ANNALI ITALIANI DI CHIRURGIA

Digital Edition
e-publish on-line
ISSN 2239-253X

Delayed diagnosis of blunt carotid trauma in a seat belt syndrome with associated abdominal wall injury

A case report

Ann. Ital. Chir.
Published online (EP) 28 November 2016
pii: S2239253X16025391
www.annitalchir.com

Savino Occhionorelli*, Dario Andreotti*, Daniela Tartarini**, Lorenzo Cappellari**, Rocco Stano**, Lucia Morganti*, Giorgio Vasquez**

University of Ferrara and S. Anna University Hospital of Ferrara, Ferrara, Italy
**Department of Morphology, Surgery and Experimental Medicine*
***Department of Surgery, Acute Care Surgery Service*

Delayed diagnosis of blunt carotid trauma in a seat belt syndrome with associated abdominal wall injury. A case report

The aim of this case report is to be aware of occult carotid lesions in thoracic- abdominal trauma because, carotid artery injury consequent to blunt trauma is rare, affecting less than 1% of patients as reported in literature. A 45-years-old female, involved in a traffic accident, arrived to Emergency Room hemodynamically stable, with a Glasgow Coma Scale of 15, complaining abdominal pain, without any neurological signs. She underwent Computed Tomography (CT) scan that showed a complete disruption of left abdominal wall muscles, associated with massive bowel loops herniation. No free air nor other visceral injuries were found. The radiological brain evaluation was negative for neurological injuries. Considering the nature of the trauma, an explorative laparotomy was performed. During the fifth postoperative day, the patient presented neurological side signs with right facial-brachial-crural hemiparesis and expressive aphasia. Head and neck CT scan revealed a lesion of the left common carotid artery with distal embolization of the internal carotid. A left-carotid-axis revascularization procedure and a surgical endarterectomy were immediately performed. Patient was discharged after 20 days without neurological consequences. Physicians should be aware of neck vascular injuries when evaluating patients with multiple trauma, even in neurological asymptomatic patients without seatbelt abrasions of the neck skin.

KEY WORDS: Abdominal Hernia, Carotid artery, Seat belt, Surgery

Introduction

The increasingly common use of car's safety seat belts reduces the severity of lesions due to motor vehicle accidents but, at the same time, it causes the appearance of a specific pattern of injuries strictly related to the type of restraint, named "Seat Belt Syndrome" [1]. This collective term was first used by Garrett and Braunstein in 1962 [2], referred to traumatic intra-abdominal and pelvic injuries, which consists of soft-tissues, skeletal and visceral injuries associated with the use of the safety systems [1-3]. Cerebral-vascular blunt injuries (CBVI) are rare, but underestimate 4, affecting less than 1% of patients [5,6]. Misdiagnosed vascular neck injuries are associated with a stroke rate of 60 % and a mortality rate from 25% to 40% [6,7], and they are easily unnoticed in the context of a multiple trauma [6]. Delayed clinical presentation is quite typical [8], so asymptomatic carotid artery injury could easily be undetected during clinical assessment of a trauma [5,6,8]. This case presents a delayed diagnosis of a left-common carotid lesion in the context of

Pervenuto in Redazione: Febbraio 2016. Accettato per la pubblicazione Aprile 2016
Correspondence to: Dario Andreotti, MD, Dipartimento di Morfologia, Chirurgia e Medicina Sperimentale, Università di Ferrara, Azienda Ospedaliero-Universitaria, Arcispedale S. Anna di Ferrara, Via Aldo Moro, 8, 44124 Ferrara (Cona), Italy (e-mail: ndrdra@unife.it)

a multiple trauma, because of a more evident abdominal trauma that kept the attention focused on this site. We highlight the importance of a careful searching for associated vascular neck injuries in case of seat belt trauma, even if there are not evident skin signs on the neck.

Case Report

Presenting concerns

A Caucasian 45-years-old female, who was driving her car at a speed of about 60 Km/h and was wearing a three-point seatbelt, was involved in a high-speed road traffic accident and she was admitted to Emergency Room (ER) with a thoracic-abdominal trauma.

Clinical Findings

Personal history was negative for relevant diseases. She did not remember the dynamics of the car accident, but at the arrival of the first aid, she was conscious, with a Glasgow Coma Scale (GCS) of 15 and she came out of her car by herself, waiting for the emergency medical service. At the ER, the patient was still awake, hemodynamically stable (arterial blood pressure 130/80 mmHg, pulse rate 85 bpm and partial saturation of oxygen 100% in ambient air), without any neurological signs. Physical examination revealed seat belt marks along the chest and the abdomen with swelling and bruising, especially on the left side of her abdomen, and a visible left flank mass that was tender, painful and irreducible, although the skin was undamaged. Clinical assessment was performed according to the Advanced Trauma Life Support (ATLS) [9], focusing on the abdomen. CT scan investigation showed a complete disruption of the left abdominal wall muscles from their insertion on the iliac crest, associated with massive traumatic herniation of bowel loops. No free air nor other visceral injury was found. At the Emergency Surgery department admission, before the patient underwent abdominal surgery, a brain CT scan and following neurosurgical evaluation were performed, and they were both negative for neurological injuries. Considering the nature of the injury (high-speed) and the important traumatic abdominal wall acute hernia (TAWAH), the probability of damage of bowel or mesentery, despite normal findings on observation, led to an explorative laparotomy. Surgery confirmed an extensive herniation on the left side of bowel loops through the three abdominal wall muscles, without bowel and major vessels damage. Abdominal wall hernia was repaired with a biological prosthetic mesh (Permacol®). Postoperative course was regular with bowel function recovery and re-feeding after 3 days.

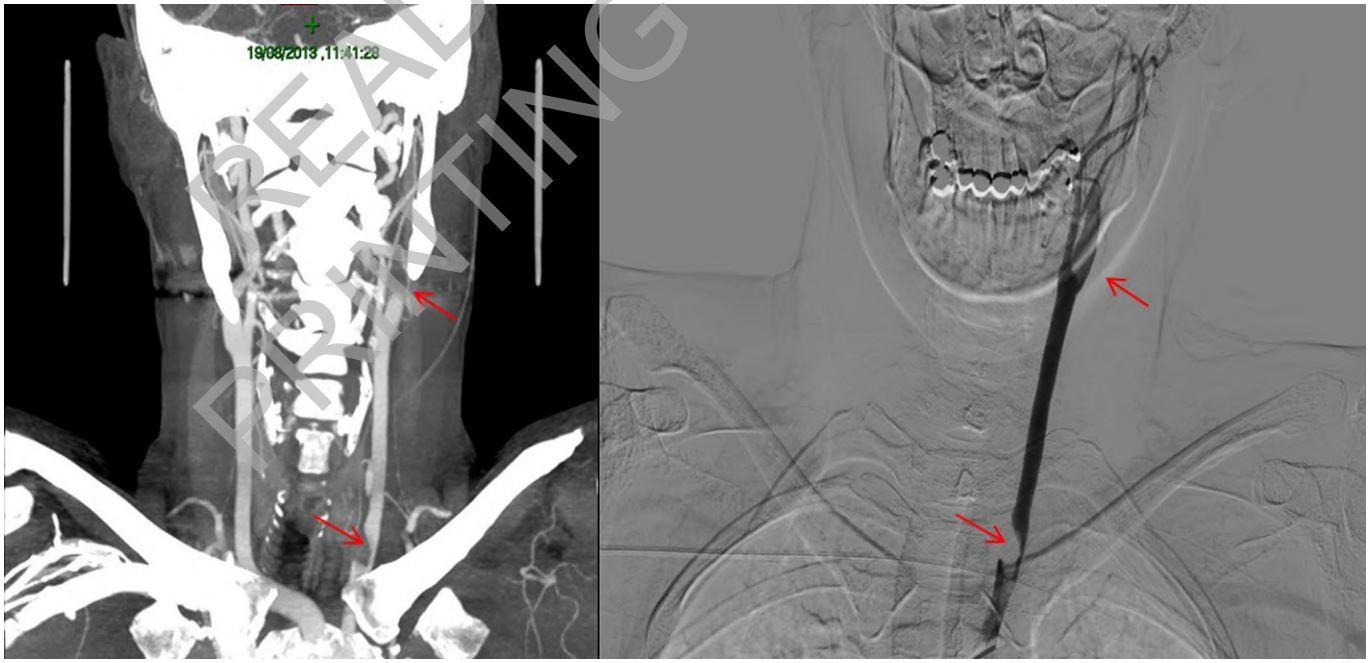

Fig. 1: Lesion of the left common carotid. a. The CT scan showed left internal carotid occlusion at 1 cm from the bifurcation. b. Carotid angiography confirmed pre-occlusive stenosis at 2 cm from the origin of the common carotid artery, with a downstream stop by the opacity of the proximal internal carotid artery.

Diagnostic Focus and Assessment

On the fourth postoperative day, the patient complained palpitations and shortness of breath, although blood tests and electrocardiogram showed no alterations. The following morning the patient presented neurological side signs with right facial-brachial-crural hemiparesis and expressive aphasia. A neurosurgical evaluation and an emergency brain CT scan were performed. The head and neck CT scan revealed a sudden and significant flow reduction (more than 90%) in the proximal third of the left common carotid, and an almost complete left internal carotid occlusion at 1-2 cm from the bifurcation (Fig. 1a), then confirmed by the carotid angiography (Fig. 1b), associated with a flow reduction in the left middle cerebral artery territory (Fig. 2). The Left common carotid artery lesion with distal embolization of the internal carotid caused the stroke. A critical analysis of the first CT scan taken in emergency setting at the hospital arriving, revealed the presence of a dissection of the origin of the left common carotid artery with a severe lumen stenosis (Fig. 3). These evidences were completely misdiagnosed by radiologist and ignored by physicians in ER, and then during the Emergency Surgery department stay.

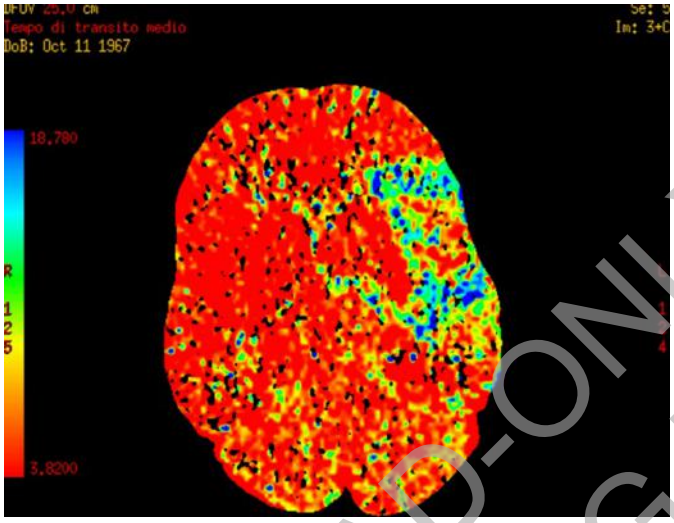

Fig. 2: Cerebral artery blood flow reduction. The perfusion brain CT scan showed blood flow reduction in the territory of the middle left cerebral artery.

Fig. 3: Left Carotid Artery Dissection. The admission CT scan showed dissection of the origin of the left common carotid artery with stenosis of the lumen.

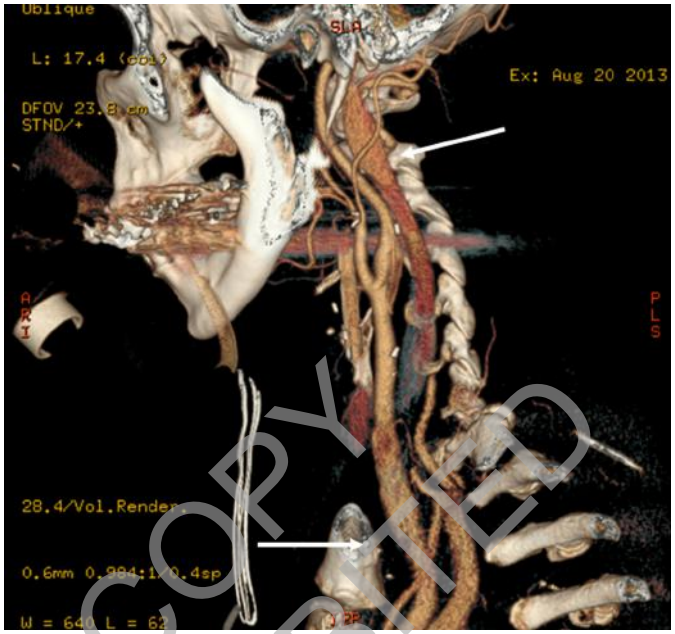

Fig. 4: Common left carotid after vascular surgery. Endarterectomy of the left proximal common carotid artery and the first portion of the left internal carotid, associated to a poly-tetra-flour-ethylene patch of both common and internal carotid artery.

Therapeutic Focus and Assessment

The Vascular Surgeon, the Emergency Surgeon and the Neuro-radiologist performed left-carotid-axis revascularization procedures: first, the patient underwent angioplasty of the narrowed lumen of the common carotid artery and mechanical thrombolysis of the entire carotid axis, and then, she underwent vascular surgery. The procedure was an endarterectomy of the left proximal common carotid artery and of the first portion of the left internal carotid, associated to a poly-tetra-flour-ethylene patch of both common and internal carotid artery (Fig. 4).

Follow-up and Outcomes

Postoperative course was free from any complication; the patient was moved on the Emergency Surgery ward from

Intensive Care Unit after 5 days, with progressive improvement in the neurological functions. Ten days later, she was discharged, 45-days brain and thoracic-abdominal control CT scan and carotid Doppler ultrasound were negative, and the patient had a complete recovery of motor functions and speech.

Discussion

The "seat belt syndrome", a collective term first used by Garrett and Braunstein in 1962 [2], refers to intra-abdominal and pelvic injuries, which consists of soft-tissues, skeletal and visceral injuries associated with the use of the restraint system [1,3,11,14]. A three-point seat belt may cause various patterns of injuries to neck, chest, abdomen, and spine. Seat belts are particularly associated with abdominal injuries, such as abdominal wall hematoma, major vessel injury, bowel perforation, and mesenteric tears [4]. Blunt trauma of the abdominal wall can lead to a TAWH [12], defined as the "herniation through disrupted musculature and fascia with adequate trauma, without skin penetration, and no evidence of prior hernia defect at the site of injury" [11-14] Though abdominal wall hernias are uncommon [3,12-14] and less than 50 cases have been reported in literature [3], they can occur as a result of a blunt trauma of the abdomen, so they should be suspected above all in patients with high- energy traumatic event [14]. Regardless of the type of restraint, skin abrasions are nearly always observed, and associated with internal injuries in 30% of cases [1]. Disruption of abdominal wall musculature is rare but normally it is associated to small and large bowel injuries, [4,12-16], and the absence of abdominal visceral lesions is very unusual. Therefore, even though the abdominal CT scan did not reveal nothing more than a traumatic abdominal wall hernia, a prompt laparotomy was done to investigate visceral lesions, and to repair the abdominal wall damage. Although blunt trauma of head and neck during motor vehicle accidents are prevalent, it is hard to find the description of neck trauma, caused by a seatbelts [17]. Particularly, injury to the carotid artery consequent to a blunt trauma is rare, affecting less than 1% of patients [5-6,18,19], with an estimated incidence between 0.08% and 0.33% for traumatic common carotid artery or internal carotid artery dissection secondary to blunt trauma [7.8]. It is associated with a stroke rate of 60 % and a mortality rate from 25% to 40 % [6,7] and it is easily overlooked in the context of multiple trauma[6]. Delayed clinical presentation is quite typical [8], only 10% of patients with traumatic carotid artery dissection show immediate symptoms, while in 35% of cases, symptoms appear after a delay, which range from hours to months [5]. So, asymptomatic carotid artery injury can easily be undetected during clinical assessment of trauma [5,6]. The presentation symptoms are related to either progressive hemodynamic impairment or thromboembolism [5] and can include headache, hemiparesis, partial Horner's syndrome, and cranial nerve palsy [8]. Although traumatic carotid artery dissection after safety belt trauma is a rare occurrence [7,8,20], this case highlights the need to consider cervical vascular injury in complex blunt trauma, even in absence of neurological symptoms. Perhaps, in this particular situation the absence of any neurological signs and the presence of a traumatic abdominal hernia diverted the attention from the possible simultaneous presence of vascular injuries. Despite this, the physical examination revealed seat belt marks over chest and abdomen with swelling and bruising, typical signs of a major trauma that must lead to suspect the existence of associated injuries. As far as the patient was surgically well managed for the traumatic abdominal wall hernia, our experience confirms that asymptomatic carotid artery injury can easily be undetected during clinical evaluation. The mistake was probably to focus the initial clinical assessment on the abdominal injury, and possible brain injuries, even if ATLS's Guidelines recommended to perform as soon as possible angiography and Doppler ultrasound to exclude cervical vascular lesions, when the dynamics of trauma is suggestive for that [9].

Conclusions

Physicians should maintain high index of suspicion when evaluating patients with multiple trauma injuries, with and without head or cervical fractures, even in neurological asymptomatic patients without seatbelt abrasions of the neck skin.

References

1. Girelli G, Di Natale R, Manocchi MC, Lutman M: *Seat belt syndrome*. Radiol Med, 993; 86:444-52, 1962; 2:220-38.

3. Narula HS, Khan RBN: *Extensive disruption of abdominal wall musculature with intestinal prolapse, a rare injury caused by seat belt.* Injury, 2004; 35:318-19.

4. Kordzadeh A, Devanesan A, Parkinson T, Rahim K, Panayiotopoulos Y: *Subtle mesenteric avulsion in a traumatic abdominal wall hernia: A case report*. Int J Surg Case Rep, 2012; 3:417-19.

5. Stanisic M, Winckiewicz M, Juszkat R, Gabriel M, Jawien A, Staniszewski R: *Endovascular treatment of intramural hematoma of internal carotid artery after blunt trauma of neck inflicted with the seatbelt.* Vasa, 2009; 38:267-71.

6. Fuse T, Ichihasi T, Matuo N: *Asymptomatic carotid artery dissection caused by blunt trauma.* Neurol Med Chir (Tokyo), 2008; 48:22-5.

7. Pugh RJ, Taylor RG: *Seat belt injury to the common carotid artery*. Inj Extra, 2006; 37:196-99.

8. Salerno S, Allard B, Waugh J, Campbell W, Freedman I,

Kossmann T: *Endoluminal stenting of a common carotid artery pseudoaneurysm due to blunt trauma.* Inj Extra, 2005; 36:26-31.

9. ATLS subcommittee;american college of surgeons' committee on trauma; international atls working group: *Advanced trauma life support (ATLS®): the ninth edition*. J Trauma Acute Care Surg, 2013; 74:1363-366.

10. Kwok-Wan Y, Chao-Peng H, Yue-Chiu S: *Delayed perforation of the sigmoid colon due to a seat belt injury.* J Radiol Sei, 2012; 37:127-32.

11. Wagner AC: *Disruption of abdominal wall musculature: Unusual feature of seat belt syndrome.* AJR Am J Roentgenol, 1979; 133:753-54.

12. Yumoto T, Sato K, Tanaka R, Ujike Y: *Seat belt injury to the inguinal region presenting with hemorrhagic shock*. J Emerg Med, 2013; 45:828-30.

13. Den Hartog D, Tuinebreijer WE, Oprel PP, Patka P: *Acute traumatic abdominal wall hernia.* Hernia, 2011; 15:443-45.

14. Damschen DD, Landercasper J, Cogbill TH, Stolee RT: *Acute traumatic abdominal hernia: Case reports.* J Trauma, 1994; 36:273-76.

15. Burdi M, Bono CM, Kauffman CP, Hoyt D, Garfin SR: *Delayed diagnosis of a flexion-distraction (seat belt) injury in a patient with multiple abdominal injuries: A case report.* Am J Orthop (Belle Mead NJ), 2008; 37:44-6.

16. Patel K, Doolin R, Suggett N: *Blunt transection of rectus abdominis following seatbelt related trauma with associated small and large bowel injury.* Int J Surg Case Rep, 2013; 4:958-60.

17. Singal R, Gupta R, Mittal A, Gupta A, Singal RP, Singh B, et al.: *Delayed presentation of the traumatic abdominal wall hernia; dilemma in the management. Review of literature.* Indian J Surg, 2012; 74:149-56.

18. Emmett KP, Fabian TC, DiCocco JM, Zarzaur BL, Croce MA: *Improving the screening criteria for blunt cerebrovascular injury: The appropriate role for computed tomography angiography*. J Trauma, 2011; 70:1058-63.

19. Bromberg WJ, Collier BC, Diebel LN, Dwyer KM, Holevar MR, Jacobs DG, et al.: *Blunt cerebrovascular injury practice management guidelines: The Eastern Association for the Surgery of Trauma.* J Trauma, 2010; 68:471-77.

20. López-Sánchez M, Ballesteros-Sanz MA, Pérez-Ceballos A, González-Fernández C, López-Espadas F: *Traumatic dissection of the internal carotid artery by a safety belt: Areport of two cases.* Med Intensiva, 2009; 33:353-57.