



# Traumatic disruption of the abdominal wall: Lap-belt injuries in children

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Received 26 October 2012; revised 7 January 2013; accepted 3 February 2013

## Key words:

Lap-belt;  
Seat belt;  
Hernia;  
Traumatic abdominal wall  
hernia;  
Abdominal disruption;  
Pediatric

**Abstract** Traumatic abdominal wall hernia (TAWH) from high speed mechanism is a unique finding in adult trauma, and exceedingly rare in pediatrics. The majority of reports are of low-speed “handlebar” hernias associated with direct injury by bicycle handlebars. We report a series of three pediatric patients in motor vehicle collisions (MVC) who experienced TAWH by lap-belt and associated intra-abdominal injuries necessitating immediate operative intervention. Different operative approaches were used in each case to manage the varying types of disruptions. This adds to the pediatric literature the largest series of its kind.

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Traumatic abdominal wall hernia (TAWH), a disruption of muscle and fascia without penetration of the skin after blunt abdominal trauma, occurs in approximately 1% of all blunt injuries [1,2]. Among children most TAWHs occur during low energy events such as falls onto bicycle handlebars, so-called “handlebar hernias,” where the hernia is localized and often without associated visceral injury [3,4]. Much less common in children are TAWH from high energy trauma with extensive disruptions of the abdominal wall and where visceral involvement is expected [5,6].

Published reviews and case reports of high energy TAWH mostly include adult subjects and few, if any, children [5,7]. We recently encountered three children who suffered disruptions of the abdominal wall from lap-belt injuries during high velocity motor vehicle collisions (MVC), one evisceration and two TAWHs. All had associated intestinal

injuries and two had lumbar spine injuries. This cluster of cases demonstrates that children are vulnerable to high energy disruptions of the abdominal wall.

## 1. Case reports

### 1.1. Patient 1

A 10-year-old boy (BMI 35 kg/m<sup>2</sup>) was wearing a lap-belt only (two-point restraint) in a high speed motor vehicle collision (MVC). He had small bowel evisceration through a 6 cm right lower abdominal laceration. Computed tomography (CT), performed after emergency abdominal surgery, demonstrated a flexion–distraction injury of the lumbar spine with ligamentous disruption at L2–L3 but without fracture.

The lap-belt caused a full-thickness disruption of the entire anterior abdominal wall including the rectus, obliques

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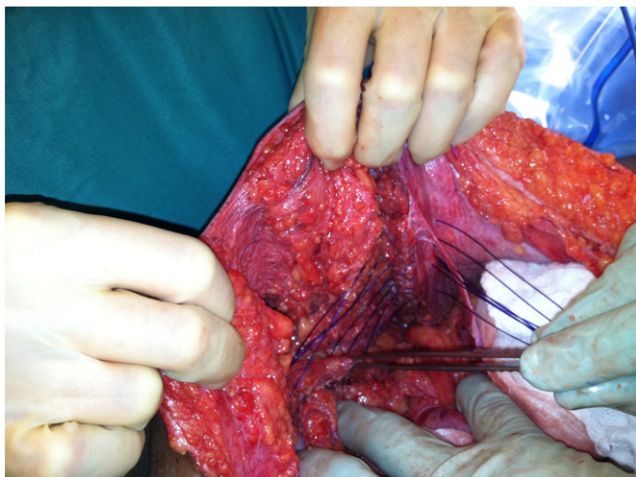
E-mail address: [jrmorem@gmail.com](mailto:jrmorem@gmail.com) (J.R. Moremen).

and transversus abdominus muscles extending to the posterior elements bilaterally. Abdominal exploration took place through a separate midline incision. The small bowel had a long segment that was devitalized and a number of perforations, and a segment of sigmoid colon was deserosalized. After multiple small bowel resections and control of enteric spillage his abdomen was left open as part of a damage control strategy. At the first operation the torn oblique layers were repaired with interrupted monofilament absorbable suture (#1 PDS, Ethicon, Inc., Somerville, N.J.) (Fig. 1). At the time of definitive closure the midline was reapproximated, again using PDS, and reinforced with biologic material (Strattice, Lifecell, Bridgewater, NJ) because of the extensive bowel injuries and surgeon preference. The patient recovered after prolonged hospitalization due to his back injury and is now seven months post-operation without clinical evidence of a hernia.

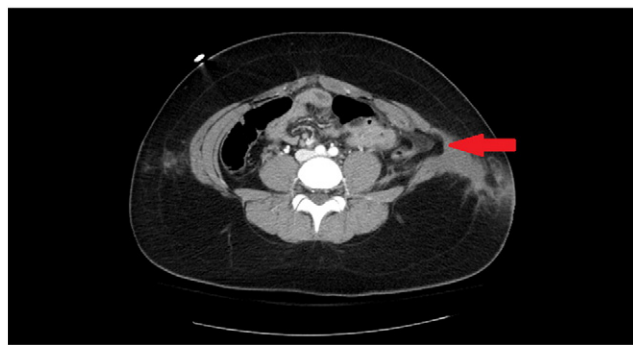
### 1.2. Patient 2

A 13-year-old female (BMI 20 kg/m<sup>2</sup>) suffered a lap-belt (two-point restraint) injury as a passenger in a high-speed MVC. She had diffuse abdominal pain and a “seat-belt sign” abrasion in the lower abdomen below the umbilicus. CT showed bowel extruding through a left full-thickness 12 cm disruption of the oblique muscles (Fig. 2). She also had a flexion–distraction ligamentous injury of the lumbar vertebrae (L2–L3) without spinal cord injury.

She underwent urgent exploration for bowel injury through a midline incision. She had large tears in the serosa, without full thickness perforation, of a number of small bowel segments and the sigmoid colon that were repaired primarily with suture. Direct inspection of the peritoneal surface from inside the abdomen failed to reveal where the overlying muscular layers were disrupted. We elected to



**Fig. 1** Intra-operative photo of suture repair of lacerated abdominal wall musculature in Patient 1. Also demonstrates subcutaneous tissue injury.



**Fig. 2** CT scan demonstrating left lateral oblique injury with bowel extrusion in Patient 2.

avoid additional dissection and manage the injury non-operatively. At follow-up examination 3 months later the patient had no exam findings to suggest hernia.

### 1.3. Patient 3

An 11-year-old female (BMI 29.8 kg/m<sup>2</sup>) was wearing both lap and shoulder harnesses (three-point restraint) in a high-speed MVC. She had diffuse abdominal pain accompanied by tachycardia that became worse during observation. CT scan showed bowel herniating through a lateral full-thickness disruption of the oblique muscles almost identical to Patient 2, but without an accompanying lumbar spine injury as in the other two patients.

She was taken emergently to OR for bowel injury. She had succus entericus from a small bowel perforation and a contusion of the sigmoid colon. In contrast to Patient 2, there was ecchymosis of the lateral peritoneum (Fig. 3). Dissecting laterally between the subcutaneous and anterior fascial layers from her midline incision we exposed a full-thickness division of the abdominal oblique muscles starting lateral to the rectus and traveling approximately 15 cm. Each layer was repaired primarily with heavy absorbable suture (#1 PDS, Ethicon, Inc., Somerville, N.J.). The child is now three months after operation without the appearance of a ventral hernia.

## 2. Discussion

All three of our patients suffered disruptions of the abdominal musculature, presumably from lap-belts during high-velocity MVC. One had evisceration of the small bowel (Patient 1), a second had radiological diagnosis of a TAWH without physical confirmation during laparotomy (Patient 2), and a third had a true TAWH contained within an intact skin layer (Patient 3). All three had associated bowel injury and two had spinal column injury, which is in keeping with high-speed mechanisms reported on in adults. Patients 1 and 3 underwent direct suture closure of the traumatic defect. No defect was readily apparent in Patient 2. At that time we

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