

G Chir Vol. 30 - n. 5 - pp. 234-236
Maggio 2009

A rare case of blunt thoracoabdominal trauma with small bowel perforation from airbag

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SUMMARY: A rare case of blunt thoracoabdominal trauma with small bowel perforation from airbag.

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Vehicle collisions represent more than 75% of mechanism of blunt abdominal trauma. In spite of the incomparable improvement of car safety devices, recent studies pointed out that the airbag might cause injuries, specially when it is not associated with seatbelt. In fact, some studies pointed out that crash victims using airbag alone have increased injury severity, hospitalisations, thoracoabdominal procedure, and rehabilitation.

Some of the most frequently injured organs reported from airbag deployment are the liver (38%), the spleen (23%) and digestive system (17%). Injury of the hollow viscera are far less common. In particular, blunt abdominal trauma resulting in small bowel perforation is an infrequent lesion. These injuries are difficult to diagnose because specific signs are poor and a delay in treatment increases mortality and morbidity of the patients.

We describe a case of thoracoabdominal trauma occurred during a head-on collision after an airbag deployment without seatbelt use.

RIASSUNTO: Un raro caso di trauma toraco-addominale chiuso da airbag con perforazione del piccolo intestino.

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Gli incidenti automobilistici rappresentano oltre il 75% delle cause dei traumi addominali chiusi. Nonostante gli enormi progressi nel campo della sicurezza stradale, studi recenti hanno evidenziato che l'attivazione del dispositivo airbag - soprattutto se non associato all'uso della cintura di sicurezza - può essere causa di traumi. L'analisi dei dati raccolti dimostra che le vittime di incidenti stradali che non utilizzano la cintura di sicurezza subiscono ferite più gravi, ricoveri prolungati e trattamenti più invasivi.

Gli organi più frequentemente colpiti sono: fegato (38%), milza (23%) e tratto digerente (17%). I traumi dei visceri cavi sono di gran lunga meno comuni; in particolare le perforazioni del piccolo intestino risultano infrequenti. Tali lesioni sono di difficile diagnosi a causa della scarsità di segni clinici; da ciò consegue un ritardo dei trattamenti e un aumento di morbilità e mortalità dei pazienti in esame.

Viene qui descritto un caso di trauma toraco-addominale chiuso da collisione tra autoveicoli con apertura dell'airbag in soggetto con cintura di sicurezza non allacciata.

KEY WORDS: Airbag - Thoracoabdominal traumas - Blunt trauma - Small bowel perforation.
Airbag - Traumi toracoaddominali - Trauma chiuso - Perforazione del piccolo intestino.

Introduction

Despite the improvement of car safety devices, vehicle collisions are still the commonest cause of thoracoabdominal injuries representing more than 75% of mechanism of blunt abdominal trauma (1-3). Besides the

seatbelt the airbag is considered as the most important invention regarding car safety.

The airbag is an established car safety device that was invented by Hetrick and Linder in the 1950s but only began to be produced 25 years ago. In spite of the incomparable triumph of this car safety device, recent studies pointed out that the airbag itself might cause injuries. In fact, several studies lead to contrasting results of the significance in the ability of passenger airbag systems to reduce both injuries severity and mortality on car accidents. The benefits of this device in decreasing trauma severity and mortality seem to be restricted to the simultaneous application of seatbelts and airbags. Physi-

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cians must be aware that airbags alone do not provide adequate protection and that, although they are meant to serve as protection for drivers and passengers, they can also be dangerous for the occupants of the vehicle. Airbags alone provide only 13% reduction of the risk. The combination of airbag and seatbelts offer an estimated 50% reduction in fatality risk (4). However, depending to the impact force during the accident and also on the driver's position to the airbag an isolated airbag deployment can even produce severe injuries. Crash victims using airbag alone have increased injury severity, hospitalisations, thoracoabdominal procedure, and rehabilitation (5, 6).

We describe a case of thoracoabdominal trauma occurred during a head-on collision after an airbag deployment without seatbelt use.

Case report

A 31-years-old man was admitted to the Emergency Department after vehicle collision, during which the automobile's airbag was deployed. At that time the patient was not wearing a seatbelt. On arrival in the hospital he was alert and hemodynamically stable, complaining of diffuse abdominal pain.

At physical examination patient's abdomen was mild tender with light guarding, and painful to touch specially in the upper right quadrant. Peristaltism was present. Laboratory tests pointed out leukocytosis (WBC 11.6 uL 87% of neutrophil), total bilirubin 2.43 mg/dl, amylase 243 U/L, myoglobin 1231 ng/ml, creatin kinase 298 U/L. A Computed Tomographic (CT) scan performed without contrast showed the presence of a sternal body fracture with overlap of bone fragments associated to costochondral disjunction of the sixth right rib. The CT also showed a small amount of free fluid in the perisplenic area and in the pelvis. This was confirmed on a ultrasound scan.

With the suspicious of a stable spleen lesion the patient was transferred to the General Surgery ward for careful observation and measurement of vitals signs. Within 24 h from admission his condition became critical experiencing sever abdominal pain with peritoneal signs. A CT scan was repeated and it showed a small bowel wall thickening compatible with haematoma of a jejunal loop, 5 cm in diameter. A small amount of free air under the right side of the diaphragm as well as fluid in the perisplenic and the perihepatic areas and in the right and left paracolic gutters were also identified by the CT scan. Then it was decided to operate on the patient.

A median laparotomy was performed. A moderate haemoperitoneum was found and taken out. A transmural perforation of a jejunal loop was identified along with at least three other injuries of the small bowel consisting in jejunal contusions of the wall with damage of the serosa. A lesion of the capsule of the pancreatic tail was also present (G1 Moore lesion). No other lesions of solid, hollow and retroperitoneal organs were identified. The transmural perforation of the small bowel required an intestinal resection; a side-to-side anastomosis was then performed with a stapler. The other bowel injuries were treated by suture repair. Sailing and haemostatic material (Tabotamp) were used for treatment of the pancreatic capsule lesion. Two drainages were placed, one in the splenic area and one in the pelvic gutter. The patient was discharged after 5 days.

The patient presented to our clinic after one month in good conditions, with normal consolidation of the sternal fracture and with a well healing surgical incision of the abdomen.

Discussion

Front airbags were introduced as an option to the vehicle fleet in Europe and United States long before regulations were enforced. The negative impact of front airbags deployment on the drivers and passengers was known primarily during investigations through the mid 1990s. These emerging data showed the occurrence of severe or fatal trauma to the paediatric population (7).

Nowadays trauma surgeons are aware that while the airbags reduce mortality and morbidity associated with motor vehicle collisions they can also cause important injuries as a consequence of their deployment (8, 9). Airbags explode at speeds up to 200 mph and have the potential to cause both blunt and chemical injuries to the human body. Airbag deployment-associated injuries can occur in either of two phases. The first phase represents the initial punch out of the bag from the module. The second phase represents the membrane force of the inflating bag. In particular in adults, punch out phase can cause thoracoabdominal trauma and membrane force phase can lead to craniocervical injury. Some of the most frequently injured organs reported from airbag deployment are the liver (38%), the spleen (23%) and digestive system (17%) (4, 10, 11). Concomitant injuries are present in 5% of patients with liver injury, 1.7% of patients with splenic injury, and 4.2% of those with injuries to both organs (10, 12). Other common, but not life-threatening injuries related to the airbag deployment include burns from the hot gas exhausted from the airbag and injuries to the upper extremities (13). Injury of the hollow viscera are far less common in blunt abdominal trauma than in penetrating abdominal trauma. In particular, blunt abdominal trauma resulting in small bowel perforation is an infrequent injury. Small bowel injuries frequency in blunt trauma ranges from 5 to 15% according to series (1). Early recognition of these injuries and timely surgical treatment are essential to prevent death in this group of patients. The high mortality of small bowel injuries after blunt trauma justifies an aggressive approach to diagnosis and surgical treatment of these injuries.

On admission, diagnosis of small bowel injuries due to blunt trauma is difficult to establish, causing a delay in definitive treatment of the patient. In fact, no diagnostic procedure, including physical examination, is completely reliable in formulating the diagnosis. Delay in diagnosis occurs in nearly 3 to 5% of cases and contributes to increase morbidity and mortality (1-3, 14).

Diagnosis of small bowel perforation is suspected in case of acute pain associated with peritoneal signs. Pain is the most constant symptom, sometimes associated with vomiting or the absence of peristaltism. Abdominal bruises are founded in 70% of patients and abdominal tenderness is elicited in 75% (1). Moreover clinical reco-

gnition can be difficult, specially when the abdominal trauma is associated with other injuries and altered mental status from a head injury, or drug/alcohol use.

Laboratory tests are non-specific and contribute little to the diagnosis. On admission, less than half of patients have a white blood cell count more than 10,000 (15). Some abnormal serum amylase can be noted even without pancreatic injury (1). Increasing of myoglobin and creatin kinase after a blunt trauma is common in these patients. Presence of free air is seen in 40% of patients with small bowel trauma (1). CT performed in emergency is often specific, showing intraperitoneal fluid without solid organ injury, bowel wall thickening, streaking of the mesentery, bowel discontinuity, bowel dilated loops, extraluminal gas or small pneumoperitoneum. Ultrasounds can also be used for detection of free intraperitoneal fluid, however this diagnostic procedure

is less specific in identifying possible intestinal injuries (1, 3, 16). For these reasons CT scan seems to be the procedure of choice for assessing hemodynamically stable patients. Some authors claim that laparoscopy is an important diagnostic and therapeutic tool in these patients. We consider laparoscopy a reasonable approach to abdominal trauma with a suspect of small bowel injury, only in patients with an unclear diagnosis.

In conclusion, small bowel injuries are difficult to diagnose because specific signs are poor. Delay in treatment increases mortality and morbidity of these patients so, an early and acute diagnosis is fundamental to offer to them the best prognosis. However, the best treatment in these cases remain driving prevention based on the application of National Highway Traffic Safety Administration (17), including the simultaneous use of seat-belt and airbag.

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