Abdominal wall necrosis and disruption in a seat belt injury

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ABSTRACT

The seat belt has reduced mortality and morbidity caused by motor vehicle accidents. Nevertheless, the seat belt has been associated with multiple abdominal injuries. We present the case of a 31 year old male referred after he was involved in a high-speed motor vehicle accident. He was wearing a seat belt when he sustained injuries and bruising across the abdomen at the seat belt area. Clinical examination and Computerized Tomography were not helpful in early detection of intra-abdominal injuries. The presence of “seat belt sign” across the abdomen should increase the index of suspicion of the presence of serious intra-abdominal injuries.

Keywords: Abdominal wall injuries, seat belt sign, seat belt.

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Motor vehicle accidents are the leading cause of death of persons less than 40 years old. Increasingly, speed car accidents and poor compliance of the driver and passengers to wear their seat belts has led to this epidemic. Seat belts have dramatically decreased fatal accidents secondary to serious head injuries and facial fractures from hitting the windshield and dashboard, chest injuries from steering wheel and ejection from the car.

Even though the seat belt has decreased car accident mortality by 40%, they have caused unique injuries. The “seat belt syndrome” or “complex” includes abdominal wall, intra-abdominal and lumbar spine injuries. The “seat belt sign” is a linear ecchymosis across the abdominal wall and when present it is commonly associated with serious intra-abdominal injuries.

Case Report. A 31-year old male in previous good health was wearing a seat belt while sitting in the back seat in a seven-passenger car. The driver lost control while travelling at high speed and the car overturned. Two passengers were killed at the site of the accident. He suffered a head injury and loss of consciousness for several minutes. He sustained a large frontal scalp laceration, multiple small lacerations to face, bilateral lung contusion with fracture of left 11th and 12th rib, severe seat belt injury, segmental fracture to left femur, anterior right hip dislocation, closed intra-articular fracture of the left distal radius with dorsal angulation and fracture to base of ulnar styloid. He was seen first at a peripheral hospital where he was stabilized and had suturing of scalp laceration and reduction of his right hip dislocation. The closed segmental left femur fracture was treated with skeletal traction. He was referred for definitive care. On arrival 12 hours later to King Faisal Specialist Hospital, the patient was conscious, oriented. Vital signs were stable, temperature 37ºC, Respiratory rate of 26, Blood pressure 100/70, and pulse of 111. He was not in respiratory distress or cyanotic, the trachea was central and there was contusion on the left side of the chest with decreased air entry to the mid and lower zones of the left lung. His face was edematous, there was a severe bilateral sub conjunctival hemorrhage.
There was an abdominal skin contusion across the lower abdomen at the site of the seat belt. The abdomen was soft with no guarding and there was mild to moderate tenderness on superficial palpation. Bowel sounds were present.

His initial white blood count was 12.9. Hemoglobin 124, arterial blood gases were normal. Chest x-ray showed obliteration of costophrenic angle and fracture of the left 11th and 12th ribs. Skull and cervical spine x-rays were normal. CT scan of the brain showed no intra-cranial injuries. CT of the chest revealed fluid left base and bilateral lung contusion. CT of the abdomen showed distended stomach, disruption of the inferior part of anterior abdominal wall, without solid organ injury or retroperitoneal hematoma. The patient was stable after initial fluid resuscitation. On the third day post trauma, the patient had internal fixation of the fracture of the left femur with interlocking nailing, closed reduction of the fracture of the left distal radius and ulna. Post operatively, the patient dropped his oxygen saturation requiring intubation and ventilation. Ventilation perfusion scan showed severe mismatch in the right lung, in the main bronchus suspecting mucous plug. Bronchoscopy was performed and showed complete obstruction of the right upper lob orifice by a mucous plug, the right upper lobe and the bronchus was washed with normal saline. On the fourth post trauma day, the patient became septic. Septic workup was carried out and the patient was started on intravenous antibiotics. On the fifth post trauma day, the patient started dropping his hemoglobin and blood pressure, this was corrected with intravenous fluids, albumin and blood transfusion. The patient developed swelling in the left thigh and leg, the skin also became warm and red. Doppler ultrasound showed evidence of deep venous thrombosis. The patient developed septic shock and required inotropic support. The abdomen became distended and the abdominal skin contusion turned into skin necrosis (Figure 1). CT abdomen showed extensive sub-umbilical anterior abdominal wall defect (absence of anterior abdominal wall and bowel herniation in the subcutaneous tissue and subcutaneous emphysema (Figure 2). CT contrast study showed some leakage of contrast and free air and a perforation at junction of descending and sigmoid colon.

On day 7 post trauma, the patient underwent an exploratory laparotomy, there was complete disruption of the musculature of the abdominal wall, the mesentery of the sigmoid colon has been torn and there was a perforation of the sigmoid communicating with the subcutaneous tissue with extensive necrotizing fascitis. A Hartmann procedure and drainage of the intra-abdominal collection, debridement of the skin and subcutaneous tissue an colostomy.
The patient continued to be unstable and septic, requiring ventilation, inotropic support, intravenous antibiotics, and total parenteral nutrition. Tracheostomy tube was necessary, as the patient required prolonged intubation. Multiple abdominal lavage and debridement of the abdominal wall subcutaneous tissue and skin were performed. Three weeks after the trauma the patient's condition became stable and was weaned off the ventilator. The abdominal wall was covered with healthy granulation tissues, which was covered with skin grafts. The patient continued to improve and was discharged home one month after his trauma.

The abdominal wall healed well (Figure 3) with a large incisional hernia. Seven months later, he was admitted and had closure of the colostomy and repair of the hernia.

**Discussion.** Kulowski⁹ in 1956 reported the first case of seat belt injury. Garrett¹⁰ coined the term “seat belt syndrome”. Seat belt injury can occur with an average speed of impact in excess of 30mph.¹¹ Multiple injuries of variable severity to the abdominal wall, intra-abdominal structure and lumbar spine are caused by the seat belt. The abdominal wall injuries consist of cutaneous abrasion and bruising, hematoma, full thickness necrosis ¹² as well as disruption of the abdominal wall musculature and intestinal prolapse¹³ and delayed herniation. A high incidence of intestinal and mesenteric lesions in patients wearing seat belts has been reported.¹₂,¹⁵ The intestinal injuries range from seroserosal tears, perforation of the small¹⁶ and large intestine,¹⁷ vascular injury consisting of mesenteric tears with hemorrhage with subsequent bowel ischemia and delayed perforation. Other intra-abdominal injuries are splenic rupture, liver and kidney injuries,¹⁰ bile duct,¹⁸ pancreas, omental amputation, uterine rupture, iliac artery injury with thrombosis and rupture of the diaphragm.

The compression of the abdominal content between the seat belt and the lumbar spine and the restraining of the seat belt acting against the forward propulsion of the trunk result in the production of a sudden increase in intra-abdominal pressure followed by explosion and disruption of the abdominal wall.¹⁹ Loose application of the seat belt allows the pelvis to rotate anteriorly and forward after impact, and the belt slides over the iliac crest inflicting a decelerating force on the abdominal wall and abdominal content.²⁰

Svane²¹ discussed the contributing factors to seat belt injury, which include short stature, obesity, incorrect mounting of the seat belt and violent force. In our patient, the force was severe enough to cause disruption of the abdominal wall and necrosis of the skin. The necrosis of the skin can be explained, as secondary to friction burns caused by the seat belt. Ischemia of the bowel may not produce signs in the early period after the injury, and there will be no abdominal tenderness.²² Some patients despite severe abdominal wall disruption may be stable in the first few days post trauma.²³ Delayed manifestation of the bowel rupture has been reported.²³ Sube described a delay in presentation up to 13 days.²⁴ Serious abdominal injury may be less evident on physical examination. Disruption of the abdominal wall muscles prevents rigidity of the abdominal wall that usually develops when blood and intestinal contents spill in to the peritoneal cavity.²²,²⁵ Failure of early diagnosis and delayed treatment has been reported²¹ as usually these patients have multiple skeletal or cerebral injuries.²⁶ The symptoms can be masked by post operative analgesics or altered conscious level from cerebral injuries.

A band-like mark across the abdomen “seat belt sign” varying from mild bruising to contusion to muscle disruption of the abdominal wall should raise the suspicion of abdominal wall, bowel or mesentery, or lumbar spine injury.¹²,¹⁴,²⁶ Although the “seat belt sign” is controversial many report a high incidence of intestinal injury and recommended laparotomy if any band like mark across the abdomen is present.¹,⁸,¹³,¹⁷,²⁸ Chandler¹ in a prospective study of 117 patients involved in a motor vehicle accident, 64% of patients with seat belt sign on admission had abdominal injury, while patients without seat belt sign, had significantly fewer abdominal injuries 8.7%. The absence of the seat belt sign, is not an indication that there are no intra-abdominal injuries.²⁸

The CT of the abdomen in our patient showed distended stomach, disruption of the inferior part of anterior abdominal wall, without solid organ injury or free air. The CT scan can find delayed abdominal exploration. By having a high index of suspicion for the possibility of small bowel and colon perforation due to the seat belt injury, an early diagnosis and operative intervention can reduce morbidity and mortality rate.

**References**

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