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DISECȚIE TRAUMATICĂ DE AORTĂ - DECES PRIN AGRESIUNE FIZICĂ: UN RAPORT DE CAZ DE AUTOPSIE

BLUNT TRAUMATIC AORTIC DISSECTION DEATH BY PHYSICAL AGGRESSION: AN AUTOPSY CASE REPORT

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Abstract

Introduction. Aortic dissection represents a life-threatening vascular emergency.

Objectives. The aim is to highlight the benefits and practical utility of complementary exams in solving medico-legal cases.

Methods. We present the case of a 65-year-old man who died from aortic dissection 6 days after suffering physical aggression.

Results. Taking into consideration all the available data (physical aggression victim presenting chest pain, chronic aneurysm, atherosclerosis, left ventricular hypertrophy), and given the morpho-pathological findings, we were able to confirm the direct causality bond between the trauma and the aortic dissection (the cause of death: post-traumatic aortic dissection, aortic rupture and massive left hemothorax), conditioned by the pre-existing pathological background (aneurysmal dilatation of the aorta, systemic atherosclerosis, aortic kinking).

Conclusions. A particularity of this case is the occurrence of traumatic aortic dissection after physical aggression with blunt chest trauma. Patients who suffer blunt chest trauma may present atypical signs and symptoms and should be investigated more thoroughly before making a diagnosis.

Rezumat

Introducere. Disecția de aortă reprezintă o urgență vasculară amenințătoare de viață.

Obiective. Scopul lucrării este de a prezenta avantajele și contribuția examenelor complementare la rezolvarea cazurilor medico-legale.

Metodă. Prezintăm cazul unui bărbat în vârstă de 65 de ani, care a decedat în urma unei disecții de aorta, survenită la 6 zile post agresiune fizică.

Rezultate. Luând în considerare toate datele disponibile (victimă agresiune fizică, cu dureri toracice, anevrism cronic, ateroscleroza, hipertrofia ventriculară stângă) și constatările morfo-patologice, am putut confirma legătura directă de cauzalitate dintre traumatism și disecția de aortă (cauza decesului: disecția de aortă post-traumatică, cu ruptură de aortă și hemotorax masiv stâng), condiționată de patologia preexistentă (dilatație anevrismală a aortei, ateroscleroză sistemică, kinking aortic).

Concluzii. O particularitate a acestui caz este apariția disecției traumatice de aortă post agresiune fizică. Pacienții cu traumatism toracic pot prezenta semne și simptome atipice și ar trebui investigați mai amănunțit, înainte de a se pune un diagnostic.

Key-words: *aortic dissection, physical aggression, aortic aneurysm, aortic kinking*
Cuvinte cheie: *disecție de aorta, agresiune fizică, anevrism aortic, kinking aortic*

Introducere

In 1557, Vesalius described an aortic aneurysm; since then, non-penetrating aortic injury has been of interest *(Jackson, Berkas and Roberts, 1968)*. Acute aortic syndromes (AAS) are life-threatening emergencies that include several entities, amongst which are traumatic aortic injuries *(Wu et al., 2021; Muggenthaler et al., 2023; Mazzolai et al., 2024)*. There are several classifications to guide AAS management anatomically, the Stanford and the DeBakey being the most used *(Bossone and Eagle, 2021; Mazzolai et al., 2024)*. Aortic dissection (AD), defined by the presence of an intimal flap separating the true lumen from the false lumen, represents a life-threatening vascular emergency with a mortality

rate that can reach 90% without rapid intervention *(Zheng et al., 2018; Bossone and Eagle, 2021; Gang et al., 2023)*. More than 50% of patients who successfully reach the hospital die within 24 hours *(Zhang et al., 2021).* Traumatic aortic dissection (TAD) is a specific type of AD, predominantly caused by trauma and stress to the chest or back, during traffic accidents or falls from heights, necessitating urgent and accurate diagnosis and treatment (Bade-Boon *et al.*, 2018; Breen *et al.*, 2021; Yamasaki *et al.*, 2022; Yang, Wang and Liu, 2022; Gang *et al.*, 2023; Amadasi *et al.*, 2025).

Regarding the mechanism of blunt traumatic aortic injuries, there are two main mechanisms described: rapid deceleration with sagittal or lateral forces and direct penetrating injury from thoracic wall fractures. The most probable cause of TAD is the subliminal biomechanical loads, which are insufficient to produce ruptures of the entire aortic wall but to produce injuries of the intima. The blood progression between the intima and the media can vary from days to months *(Türkoglu et al., 2018; Yamasaki et al., 2022; Muggenthaler et al., 2023).*

This paper aims to present the case of a 65-year-old man who died from aortic dissection 6 days after suffering physical aggression, to highlight the benefits and practical utility of complementary exams in solving medico-legal cases. This paper presents a case report from the County Legal Medicine Service of Brasov, Romania, discussing the difficulties of diagnosing post-traumatic aortic dissections. Written informed consent for publication was obtained from the deceased's family.

Case presentation

We present the case of a 65-year-old man who suffered physical aggression. The patient was hit with blunt objects (some of which elongated), followed by falling on hard surfaces. Two days after the aggression, he came to our service to obtain a medico-legal certificate, stating the lesions he suffered. At that time, the patient presented multiple body contusions and abrasions located on the chin, in the left deltoid area, on the left lateral thoracic and abdominal wall, on the left arm and elbow, on both hands, in the lumbar area, on the left knee, and on the right calf. The patient complained of chest pain. He was then sent to the hospital for further investigations. The day after, he came back with the hospitals investigation results. Parameters recorded at the hospital in the emergency department- respiratory frequency 24 resp./min., heart rate 80 bpm, pulse 80 bpm, blood pressure 153/112 mmHg, temperature 37.3ºC, oxygen saturation 98%. A chest CT scan with intravenous contrast material revealed ascending aorta and aortic arch aneurysm (*Figure 1*), aortic kinking, fracture of the sternum (between manubrium and the body of the sternum) and several fractured ribs as follows: on the right anterior arch (II, III, IV, V, VI) and on the left anterior arch (II, III, IV, V, VI, VII, VIII, IX). No signs of AD, pneumothorax, pleural or pericardial effusion were described. Craniocerebral, cervical, abdominal, and pelvic CT scan, without contrast material, revealed left vertebral artery aneurysm with parietal microcalcifications, maxillary and ethmoidal sinusitis, and left ischio-pubic ramus fissure. There were no signs of subarachnoid hemorrhage, pneumoperitoneum, or hemoperitoneum. Three days later, the patient collapsed at home and died during the night (*Table 1*). He was then transported to our service for the necropsy.

Day 0	Day 2	Day 3	Day 6
Aggression occurs	First visit to our service and hospital investigation	Second visit to our service	Death

Table 1 – Timeline of events

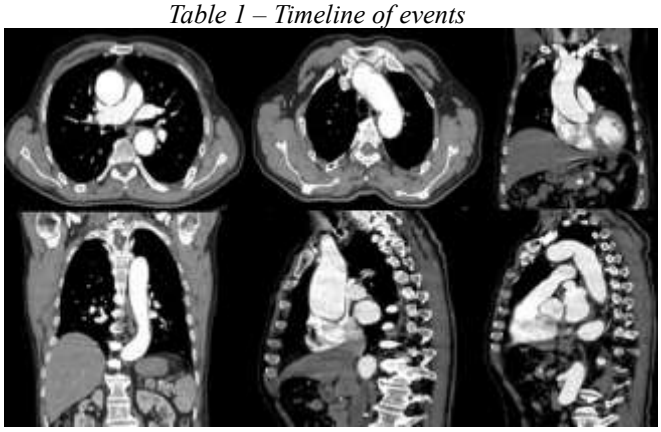

Fig. 1 – *Chest CT scan with intravenous contrast material, axial, coronal and sagittal planes, revealed ascending aorta aneurysm (max 47 mm), aortic arch aneurysm (43 mm), aortic arch and descending thoracic aorta showing areas of curvature and narrowing (27-43 mm), thoraco-abdominal aortic kinking (30-41 mm).*

Autopsy findings

The autopsy confirmed the presence of contusions and abrasions, non-penetrating sternal and rib fractures (on the right anterior

arch rib: II, III, IV, V, VI, and on the left anterior arch rib: II, III, IV, V, VI, VII, VIII, IX). The ascending aorta (44.5 mm diameter), aortic arch (43 mm diameter), and left vertebral artery aneurysms were also highlighted. The aorta was continuously dissected (*Figure 2*) from the emergence to the abdominal portion. Thirteen centimeters above the emergence of the aorta, there was a sharp tear of the aortic wall, perpendicular to the long axis, with a length of 1.5 cm (*Figure 3*), producing a massive left hemothorax (3000 ml of liquid and clotted blood). Thoraco-abdominal aortic kinking, bilateral pleuritis, systemic atherosclerosis, left ventricular hypertrophy (LVH), myocardial fibrosis, steatosis, and nephroangiosclerosis were also observed. Moreover, there was a recent frontoparietal subdural hematoma, with a maximum thickness of 0.2 mm, without mass effect. The cause of death was a massive left hemothorax following a rupture of the dissected aorta.

Histological investigations

Morpho-pathological diagnosis stated aortic aneurysm (on atheromatous plaque stage IV complicated with ulceration, dissection, rupture, and recent hemorrhage – produced approx. 5 days prior), subepicardial lipomatosis, hypertrophic cardiomyopathy, myocardial fibrosis, acute myocardial ischemic lesions, liver steatosis, nephroangiosclerosis, left vertebral artery aneurysm on stage IV atheromatous plaque, thrombosed.

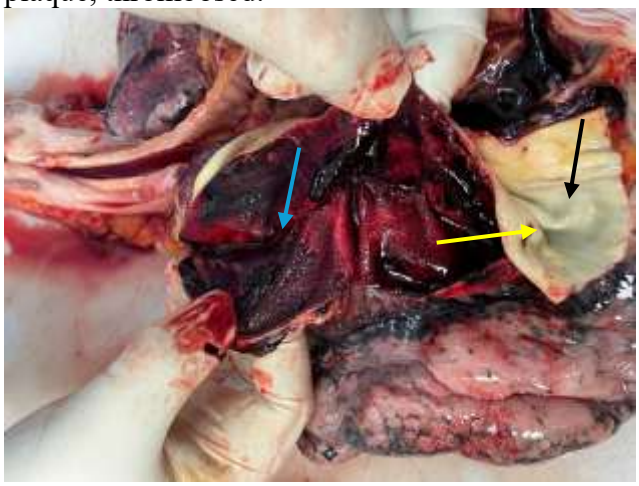

Fig. 2 *– Aortic dissection in the descending aorta.*

The intima of the aorta is separated from the other aortic layers. The black arrow (right) shows the aortic lumen, and the blue arrow (left) shows the pseudo-lumen created by the rupture of the intima. The yellow arrow (middle) shows the intima.

Fig. 3 *– Aortic rupture. The black arrow illustrates the rupture of the aortic wall. This rupture is located on the descending aorta, 13 cm above the emergence*

Discussion.

In terms of organic diseases, aortic aneurysms are the second most encountered aortic pathology, following atherosclerosis, usually being diagnosed accidentally during an imaging test performed for other indication, as it was the case in our case *(Bossone and Eagle, 2021)*. Aortic dilatation is the enlargement of the aortic diameter above 40mm in males and above 36 mm in females *(Mazzolai et al., 2024)*. The case we discussed presented an enlargement of the ascending aorta (a diameter of 44.5 mm) and of the aortic arch (a diameter of 43 mm). Moreover, the cranio-cerebral CT scan showed the dilatation of the distal section of the left vertebral artery. Bossone et al. (2020) *(Bossone and Eagle, 2021) a*lso described that thoracic aortic aneurysm might be linked to intracranial aneurysm.

Due to anatomical location, the dissection or rupture most commonly occurs in the thoracic aorta *(Peacock et al., 2024)*. The most common risk factors that can lead to AD include hypertension, atherosclerosis, aortic aneurysm and aortic valve disease *(Aortic Dissection: Symptoms & Treatment, no date)*. Moreover, advanced age, male gender *(Daou et al., 2023),* cocaine consumption, pregnancy *(Zhou et al., 2022)*, weightlifting *(Hatzaras et al., 2007; Ahmadi et al., 2008),* iatrogenic causes *(Elefteriades, Zafar and Ziganshin, 2016),* and, for the younger population, genetic connective tissue diseases (ex., Marfan syndrome, Turner syndrome) *(Bossone and Eagle, 2021; Daou et al., 2023)*

are mentioned. CT of the chest with intravenous contrast is recommended for the diagnosis of AD *(Bade-Boon et al., 2018; Wu et al., 2021; Wang et al., 2022).* Clinical signs are minimal or there are no signs of chest trauma. Hemodynamic instability, expressed by a drop of systolic blood pressure (less than 90 mmHg), is recognized as a triage criterion for TAD, although there are hemodynamically stable patients *(Bade-Boon et al., 2018)*. Treatment of AD includes both drug therapy (beta-blockers to reduce pulse pressure and heart rhythm) and surgery (thoracic endovascular aortic repair - TEVAR) *(Stiru et al., 2018; Zhou et al., 2022; Mazzolai et al., 2024)*. Unfortunately, aortic dissection misdiagnosis is not uncommon *(Wu et al., 2021; Lovatt et al., 2022).*

Traumatic aortic injuries are commonly associated with injuries of other organs, such as the brain, heart, and lungs. The mortality rate for this type of injury varies from 57% to 80%, making it the second most frequent cause of death in trauma patients *(Bossone and Eagle, 2021; Song et al., 2024).*

Aortic dissection is an entity that may lead to severe end-organ failure, for instance, aortic regurgitation, heart ischemia and infarction, mesenteric ischemia, and neurological entities *(Sayed, Munir and Bahbah, 2020)*. Considering the risk factors, we were in the presence of a 65-year-old male suffering from blunt chest trauma, systemic atherosclerosis, and aortic and vertebral aneurysms. The ruptured aorta produced a recent massive left hemothorax (~ 3000 mL of blood). On one hand, the presence of aortic aneurysm, severe generalized atherosclerosis, thoraco-abdominal aortic kinking, LVH, and nephron-angiosclerosis indicates that preexisting pathologies were present in our patient, therefore making him more susceptible to AD *(Bossone and Eagle, 2021).* LVH may indicate the presence of hypertension as another risk factor for AD *(Muggenthaler et al., 2023).* On the other hand, the subdural hematoma and the ruptured aorta following AD with massive hemothorax confirm the recent nature of the trauma and the lethal aspect of the dissection (cause of death).

The average period of survival for patients with AD who survive a hospital visit is 4h *(Song et al., 2024).* In other cases, the period is longer, as it was in this case (6 days). Kallistratos et al. *(Kallistratos et al., 2012)* have reported three months between the traumatic event (motorcycle accident) and the diagnosis of AD, showing that this is not a general rule, but exceptions can occur.

According to Wu et al. (2023) (Wu *et al.*, 2023), when diagnosing and treating a trauma patient, several aspects should be considered: understanding the underlying disease, paying attention to clinical findings and imaging results. In most cases (>76%), patients with AD have severe chest pain. A plain CT cannot be used to diagnose aortic dissection but can show suggestive findings to focus on diagnosing aortic dilatation (intermural hematoma, pleural effusion - 88% of patients) (Wu *et al.*, 2021; Wu, Tu and Zhang, 2023). During the patients first presentation to our Service, he complained of pain in the sternal area. Therefore, he was sent to the hospital for a complete check-up on this symptomatology. He underwent a CT scan with intravenous contrast material, which did not show pleural effusion or any other suggestive signs of aortic dissection. Moreover, a thoracic surgeon has seen the patient and recommended ambulatory care, considering it was not a surgical emergency. Although many studies described hemodynamic instability in patients with TAD, in our case, the systolic blood pressure and the rhythm did not suggest this condition, making hypotension insufficiently sensitive to rule out this type of injury *(Bade-Boon et al., 2018).*

From a medico-legal perspective, it is paramount to determine the cause and origin of AD. Given the fact that we were in the presence of a physical aggression victim who passed away 6 days after the aggression, with no relevant CT findings connecting the trauma to the AD, we had to find an answer to the following question: did the traumatic event cause the aortic dissection and rupture which ultimately led to the patients death?

During the autopsy, a fragment of the double-layered aortic dissected wall was taken and morpho-pathologically investigated, showing that the primary rupture of the intima was produced approximately 5 days before death. Moreover, the thoracic trauma was documented by multiple ribs and sternal fractures. Other authors have also described the delayed occurrence of traumatic aortic dissection *(Wu et al., 2021; Muggenthaler et al., 2023).*

Taking into consideration all the available data (physical aggression victim presenting chest pain, chronic aneurysm, atherosclerosis, LVH), and given the morpho-pathological findings, we were able to confirm the direct causality bond between the trauma that our patient has suffered and the AD that ultimately led to his death (the cause of death being post-traumatic aortic dissection with aortic rupture and massive left hemothorax), conditioned by the pre-existing pathological background (aneurysmal dilatation of the aorta, systemic atherosclerosis, aortic kinking).

Conclusions

A particularity of this case is the occurrence of traumatic aortic dissection after physical aggression with blunt chest trauma, usually this condition being associated with high-speed motor vehicle accidents or falling from height.

Patients who suffer blunt chest trauma (especially falls from height, traffic accidents) may present atypical signs and symptoms and should be investigated more thoroughly before making a diagnosis and considering it not an emergency case and discharging them.

There are several investigation techniques (CT scan with IV contrast, radiography, trans-thoracic echocardiography) which can be used to confirm AD, therefore saving a patients life.

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