help with proper positioning of the seatbelt, and has been shown to reduce seatbelt-associated injuries to the abdomen, spine, and legs.7

Identification of concomitant abdominal, spinal, or retroperitoneal injuries is often delayed after blunt trauma.1,8–12 Computed tomographic (CT) scanning, abdominal ultrasound, and peritoneal lavage are often used to screen for these injuries before proceeding to a laparoscopy or laparotomy. There are limitations in the CT scan’s ability to identify intestinal perforation in children involved in collisions.1,13–15 Delayed (>24 hours) diagnosis of visceral injuries after abdominal CT scanning has been reported in 10 to 50% of such patients.1,13–15 The delayed diagnosis of genitourinary tract injuries and ureteropelvic junction disruptions seen in 4 out of 7 patients following blunt trauma is another concern.10 Intravenous pyelography was the conventional means of assessing the results of blunt abdominal trauma, but contrast-enhanced CT scanning with delayed scans is now the imaging modality of choice. CT is far more effective at demonstrating contrast in the distal ureter, and the diagnosis of ureteral disruption is made on the evidence of contrast extravasation and non-opacification of the distal ureter. If contrast cannot be demonstrated in the distal ureter, early retrograde pyelography is indicated.

Ureteric injury following blunt abdominal trauma involves <1% of all urologic traumas; ureteropelvic junction avulsion is the most common ureteral injury in children.9 The concomitant injury to the mid and distal portion of the ureter in our patient is a rare pattern of disruption. A ureteric injury associated with a Chance fracture has not been reported before. This mechanism of ureteropelvic junction avulsion has been postulated: the sudden acceleration-deceleration forces cause the kidney to accelerate anterosuperiorly while the ureter remains in a fixed position.9

CONCLUSION

Abdominal visceral injuries, ureteropelvic junction avulsion, and injuries to the urinary system may occur in children involved in a traffic accident. A contrast CT scan is the imaging modality of choice. Early use of a multidisciplinary approach is recommended to reduce morbidity and mortality.