

The Role of Computed Tomography in the Diagnosis of Bowel Avulsion in Seat-Belt Injury: Report of a Case

Emniyet Kemerini Yaralanmasında Görülen Bağırsak Avülsiyonu Tanısında Bilgisayarlı Tomografi Kullanımı: Olgu Sunumu

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ABSTRACT

Seat-belt sign (SBS) is the pattern of thoraco-abdominal ecchymosis in distribution of seat-belt and considered to be strongly associated with intestinal injuries. Herein, an 11-year-old boy who had bowel avulsion was presented to discuss the use of computed tomography (CT) in the diagnosis of seat-belt injury in children. An 11-year-old boy was brought to the emergency room because of high-speed motor vehicle crash. His general condition was good. He had mild abdominal tenderness and a seat-belt bruising on his belly. The first laboratory examinations, chest and abdominal X-rays revealed normal findings. Abdominal ultrasound showed minimal free fluid. Since physical examination revealed ongoing tenderness, CT was performed. A large defect in abdominal fascia and disruption in sigmoid colon integrity were detected in CT. The patient underwent emergent exploration revealing disruption in fascia and avulsion in small and large intestine. The postoperative course was uneventful. Seat-belt injury is a rare type of pediatric trauma and may cause severe bowel injury. The diagnosis of bowel avulsion due to seat-belt injury can be challenging in the absence of free sub-diaphragmatic air in abdominal X-rays. CT should be performed if other radiologic interventions are not compatible with the physical findings.

Key Words: Contusion, Thoracic injuries, Abdominal injuries

ÖZ

Emniyet kemeri işareti, emniyet kemeri seyrinde torako-abdominal ekimoz görülmesi olup bağırsak yaralanmalarıyla güçlü bir şekilde ilişkilidir. Burada, çocukluk çağı emniyet kemeri yaralanmalarının tanısında bilgisayarlı tomografinin (BT) kullanımı tartışmak amacıyla bağırsak avülsiyonu olan 11 yaşında bir hasta sunulmuştur. Yüksek hızlı trafik kazası nedeniyle 11 yaşında erkek hasta acil servise getirildi. Araçta hastanın emniyet kemerinin takılı olduğu öğrenildi. Genel durumu iyi olup fizik incelemede, batında hassasiyet ve emniyet kemeri izi şeklinde morluk vardı. Tam kan sayımı, idrar tahlili ve kan biyokimyasını içeren ilk tetkikler normal sınırlardaydı. Akciğer ve batin grafilerinde normal bulgular mevcuttu. Batin ultrasonografisinde sol kadrantlarda minimal serbest sıvı vardı. Fizik incelemede batin hassasiyeti olduğundan BT çekildi ve batin fasyasında geniş defekt ve sigmoid kolon bütünlüğünde bozulma tespit edildi. Hasta acil ameliyata alındı ve fasyada defekt, ince ve kalın bağırsakta avülsiyon tespit edildi. Hastanın ameliyat sonrası izlemi sorunsuzdu. Emniyet kemeri yaralanması çocukluk çağının ender görülen bir yaralanma şeklidir ve ciddi bağırsak yaralanmasına neden olabilir. Emniyet kemeri bağırsak avülsiyonunun tanısı özellikle direk batin grafisinde diafragma altı serbest hava olmadığı durumlarda çelişkili ve zordur. Diğer radyolojik tetkikler fizik inceleme bulguları ile uyumsuz olduğunda tanı için BT yapılması önerilir.

Anahtar Sözcükler: Kontüzyon, Toraks travması, Karın yaralanması

INTRODUCTION

The seat belt related injuries have long been reported in the literature since 1960s in which seat-belt sign and syndrome were defined by Garrett and Braunstein (1). Seat belt sign (SBS) is the pattern of thoracic and abdominal ecchymosis in distribution of the seat belt

(2,3). Seat belt syndrome involves SBS, hollow viscous injury and chance fracture of lumbar spine (2,3). Children are more vulnerable to these injuries since the lap belt can easily slide upward over their immature unstable pelvic bones. Therefore, lap belt compresses bowel and mesentery between belt and spine causing intestinal

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perforation, seromuscular tears and mesenteric avulsion (4).

SBS is likely to be strongly associated with intestinal injuries. However, intestinal injuries may be diagnostic dilemma since initial physical examination may reveal normal findings (2,5,6). Additionally, it is controversial whether the radiological examinations such as focused abdominal sonography for trauma (FAST) and computed tomography (CT) are diagnostic for intestinal injuries. Some authors strongly suggest performing abdominal CT in the presence of SBS, whereas some claim that CT would be unreliable to predict injury and surgery need because of subtle findings (2-4, 6-8).

Herein, we presented an 11 year-old boy who had SBS due to motor vehicle accident to discuss the use of computed tomography (CT) in the diagnosis of intestinal injury and surgery need.

CASE PRESENTATION

An 11-year-old boy was involved in a high-speed head-on motor vehicle accident. He was restrained with a lap-belt in the rear seat and brought to the emergency room. At arrival, his consciousness and his general condition were good. The vital signs were normal except mild tachycardia (110/min). He had visible bruising from lap belt to the anterior abdominal wall and mild tenderness over bruising (see Figure 1). The first laboratory examinations including total blood count, urine analysis and blood chemistry were within normal limits.

The chest and abdominal X-rays revealed normal findings. FAST showed free fluid in the left quadrants. Since there was intra-abdominal free fluid and ongoing abdominal tenderness in serial



Figure 1. The photography of the patient showing ecchymosis revealing the abdominal seat belt sign.

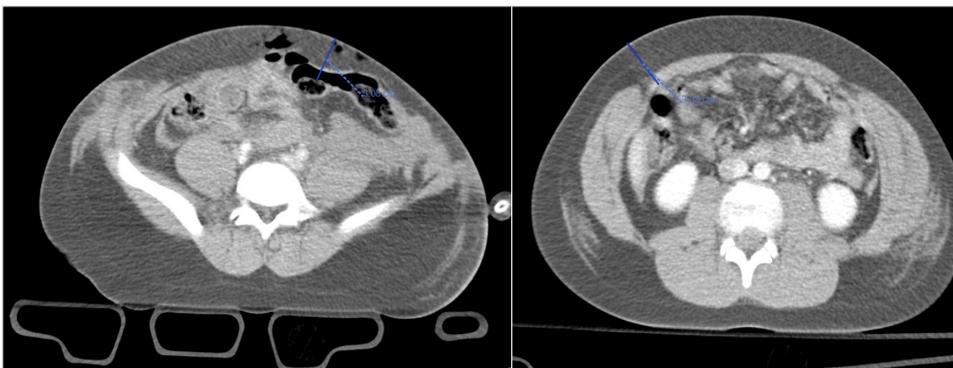


Figure 2. The abdominal CT scan revealing free air in the peritoneal cavity large defect in abdominal fascia. The depth of abdominal wall contusion 3.08 cm (left) and the thickness of non-injured abdominal wall is 3.33 cm (right).

physical examination, we performed abdominal CT revealing large amount of free fluid without solid organ injury, subcutaneous and intra-peritoneal free air bubbles, large defect in abdominal fascia and disruption in sigmoid colon integrity (see Figure 2). Therefore, the patient underwent exploratory laparotomy. There was disruption in abdominal wall muscles and fascia together with complete seromuscular degloving of ileum and sigmoid colon and avulsion in associated mesenteries. There was plenty of cloudy dark colored free fluid within the abdominal cavity. A 20 cm of sigmoid colon with a severe mesenteric avulsion was resected and primary anastomosis was performed. Then, an ileostomy was performed after removing the necrotic small bowel. The fascia was repaired. The postoperative course was uneventful.

DISCUSSION

Although seat belt sign (SBS) is likely to be strongly associated with hollow viscous injury, the incidence of SBS and intestinal injury presents in a wide range. A large population-based study data revealed that the incidence of SBS in restrained children involved in motor vehicle crash (MVC) is 1.33%. Among these patients, intra-abdominal injury is 232 times more likely to be seen compared to the children who do not have SBS (9). In the literature, the risk of solid organ injury has been reported as 9% to 21% and risk of intestinal injury has been reported as 11% to 25% in patients having SBS (2). In another large multicenter prospective study, SBS has been confirmed to be independently associated with intra-abdominal injuries (5). On the other hand, a few reports revealed that SBS is not significantly associated with higher risk of intestinal injury (10, 11). However, it should be kept in mind that SBS causes direct trauma to the abdominal wall muscles which may be seen concurrently with intra-abdominal injuries.

The diagnosis of intestinal injury in the patients with SBS remains challenge to clinicians because the clinical signs may not be obvious. The initial abdominal pain may also be attributed to the injury of abdominal wall muscles and not be specific to the intestinal injury (2,6,10). Some authors suggest performing additional interventions in patients with SBS even if they do not have complaint of abdominal pain at initial evaluation (5). The location of SBS and abdominal wall injury depth has also been used to predict the severity of injury and surgery need (7). SBS located above anterior superior iliac spines (ASIS) has been reported to be highly associated with intra-abdominal injury (7). Additionally, the

authors calculated an index by dividing abdominal wall injury depth to thickness of abdominal wall in sagittal scans of CT (7). When they accepted 0.75 as cut-off value for this index, they concluded that the index is a strong predictor for operation need (7). By inspiring from this report, we re-evaluated the CT scans of the present case. The location of SBS in the present case was above ASIS and the SBS index was 0.91 revealing high probability for operation. However, future prospective clinical studies are needed to validate this index. The initial physical examination of the present case revealed mild tenderness over SBS that might be due to the injury of abdominal wall muscles. Although these findings were suggestive for intra-abdominal injury, progression of pain in serial physical examination raised our suspicion more and we performed additional interventions.

Radiological examinations may not be diagnostic because of subtle findings. Abdominal X-rays are not diagnostic unless there is significant pneumoperitoneum. FAST is a quick diagnostic modality which can easily detect intra-abdominal free fluid. Its sensitivity is low, but its negative predictive value has been reported to be 95% which should be taken into account (3). In contrast, it was reported that FAST should not be performed in patients having SBS since it has a very low sensitivity with a high false negative rate (12).

Abdominal CT is frequently used in trauma patients. Although CT has low sensitivity in detecting intestinal injuries, newer helical CT scans may detect intestinal injury with a higher sensitivity (2). Several findings may indicate bowel injury indirectly such as unexplained free fluid, presence of free air, increased echogenicity of mesentery, and increased bowel wall thickening (2). Besides, CT has several advantages including detection of solid organ injury and vertebral injury (3,13). The presence of vertebral fracture and tachycardia associating to the presence of free fluid should raise suspicion for intestinal injury in patients with SBS (14). Therefore, CT is strongly suggested in patients with SBS especially if they have abdominal tenderness in physical examination (2,5). Moreover, some authors suggest performing CT scan in the presence of SBS with or without any clinical sign (12). Despite its advantages, reports differ regarding its reliability and usefulness in predicting surgery need. CT findings alone would not be appropriate to decide surgery (2,4,6,8). One exception for CT findings is free fluid without solid organ injury in the presence of SBS, indicating strongly for intra-abdominal injury (8). Since CT has radiation exposure risk, Holmes JF et al suggested using clinical predictive signs for determining very low risk patients to avoid unnecessary CT scans especially in hemodynamically stable patients (13,15).

The present case has mild abdominal tenderness that might be attributed to injury of abdominal wall muscles instead of intestinal injury. FAST revealed free fluid in the abdomen and there was ongoing abdominal tenderness in serial physical examinations. Therefore, we performed abdominal CT and diagnosed intestinal, mesenteric and abdominal wall muscle injuries.

In conclusion, seat-belt injury is a rare type of pediatric trauma and may cause severe bowel injury. Since physical and radiological examinations may not be reliable in diagnosis of intestinal injury in patients with SBS, high index of suspicion and serial examinations are the most valuable diagnostic tools. In suspected hemodynamically stable patients, abdominal CT scan should be performed in order to diagnose intestinal injury and to predict surgery need.

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