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Case Report

Primary abdominal Tyre blast injury: A rare case of intra-abdominal trauma

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ABSTRACT

Tyre blast injuries are an infrequently encountered but important cause of significant injury. Due to their rare nature tyre blast injuries are often not recognised as major trauma and this can pose significant risk to patient.

Case History.

A 50 year old male was brought in by ambulance to a rural emergency department following a tyre explosion. The patient was fitting treads to industrial rims and inflating them to specifications. He had completed fitting three of the four tyres when the tread of the fourth tyre failed releasing a blast of compressed air at approximately 80 kPa. The patient was standing in close proximity to the tyre when the blast occurred. The patient recalled being thrown backwards into another vehicle then collapsing onto the ground. A witness reported a brief loss of consciousness with no obvious head strike or significant impact with the second vehicle.

On arrival to the rural emergency department the patient was alert and oriented with no imminent airway, breathing or circulation issues identified. He was observed in the emergency department over a period of hours with no evidence of clinical deterioration. Prior to discharge the general surgical team were requested to review the patient.

On review by the general surgical team the patient remained hemodynamically stable however was complaining of increasing abdominal bloating and pain. He had significant bruising to the anterior abdominal wall and diffuse tenderness to palpation with involuntary guarding. Secondary survey revealed only a superficial laceration to the distal shaft of the penis.

CT imaging of the abdomen demonstrated hyperdense free fluid within the abdomen and significant focal bowel wall thickening and submucosal oedema involving the splenic flexure, ascending colon and terminal ileum with adjacent fat stranding (see Fig. 1) [1–7]. Mesenteric hematomas were identified in the mesentery of the jejunum and ileum with deformity of the anterior wall of the caecum and an adjacent gas locule suggestive of perforation. A left adrenal hematoma was noted and anterior compression of the L1 and L2 vertebral bodies which was favoured to be chronic and degenerative in nature.

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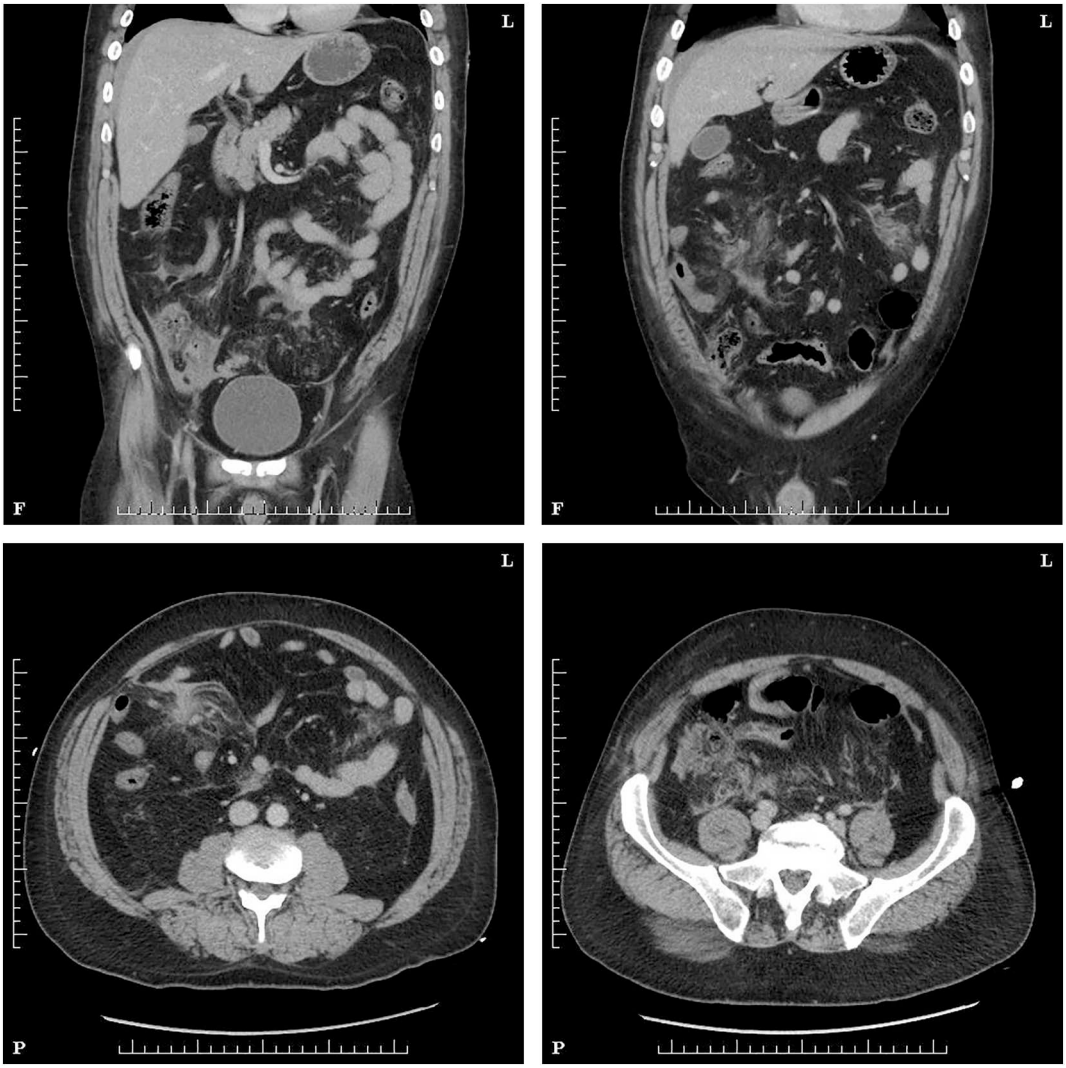

Fig. 1. Coronal and Sagittal CT imaging demonstrating mesenteric hematomas and intestinal injury.

Outcomes.

The patient was taken to theatre for exploratory laparotomy at the rural base hospital. On laparotomy there was a moderate volume of hemoperitoneum. Mesenteric hematomas were noted within the small bowel mesentery. There was non-viable bowel extending from the caecum to the hepatic flexure. A small capsular tear to segment 5 of the liver was noted. The patient underwent a right hemicolectomy with stapled side to side primary anastomosis. Following laparotomy, the patient was transferred stable and intubated to a tertiary trauma centre.

On arrival to the trauma centre he was hypotensive with a systolic blood pressure of 85 and HR 100 and was taken for completion CT trauma series imaging. Repeat imaging at the trauma centre additionally found bibasal pulmonary consolidation in keeping with dependant change, and a small left upper pole renal laceration. The patient was admitted to ICU for haemodynamic support however stabilised rapidly and was extubated 24 h later. He transferred back to the rural base hospital after 7 days at the trauma centre and was discharged home two days later following an uncomplicated admission.

Histopathological examination of the resected specimen demonstrated a 60x40mm section of haemorrhagic mesentery and macroscopically a 65 mm segment of dusky small bowel with mesentery at this site separated from the bowel wall. Microscopic analysis of the affected small bowel demonstrated ischaemic change with occasional organising thrombi seen in large mesenteric vessels. These findings were consistent with findings of primary blast injury.

Discussion

Blast injuries are described as four separate entities. Primary blast injuries are due to the effects of blast overpressure. Secondary blast injuries are due to the projectile components of the blast. Tertiary blast injuries are injuries that are due to the individual being

thrown against other objects as a consequence of the force of air displacement. Quaternary blast injuries are all other injuries that do not fit these categories and include burns, exposure to toxic substances [1–3].

Tyre blast injuries have been infrequently described in the literature [4–6]. The mechanism of tyre blasts is typically failure to contain the pressure of air on inflation of a tyre during servicing or repair. A “zipper fault” is described as a weakened line of tread that splits to release a condensed blast of compressed air [5,6]. This directed air pressure wave can cause isolated primary blast injuries.

Gastrointestinal tract injuries secondary to primary blast injury are uncommon [7]. The majority of reported significant abdominal blast injuries are attributed to secondary injury [7]. It is noted however that the true incidence of primary blast injury is difficult to ascertain due to the significant overlap in the mechanisms of primary and tertiary blast injury [7]. The most frequently reported injury from primary blast injury is mural haematoma. Mural hematoma varies in severity and so therefore does the integrity of the affected bowel with the potential for delayed perforation reported in primary abdominal blast injuries [7].

In this case primary blast injury was the mechanism responsible for the intra-abdominal injuries sustained. A clear history of mechanism suggested there was no significant injury to the abdomen from a tertiary mechanism. There was no noted barotrauma to the lung or the ears in keeping with an isolated abdominal blast overpressure wave. This case demonstrates that isolated primary blast injury is a potentially serious injury that may be missed in the absence of other blast injuries and in a rarely encountered mechanism such as tyre blasts.

Conclusions

Any suspected blast injury should be promptly assessed following ATLS principles with early surgical involvement. Tyre blasts have potential to cause significant injury that could be life threatening if not recognised. Blast injuries are classified as primary, secondary, tertiary and quaternary in nature and assessment of a patient should be directed by these defined mechanisms of injury. Primary abdominal blast injury is an uncommon isolated injury but has been described in the literature as an injury with high associated morbidity and mortality.

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Conflicts of interest

None declared.

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