International Journal of Case Reports in Surgery

E-ISSN: 2708-1508
P-ISSN: 2708-1494
Impact Factor (RJIF): 5.39
IJCRS 2025; 7(2): 394-396
www.casereportsofsurgery.com
Received: 02-10-2025
Accepted: 05-11-2025

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Seatbelt syndrome: A case report

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DOI: https://www.doi.org/10.22271/27081494.2025.v7.i2f.247

Abstract
Seat belt syndrome refers to a spectrum of injuries caused by restraint systems during motor vehicle collisions. The presence of a seat belt sign is a strong predictor of underlying intra-abdominal injury. We report the case of a 50-year-old man involved in a high-speed motor vehicle accident who presented with abdominal tenderness and a transverse abdominal contusion. Computed tomography revealed pneumoperitoneum and peritoneal effusion. Exploratory laparotomy identified a small bowel perforation with peritoneal contamination, managed by peritoneal lavage, ileostomy, and drainage. The postoperative course was complicated by an abdominal wall infection requiring surgical debridement, with eventual recovery. This case highlights the importance of early imaging, surgical exploration, and close monitoring in patients with a seat belt sign to prevent delayed diagnosis and complications.

Keywords: Seat belt syndrome, seat belt sign, small bowel perforation, blunt abdominal trauma, motor vehicle accident, hollow-viscus injury, computed tomography, ileostomy

Introduction
The use of vehicular restraints is effective in preventing severe cranial trauma and significantly reduces the likelihood of occupant ejection during motor vehicle collisions. While seat belts are lifesaving by maintaining occupants in a stable position, they may also produce characteristic injury patterns. The standard three-point restraint system traverses the shoulder, thorax, and abdomen, transmitting substantial force depending on the dynamics of the collision. Seat belt-related injuries arise when these forces are imparted to the occupant, resulting in blunt trauma to underlying anatomical structures, most frequently involving the cervical region, thorax, and abdomen.
The classic clinical feature is a transverse abdominal contusion, also known as the "seatbelt sign," which is strongly associated with intra-abdominal injuries [2].
CT imaging is essential for identifying perforation, pneumoperitoneum, and hemoperitoneum. Surgical management remains the definitive treatment, with the choice of procedure dictated by injury severity and intra-abdominal contamination [3, 4].

Case Presentation
Patient: 50-year-old male, no significant past medical history.

Mechanism of injury: High-speed motor vehicle accident.

Admission Findings
- Conscious and hemodynamically stable on arrival.
- Abdominal examination: guarding, tenderness, and transverse ecchymotic contusion consistent with a seatbelt mark.
- Laboratory: mild leukocytosis.
- CT scan: moderate peritoneal effusion and pneumoperitoneum.

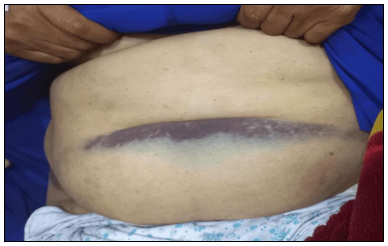

Fig 1: Abdominal contusion / seatbelt sign at admission

Operative Findings

- Midline laparotomy was performed.
- Intraoperative findings: punctiform small bowel perforation with the presence of false membranes.
- Moderate peritoneal contamination by turbid fluid.
- Management: thorough peritoneal lavage, ileostomy, and placement of drains.

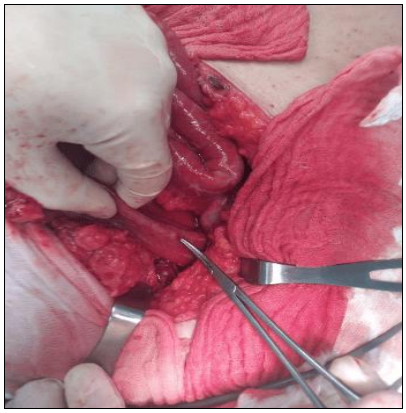

Fig 2: Perforation and peritoneal contamination during surgery

Postoperative Course and Complications

- Initial postoperative course complicated by abdominal wall infection.
- Necrotic tissue of the abdominal wall was excised.
- Laboratory workup revealed inflammatory changes.
- Recovery was completed after three months with stable condition and functioning ileostomy.

Fig 3: Postoperative abdominal wall infection / necrotic tissue excision

Discussion

The "seat belt sign" was first described by Garrett and Braunstein in 1962 as an area of ecchymosis across the abdominal wall corresponding to the location of the lap belt. "Seat belt syndrome" refers to the combination of musculoskeletal and visceral injuries associated with the forces transmitted through seat belt use [7].

Seatbelt syndrome is rare but associated with serious morbidity due to delayed recognition. The seatbelt sign is a strong clinical predictor of underlying visceral injury [7, 2].

Pathogenesis of seat belt syndrome injuries indicates that they are causedby hyperflexion of the spine around the lap strap in sudden deceleration leading to crushing of intra-abdominal contents between the spine and the seat belt. Fixed portion of the bowel such as proximal jejunum and distal ileum are more susceptible to injury than mobile portions since mobile segments can escape the high-pressure injury and damage [3].

Mesenteric tears typically occur due to shear forces applied to the mesentery when the mobile intestines continue to move at the vehicle's original speed, even as the car rapidly decelerates under braking an effect explained by the principle of inertia. These tears may initially be subtle and not produce immediate, overt signs of intestinal ischemia. [8]. In seat belt syndrome, abrupt deceleration causes intra-abdominal injury through different mechanisms depending on the organ involved. Solid-organ injuries (liver, spleen, kidneys) typically result from direct compression by the seat belt, leading to contusions, lacerations, and rapid hemorrhage with early hemodynamic instability. These injuries are usually evident on the initial CT scan. Conversely, hollow-viscus injuries (small bowel, colon, mesentery) arise mainly from deceleration forces, bowel compression against the spine, or sudden increases in intra-abdominal pressure. Their presentation is often delayed, with progressive abdominal pain followed later by peritonitis. Early CT imaging may appear normal, making these injuries more difficult to detect and requiring close monitoring and repeated evaluation. Overall, solid-organ injuries present early and more dramatically, whereas hollow-viscus injuries are more insidious, carry a higher risk of missed diagnosis, and underscore the need for vigilant assessment in any patient with a seat belt sign [9].

CT imaging is essential in stable patients to guide surgical intervention, assess bowel viability, and detect peritoneal contamination [4].

Management of seat belt syndrome requires an individualized approach based on the type and severity of internal injuries. Stable solid-organ injuries may be managed non-operatively with close monitoring, whereas ongoing hemorrhage or hemodynamic instability warrants urgent surgical intervention. In contrast, hollow-viscus and mesenteric injuries more frequently require surgery due to the risks of perforation, ischemia, and peritonitis especially when diagnosis is delayed. Prolonged observation is recommended for any patient with a seat belt sign, even when early imaging appears normal, as intestinal perforation may present late. Optimal outcomes depend on a coordinated multidisciplinary approach involving emergency physicians, trauma surgeons, radiologists, and anesthesiologists [6].

Postoperative complications, particularly abdominal wall infections, are common due to contamination and tissue trauma. Timely excision of necrotic tissue and appropriate antibiotic therapy are crucial for recovery [5].

Conclusion

Seatbelt syndrome should be suspected in patients presenting with abdominal contusions after high-velocity motor vehicle accidents. Early imaging, surgical exploration, and management of complications such as infections are essential. Ileostomy and peritoneal lavage are effective for controlling contamination and facilitating recovery.

Acknowledgement

Not available

Author's Contribution

Not available

Conflict of Interest

Not available

Financial Support
Not available

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How to Cite This Article
Kamal K, Rihane S, Moustaquime Z, Ettaoussi A, Majd A, Bouali M, *et al*.. Seatbelt syndrome: A case report. International Journal of Case Reports in Surgery. 2025; 7(2): 394-396.

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