



Case Study: “A Case of the Seat-Belt Sign” by Joseph Vitello, MD, FACS

Each year thousands of lives are saved and the overall morbidity of motor vehicle crashes is lessened through the use of seat belt and shoulder restraints. No restraint system, however, is perfect and the very device which intends to prevent harm, may be the cause of serious injury. Lap belts can produce a distinctive pattern of injury. Awareness of these injury patterns can aid in the diagnosis of occult intraabdominal injuries. Failure to be aware of these injury patterns can delay diagnosis and increase morbidity and mortality. The following case is illustrative.

An 8 y/o male was a restrained front seat passenger involved in a motor vehicle crash. His father, the driver had rolled the pick-up truck over 24 hours previously. At the time of the event, EM S responded in an appropriate fashion and based upon the mechanism of injury prepared for hospital transport. The father and his son did not feel as though they had been injured and they declined treatment. Approximately 24 hours after the event, the boy vomited 3 times and began to complain of abdominal pain. Of significance, the child was developmentally delayed. There was no other past medical or surgical history in the child.

Examination of the boy in the emergency department of Good Samaritan Hospital revealed the following:

BP= 120/82, Pulse= 92 and regular, Temperature= 98.3 orally.
 The father re-iterated the history and events of the prior 24 hours.
 The child was non-communicative secondary to his developmental abnormalities.
 He lay on the emergency department cart smiling in no obvious distress.
 The remainder of his physical examination was remarkable only for his abdominal findings.
 There was an abrasion with some ecchymosis in the lower abdomen that extended from one iliac crest to the other iliac crest (“seat belt-sign”). There was normal bowel sounds. There was mild abdominal tenderness in the left lower quadrant with voluntary guarding. There was no rebound tenderness or peritoneal signs. No masses could be detected. Of note the child said nothing during the entire examination.

Laboratory data revealed the following findings:
 WBC: 14,300 with 82 segmented neutrophils, 4 bands, 5 lymphocytes and 7 monocytes.
 The hemoglobin was 14.3 grams with a hematocrit of 43.4
 Urinanalysis was normal and specifically without blood.
 The remaining laboratory data including serum amylase and electrolytes were within the normal ranges.

An upright chest x-ray (Figure 1) and and plain abdominal films were obtained.
 These revealed no free air or pneumonia; however, there were some dilated loops of small bowel suggesting an ileus pattern.

A CT of the abdomen with oral and IV contrast was obtained (Figure 2). The patient vomited the oral contrast. This once again revealed no free air. There were multiple loops of dilated small bowel containing fluid, but no clear transition point with collapsed bowel. There was no evidence of pancreatic injury. The spleen and liver were intact. There was no duodenal hematoma. Once again the findings only suggested an ileus.



Figure 1.

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Subsequent to the CT scan of the abdomen, the patient was returned to the ED, where he underwent a diagnostic peritoneal lavage (DPL). The lavage fluid was sent to the lab with the following results:
RBC's: 23,650
WBC's: 776
Bilirubin: 0
Amylase: 0

A DPL WBC count over 500 is considered abnormal. Therefore, with 776 white blood cells in the lavage fluid an indication for operation existed.

A midline laparotomy was performed. Thorough exploration of the abdominal cavity was performed. A small bowel perforation had occurred in the mid jejunum, which was consistent with an injury pattern from a seat belt. There was an associated small phlegmon in the region of the perforation that had contained the small bowel contents, thus limiting the extent of the injury. A segmental small bowel resection and primary anastomosis was performed.



Figure 2.

Postoperatively, the child did extremely well. He tolerated a diet on POD#2 and was discharged the following day.

Discussion

Injuries to the small intestine are common following penetrating trauma. While much less common following blunt trauma, small bowel injuries are increasing in incidence due to high-speed motor vehicle traffic and may present diagnostic challenges. More widespread use of restraint devices has undoubtedly contributed to this increasing incidence. During the rapid deceleration commonly experienced in motor vehicle accidents, lap belts suddenly compress intraabdominal viscera. Closed loops of bowel are created and intraluminal pressure can rise, resulting in a blow out injury to the intestine. Stretching and traction on the bowel at sites of fixation may be another mechanism of injury following deceleration injury. Since the defect can be small and the peritoneal contamination and bleeding minimal; physical findings and diagnostic tests can be non-diagnostic. In the presence of a "seat-belt sign" in the lower abdomen a high index of suspicion for intra-abdominal injuries should exist. In Chandler's study a "seat-belt sign" on admission had a 64% incidence of surgically correctable intraabdominal injuries. Therefore, the astute clinician should aggressively pursue the diagnosis of intraabdominal injury in the face of a seat belt sign even when conventional testing proves negative.

Although almost any associated injury is possible in cases of blunt intestinal injury, Chance fractures are a particularly important indicator of such an injury. A chance fracture is a fracture through the lower thoracic or lumbar spine oriented transversely through the vertebral body and produced by flexion-distraction mechanisms. This injury usually occurs in association with seat belts.

Blunt small bowel injury can be a diagnostic dilemma. Physical examination may reveal obvious peritonitis. However, associated head injuries or drugs and alcohol can mask findings. A methodical work-up should be performed for the victim of a deceleration injury with an associated bruise in the lower abdomen from a seat belt. Computed tomograms may show free air but overall are unreliable for making the diagnosis. DPL may also miss the injury since it commonly is not associated with much bleeding. Alkaline phosphatase concentrations in the lavage fluid above 10IU/L has a good sensitivity.

In conclusion: This case demonstrates persistence in the work up of a restrained patient presenting in a delayed fashion after a deceleration injury and a positive seat-belt sign. Despite a non-specific physical examination and a negative CT scan the diagnosis of an intraabdominal injury was still suspected. A DPL did not reveal a significant amount of blood. However, the somewhat rare DPL finding of more than 500 WBC's was detected necessitating operative therapy. Once detected, the small bowel injury was easily treated. Clinicians should be on the look out for the "seat belt sign" and when detected, aggressively pursue the possibility of an intraabdominal injury even in the face of a negative physical examination, CT scan, or DPL.

Suggested Reading

1. Trauma 3rd Edition by Feliciano, Moore, Mattox. Appleton and Lange 1996
2. Asburn HJ, Irani H, Roe EJ, Bloch JH: Intra-abdominal seatbelt injury. J. Trauma 1990 Feb; 30(2): 189-193
3. Chandler CF, Lane JS, Waxman KS: Seatbelt sign following blunt trauma is associated with increased incidence of
4. Abdominal injuries. Am Surg 1997 Oct;63(10): 885-888.
5. Velmahos GC, Tatevossian R, Demetriades D: the seat belt mark sign: a call for increased vigilance among physicians

“Rural & Remote Australia” by Karen Croker, RN

Hi, my name is Karen Croker and I am visiting here on a scholarship awarded to me from the Royal Australasian College of Surgeons. The main focus of my time here is to look at and compare EMS, emergency departments, retrieval systems and trauma management. I am an emergency nurse at Toowoomba Base Hospital and a Clinical Educator for the Cunningham Centre, Rural Health Training Unit for the southern Zone of Queensland. The district I cover when educating is 220,000 square kms and I cover 20 hospitals – everything from single nurse primary health clinics to 40 bed hospitals.

Australia is a vast, sparsely populated place – 18.6 million people compared with 260 million in the United States – in a similar size landmass. Illinois has a population density of 217 people per square mile; Queensland, the state that I am from has 5 people per square mile. This leads to problems when transporting injured people. In rural areas, transport times can be anywhere from 1 – 8 hours. The Golden hour does not exist – we have the ‘bronze 6 hours’.

Transportation of patients is accomplished by either ground or air. The Queensland Ambulance Service (QAS) provides the transport by road. The ambulance system in Australia is set up quite differently to here. It is totally separate from the fire department – organizationally as well as physical locations. The Queensland Ambulance Service (QAS) is a state government run service. This means that the training, protocols and employment is state wide – i.e. no matter where you work in the state, you are employed by the state government and follow exactly the same standard protocols.

To transport patients, helicopters are only utilized in the major metropolitan areas. Due to the distances involved, fixed wing aircraft of the Royal Flying Doctors Service (RFDS) is the main transportation method. There are 20 bases with 45 aircraft and 280 staff that provide 24-hour coverage, 7 days a week, 365 days a year. Most of the medical evacuations are accomplished with 1 nurse only on the flight. A doctor will accompany the nurse if the patient is deemed critical or it is a multi-trauma situation. It may take 2-3 hours of flying time to get the patient to a tertiary hospital.

The town that I am from, Toowoomba, has a population of 90,000. There are 3 hospitals in Toowoomba – 2 private where you pay for services through health insurance; 1 public hospital where the services are provided for free. There are public hospitals in every Australian city and most towns. This means that the majority of health care is delivered through the ‘free’ public system – paid for by a medicare levy imposed on all income earners.

The Toowoomba Base Hospital where I work is the public hospital. It has 175 beds – we are able to look after most except those require neurosurgery, significant burns, spinal cord trauma, neonates and pediatrics requiring ICU and those requiring specific cardiothoracic surgery. The ED sees on average 90–100 patients a day during the week and 110–130 on the weekends. There is no such thing as a in hospital trauma surgeon. When a trauma patient comes in after hours, the team has to come in from home.

For more on the Australian Healthcare and ‘Trauma in the Outback’, you can request a copy of Karen’s Trauma Grand Rounds video (June 2001) by calling 630.275.2544 or by email at cmiller@level1traumacenter.com with your name and address. We will mail the video out to you as soon as it is ready.



The Level 1 Trauma Service at Good Samaritan Hospital would like to welcome Robert C. Gross, D.O., as a member of our trauma surgeon staff.

Dr. Gross is a graduate of the University of Colorado, and Michigan State University College of Osteopathic Medicine. He completed an internship at Grandview Hospital and Medical Center, and a Residency in General Surgery at POH Medical Center, where he served as Chief Resident.

Dr. Gross is board eligible for the American College of Surgeons. He is also a member of the American Osteopathic Association, the American College of Osteopathic Surgeons, and the Sigma Phi National Honor Society.

Dr. Gross currently holds certification in BCLS, ACLS and ATLS.

Good Samaritan Hospital is pleased to welcome Dr. Gross as a valuable member of our Level 1 Trauma Surgery Team!



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- CME (2.0) and CE (2.4) accredited.
- Audience participation encouraged in case presentations.

October 23, 2001

Dr. Wolbrink

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August 20 & 27, 2001

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November 12, 2001

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- Open to active, participating paramedics.
- Opportunity to spend 12-24 hours with the Good Samaritan Hospital Trauma Team and witness trauma resuscitation, operative procedures, formal rounds and clinic.
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