CASE REPORT

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Seatbelt Injury to the Common Iliac Artery: Case Report

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ABSTRACT: In traffic accident victims, the seat belt syndrome is a well known injury which rarely involves the common iliac artery due to its posterior anatomical position and to protection by the pelvis. We report a case of blunt abdominal trauma related to the type of seat belt worn. The trauma provoked subintimal haemorrhaging of the left common iliac artery, without skeletal lesions or other visceral injuries. Correct diagnosis was delayed for three months after the crash, when an angiogram was performed to investigate disabling claudication and vascular pulse change in the left leg. This arterial injury could have been related to the association of two different types of force created during the crash ("compression/deceleration-type mechanism") that might have produced shearing forces causing a vascular wall discontinuity and/or an intimal flap. The authors speculate that the vascular lesion was observed on the same (left) side as the fastening point of the seat belt (a lap-and-shoulder belt with a three-point attachment) where the shearing forces may have been most intense due to the junction between the lap strap and the diagonal shoulder belt.

KEYWORDS: forensic science, forensic pathology, road-traffic accident, seat belt syndrome, common iliac artery injuries, clinical evidence

Safety seat belts were first proposed in 1937 by Straith (1). They became a legal requirement in automobiles at different times in the different nations; in the 1960s in the USA and, strange to say, only in 1989 in Italy for front seat passengers, those for rear seat passengers and children being included a year later (2).

There is no doubt that widespread seat belt use has reduced and limited serious injuries in road accidents and decreased the number of deaths, especially in head-on collisions (3,4).

However, various new injuries have emerged with the advent of seat restraints. Garret and Braynstein first described the "seat belt syndrome" in 1962 (5). A set of clinical signs and symptoms may be present and in severe cases will require admission of the victim to hospital and later follow up to check for potentially lethal visceral lesions. Several reports have revised and expanded the characteristics of the syndrome, showing that injuries are most frequently related to the use of a lap belt or a shoulder belt or the improper application of the lap-and-shoulder belt (6–10).

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We report a case of injury to the left common iliac artery, without associated skeletal, abdominal visceral or other vascular lesions, related to a lap-and-shoulder seat belt worn by a car passenger involved in a moderate-speed crash. There is only one other report in the literature of iliac artery seat belt injury without other associated injuries (11). The authors describe two cases one of which showed transverse and diagonal seat belt signs over the lower abdomen and on the chest respectively. Both patients suffered from intestinal lesions (seromuscolar and mesenteric tears with resultant haemorrhaging) and occlusion of the right iliac artery due to an intimal flap with secondary thrombosis which required surgical treatment (arteriotomy, resection of the contused vascular area, polytetrafluoroethyl (PTFE) graft interposition). The vascular lesions were related to a sudden deceleration-type mechanism associated with compression.

Case Report

A 42-year-old man was involved in a road accident while traveling as a passenger on an intercity highway, sitting in the front right seat of a Citroen Ax (950 cc), next to the driver. According to the Police report, at a cross-road, the front of the car impacted with moderate speed (60 Km/h) against the right side of another vehicle (FIAT Ritmo 1100 cc) coming from the left. The crash caused damage to the frontal structure of Citroen (Fig. 1) with partial

FIG. 1—*The impact side of the Citroen Ax.*

intrusion of the steering wheel and the dashboard (Fig. 2). The passenger suffered from blunt abdominal compression due to sudden forward projection of the body against lap-and-shoulder seat belt worn correctly. On admission to hospital, he had intact motion and sensation and was only suffering from left elbow pain related to a traumatic contusion, and a superficial abrasion on his forehead. No skeletal or visceral lesions were found or suspected during clinical examination or even after radiological examination, and he was discharged two days later. He returned to the hospital six days later complaining of backache and ischioneuroalgia on the left side and rehabilitative physio-therapy was prescribed.

Over the following three months he continued to feel pain in the left leg and progressively disabling claudication developed which eventually limited his ability to walk 200 m. Vascular echo-doppler evaluation of both legs showed a pulseless flow on the left arterial axis (femoral, popliteal, anterior and posterior tibialis) and normal values on the right. Stenosis of the left iliac artery was suspected and the patient was referred to a vascular surgical unit. On admission, his family and past medical history did not reveal significant events or habits to which vascular injuries might be related, apart from the seat belt abdominal trauma. The general clinical examination (weight 70 kg; height: 170 cm) excluded pathological causes such as haematological or cardiovascular disease (blood pressure: 130/80 mmHg, H.R.: 80 beats/min). It confirmed the weak pulse in the left femoral artery and otherwise normal state of all vascular pulses. No alterations in temperature, or skin-color, impaired sensation nor lack of motion in either leg were noted on the record-chart. He was subjected to a transfemoral angiography that revealed severe stenosis of the left common iliac artery, in the proximal part after its origin (Fig. 3), corresponding at X-ray approximately to the inferior border of the IV lumbar vertebral centrum. The radiological finding was attributed to subintimal haemorrhaging of the vascular wall stressed by trauma. Percutaneous transluminal angioplasty (PTA) was performed and, after an attempt at lumen dilatation with bougienage (balloon-catheter 8-mm), an intravascular stent (Palmatz, 8-mm × 2,4-cm) was positioned with good results. He was discharged five days later with normalized pressure indices and a prescription for thrombocytic antiaggregant therapy. The patient, a government inspector of health and safety at work, was referred to our observation four months after the operation for a medico-legal evaluation to assess any permanent impairment of his health consequent to the vascular lesion and its possible incidence on his professional activity. During our medical examination

FIG. 2—*The front passenger compartment.*

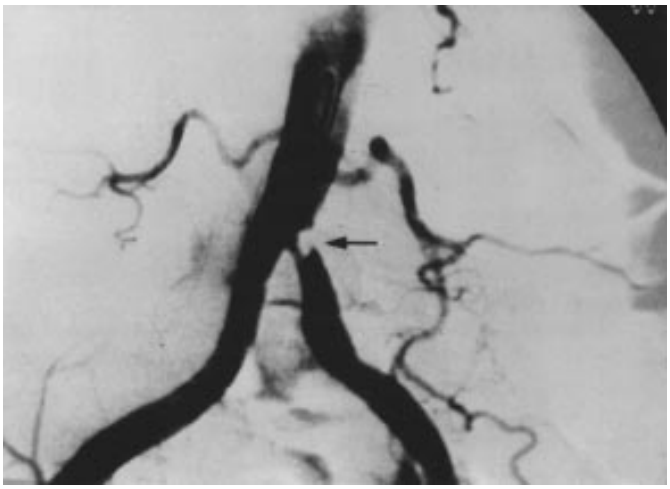

FIG. 3—*Selected opacification of the aorto-iliac vascular system by catheterization: the arrow shows segmental area of stenosis of the proximal left common iliac artery. Magnification was performed using an AF Micro-Nikkor 55 mm f/2.8 lens.*

he was found to be suffering from desultory pain in the left leg with hyposthenia; muscular hypotrophy of the left thigh was observed, the circumference measured on the middle third being 6-cm shorter than the heterolateral parameter.

Discussion

Abdominal wall contusion, rupture of the diaphragm, intestinal tears with related mesenteric haemorrhaging and intestinal perforation of the ischemic area are the most frequently described injuries related to seat belt use in road accident victims (12,13). Fractures or dislocations, especially of the lumbar vertebrae, may occur due to jack-knife type hyperflexion of the upper and lower parts of the body against the lap belt, while the lap-and-shoulder belt may induce sudden movements of the neck (hyperflexion or hyperextension), giving rise to cervical or upper thoracic spine fractures (14). Cervical spine injuries, such as severe carotid trauma or trachea transection, may be attributed to a whiplash effect in which the head and neck are thrown forward while the body is restrained or to a "submarining" effect in small subjects, who may slide down and be caught around the neck (15–18).

Isolated deep vascular lesions related to the wearing of seat belts are very rare, the aorta and the vena cava being the most frequently injured (19). Two combined mechanisms have been proposed to explain the pathophysiology of deep vascular injuries. The first consists of the "compression force" related to abdominal blunt trauma produced by seat belt traction on the muscle wall and viscera between the belt and the spine. This force determines a sudden increase in intraperitoneal pressure that may cause the avulsion of small branches from their origin; free peritoneal haemorrhaging may feature slow dripping, delaying diagnosis. The "deceleration-force" is considered to be the cause of intimal tears with secondary intravascular thrombosis which may even occlude the arterial lumen. It is generally accepted that the association of these two different types of force may create other shearing forces provoking vascular wall discontinuity or an intimal flap. The bony pelvis and the posterior position of the aorto-iliac system protect the common iliac artery to a large extent but the same shearing deceleration injuries may cause intimal tears (20–23).

In our case report, the iliac arterial traumatic injuries did not

require emergency surgery immediately after the car accident, as stenosis occurred rather than occlusive thrombosis of the arterial lumen, which could have been life-threatening or have provoked the loss of the limb. It confirms that seat belt lesions are usually very difficult to diagnose on first examination, especially when objective examination of the patient does not reveal seat belt signs which could lead the doctor to suspect underlying visceral injuries. Hence pelvic, spinal or lower extremity ischemia and vascular damage may manifest after some days or months.

Unlike in previous reports, the front passenger suffered from iliac arterial lesions on the same left side as one of the three fixed points of the seat belt worn, a combined lap strap and diagonal shoulder belt ("three-point attachment belt—inertial-reel type") to be fastened manually by the passenger on the left side of the seat (floor frame). The opposite two fixed points are on the right side, below and above the seat on the car structure behind the passenger door.

In view of the seat belt type and the combined compression/deceleration type mechanism, although various explanations could be advanced regarding the relative weaknesses of the various tissues, we speculate that the observed vascular injuries could be related to the junction between the lap strap and the shoulder belt, situated at the level of the left iliac fossa. The combined restraint might have stressed the left side more than the right, generating major shearing forces in this anatomical region.

References

1. Straith CL. Guest passenger injuries. JAMA 1937;137:348–51.
2. Costanzo A. Lesioni traumatiche da cinture di sicurezza e air-bag. Lombardo ed., Roma (Italy), 1995.
3. Newman RJ. A prospective evaluation of the protective effect of car seat belts. J Trauma 1986;26(6):561–4.
4. Kaplan BH, Cowley RA. Seat belt effectiveness and cost non compliance among drivers admitted to a trauma center. Am J Emerg Med 1991;9(1):4–10.
5. Garret JW, Braunstein PW. The seat belt syndrome. J Trauma 1962; 2(2):220–38.
6. Doersch KB, Dozier WE. The seat belt syndrome. The seat belt sign, intestinal and mesenteric injuries. Am J Surg 1968;116:831–3.
7. Williams JS, Kirkpatrick JR. The nature of seat belt injuries. J Trauma 1971;11(3):207–17.
8. Woelfel GF, Moore EE, Cogbill TH, et al. Severe thoracic and abdominal injuries associated with lap-harness seat belts. J Trauma 1984;24(2):166–7.
9. Sato TB. Effects of seat belts and injuries resulting from improper use. J Trauma 1987;27(7):754–8.
10. Contostavlos DL, Laposata EA. Sagittal liver transection—an injury from improperly worn shoulder harness seat belts: reports of two cases. J Trauma 1992;33(4):637–40.
11. Nitecki S, Karmeli R, Ben-Arieh Y, Schramek A, Torem S. Seat belt injury to the common iliac artery: report of two cases and review of the literature. J Trauma 1992;33(6):935–8.
12. Asbun HJ, Irani H, Roe EJ, Bloch JH. Intra-abdominal seat belt injury. J Trauma 1990;30(2):189–93.
13. Ljungstrom J. Injury to the abdominal wall and the viscera caused by seat-belts. Reports of five cases. Lakartidningen 1978;75: 1410–2.
14. Hampson S, Coombs R, Hemingway A. Case reports—fractures of the upper thoracic spine—an addition to the seat belt syndrome. Br J Radiol 1984;57:1033–4.
15. Bourbeau R, Desjardins D, Maag U, Laberge-Nadeau C. Neck injuries among belted and unbelted occupants of the front seat of cars. J Trauma 1993;35(5):794–9.
16. Baik SO, Uku JM, Joo KCT. Seat belt injuries to the left common carotid artery and left internal carotid artery. Am J Forensic Med Pathol 1988;9(1):38–9.
17. Reddy K, Furere M, West M, Hamonic M. Carotid artery dissection secondary to seat belt trauma: case report. J Trauma 1990;30(5): 630–3.
18. Roh LS, Fazzalaro W. Transection of trachea due to improper application of automatic seat belt (submarine effect). J Forensic Sci 1993; 38(4):972–7.
19. Dajee H, Richardson IW, Iype MO. Seat belt aorta: acute dissection and thrombosis of the abdominal aorta. Surgery 1979;85(3):263–7.
20. Morris GC, Beall AC, Roof WR, De Bakey ME. Surgical experience with 220 acute arterial injuries in civilian practice. Am J Surg 1960;99:775–81.
21. Buscaglia LC, Matolo N, Macbeth A. Common iliac artery injury from blunt trauma: case reports. J Trauma 1989;29(5)697–9.
22. Lock JS, Huffman AD, Johnson RC. Blunt trauma to abdominal aorta. J Trauma 1987;27(6):674–7.
23. Brathwaite CE, Rodriguez A. Injuries of the abdominal aorta from blunt trauma. Am Surg 1992;58:350–2.

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