

# Traumatic Coronary Dissection: Case Presentation and Literature Review

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## ABSTRACT

In posttraumatic coronary dissection, a small intimal tear occurs due to the sudden compression of the thoracic wall during the chest trauma, this being sometimes fatal. We present the case of a 56-year-old truck driver with chest trauma after a car crash. The 12-lead ECG showed signs suggestive of an acute anterior myocardial infarction, and the coronary angiography confirmed an arterial dissection of the left anterior descending coronary artery. A stent was inserted the same day, and the patient was treated accordingly. He survived for a total of three days. The autopsy and histological examination confirmed the MI and the coronary dissection. The chest trauma was linked to the patient's death. The literature review reveals 46 cases in which the most frequent cause of chest trauma was a car or motorcycle accident; also, young male subjects were more frequently involved. Stent placement was the main course of treatment, and a delay in the onset of symptoms was also frequent.

**Keywords:** post-traumatic coronary dissection, sudden death, myocardial infarction, chest trauma

## INTRODUCTION

Cardiac injury secondary to a chest trauma is not uncommon and may lead to various symptoms, from simple arrhythmias to myocardial infarction due to coronary dissection or even fatal cardiac rupture.<sup>1</sup> Posttraumatic coronary dissection is a rare entity, and not many cases are reported in the literature. A possible reason for the small number of cases could be sudden death occurs in many of these patients.<sup>2</sup>

The small intimal tear caused by the sudden compression of the thoracic wall during the chest trauma, may evolve under the hemodynamic stress and, associated with the disruption of the endothelial lining, may lead to coronary thrombosis and acute myocardial infarction (MI).

The left anterior descending (LAD) artery is the most commonly affected branch (76%), mainly due to its position close to the chest wall, followed by the right coronary artery (12%) due to its anterior position toward the sternum dur-

ing systole. Finally, the least involved is the left circumflex artery (6%).<sup>2-4</sup>

## CASE REPORT

A 56-year-old male truck driver with chest trauma after a car crash presented with prolonged chest pain, followed by ventricular fibrillation and cardiac arrest, one hour after the accident. He was successfully resuscitated at the place of the accident and was transported to the nearest emergency hospital. Thoracic CT revealed an inferior sternum fracture, the fracture of the 4<sup>th</sup> and 5<sup>th</sup> ribs on the right, and minimal bilateral pulmonary contusions. The 12-lead ECG revealed a 3 mm ST segment elevation in the anterior leads (V1–V3), while the coronary angiography showed a 15 mm dissection of the proximal S1 segment of the LAD artery with TIMI I flow. Four hours after the car crash, the patient had a 3 × 15 mm metal stent implanted. The following day, the ECG recording revealed pathological Q waves in V1–V3, 5 mm ST segment elevation with T-wave changes in DI and aVL, 5 mm ST depression and T-wave changes in DIII and aVF. The patient's blood pressure was constantly low during the second day, with values between 75/50 mmHg and 85/90 mmHg, therefore dobutamine 5 µg/kg/min was administered. The cardiac enzymes were elevated. On the third day, the patient's blood pressure was still low, and cardiac enzymes were continuously rising, creatin-kinase 2900 U/L, liver enzymes AST-ALT ~3000 U/L. Dobutamine continued to be administered. That evening, the patient presented a cardiac arrest with asystole, with no response to cardiopulmonary resuscitation, being pronounced dead an hour later.

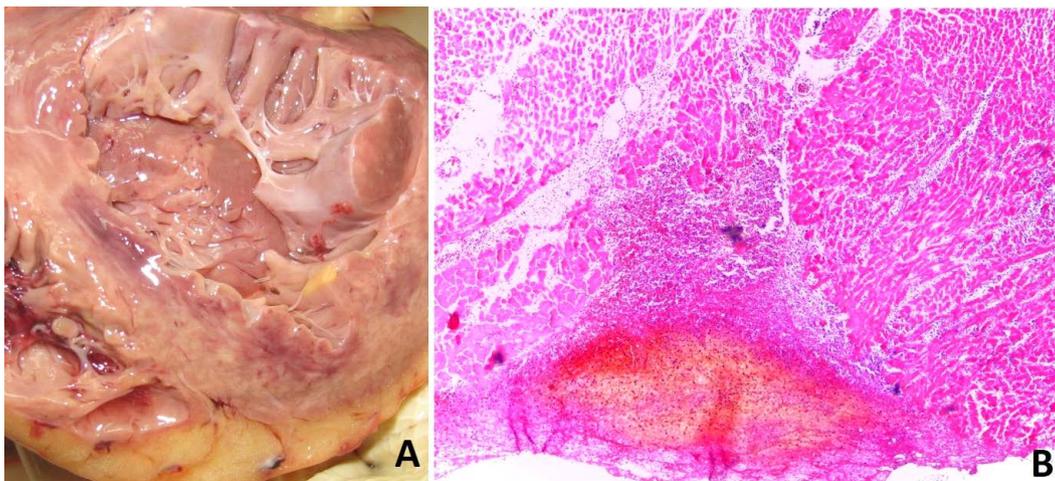
## Abnormal autopsy findings

A medicolegal autopsy was performed. The external examination found a 15 × 5 cm ecchymosis in the left infraclavicular region, probably from the car crash, needle marks on the right arm, forearm and right inguinal region. Also, on the right and left sides of the anterior thoracic region, roundish brown signs from defibrillation were present.

The internal examination revealed a C3–C4 sternum fracture, multiple rib fractures on both sides (we interpreted some of them as being secondary to cardiopulmonary resuscitation, and others to the car crash). In the pericardium, 600 ml of red blood clots were present; the anterior wall of the left atrium and ventricle presented blood infiltrate and fine cardiac muscle ruptures. On the section of the heart, a yellowish 6.5 × 1.2 cm area with rare hemorrhagic lines extended from the anterior 1/3 of the septum to the anterior wall of the left ventricle (Image 1A). In the lumen of the LAD artery, 8 mm from the left main coronary artery, a 15 mm permeable stent was present, with non-significant atherosclerosis before and after the stent (first-degree coronary atherosclerosis, isolated fatty streaks).

Histopathological examination with hematoxylin-eosin stain revealed severe interstitial myocarditis, an acute myocardial infarction that occurred 24–72 hours before death. The coronary artery examination showed hemorrhagic infiltrate in the epicardium, as well as coronary atherosclerosis.

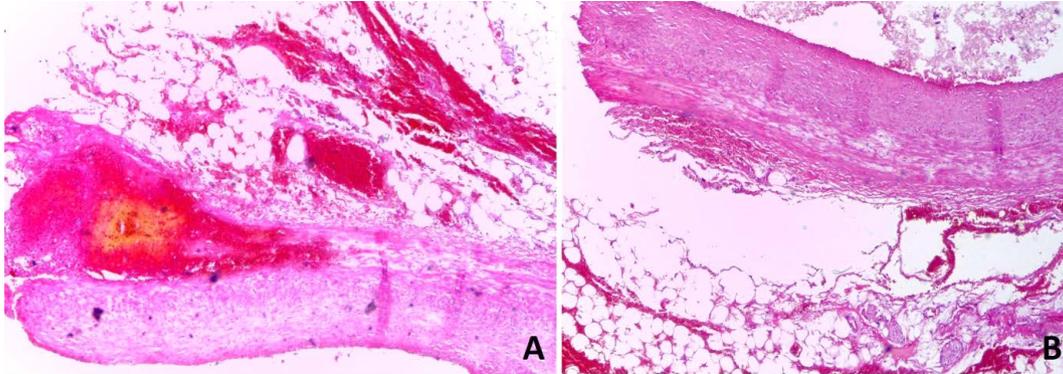
We concluded that the cause of death was a recent myocardial infarction due to the dissection of the left coronary artery following a chest trauma. We also established a direct causal link between the traumatic lesions and the patient's death.



**IMAGE 1.** **A** – Myocardial infarction on the septum and anterior wall of the heart; **B** – Myocardial infarction with inflammatory and haemorrhagic infiltrate, haematoxylin-eosin stain, 50×.

TABLE 1. Summary of the cases

Author/year	Sex	Age	Comor-bidity	Artery	Mechanism	Time until symptoms	Treatment	Survival
Boland <i>et al.</i> , 1988 <sup>5</sup>	F	32	None	LAD and LCx	Car driver	Immediate	Bypass	Yes
Goulah <i>et al.</i> , 1988 <sup>6</sup>	M	31	None	LAD	Car accident	2 years	Conservative	Yes
Marcum <i>et al.</i> , 1996 <sup>7</sup>	M	44	None	RCA	Kicked	Immediate	Angioplasty	Yes
Masuda <i>et al.</i> , 1996 <sup>8</sup>	F	17	None	LAD	Motorcycle	Immediate	Conservative	Yes
Chun <i>et al.</i> , 1998 <sup>9</sup>	M	17	None	Left main	Falling	Immediate	Conservative	Yes
Greenberg <i>et al.</i> , 1998 <sup>10</sup>	F	35	None	Lcx	Waterski accident	3 days	Conservative	No
Kawahito <i>et al.</i> , 1998 <sup>11</sup>	M	43	None	RCA	Falling	2 months	Conservative	Yes
Hazelger <i>et al.</i> , 2001 <sup>12</sup>	M	29	None	LAD and obtuse branch	Sport accident	2 months	Stent	Yes
Moore <i>et al.</i> , 2001 <sup>13</sup>	M	30	None	LAD	Sport accident	Immediate	Angioplasty	Yes
Harada <i>et al.</i> , 2002 <sup>14</sup>	M	14	None	L main	Motorcycle	Immediate	Bypass	Yes
Kerwin <i>et al.</i> , 2002 <sup>15</sup>	M	49	hyperlipidaemia	LCx	Minor trauma	2 days	Conservative	Yes
Naseer <i>et al.</i> , 2003 <sup>16</sup>	M	32	None	LCx	Kicked	Immediate	Stent	Yes
Yoon <i>et al.</i> , 2003 <sup>17</sup>	M	66	None	LAD	Car driver	20 hours	Conservative	Yes
Swinkels <i>et al.</i> , 2005 <sup>18</sup>	F	43	Smoking	RCA	Falling	10 days	Conservative	Yes
Morenot <i>et al.</i> , 2005 <sup>19</sup>	M	17	None	RCA	Bicycle accident	Immediate	Stent	Yes
Brasseur <i>et al.</i> , 2006 <sup>20</sup>	M	43	Smoking, hypertension	LAD	Punch in chest	Immediate	Stent	Yes
Korach <i>et al.</i> , 2006 <sup>21</sup>	M	40	None	LAD	Pedestrian	Immediate	Bypass	Yes
Leong <i>et al.</i> , 2006 <sup>22</sup>	M	50	None	LAD	Motorcycle	Immediate	Stent	Yes
Hobelmann <i>et al.</i> , 2006 <sup>23</sup>	M	32	None	RCA	Sport accident	1 hour	Stent	Yes
Tepe <i>et al.</i> , 2006 <sup>24</sup>	F	55	Not specified	LCx	Car driver	Not specified	Stent	Yes
Yuichi <i>et al.</i> , 2007 <sup>25</sup>	M	54	None	L main	Motorcycle	1 month	Bypass	Yes
Li <i>et al.</i> , 2007 <sup>26</sup>	M	33	None	L main	Motorcycle	13 hours	Bypass	No
Nan <i>et al.</i> , 2007 <sup>27</sup>	M	40	None	L main and LAD	Car driver	Immediate	Bypass	Yes
Pawlik <i>et al.</i> , 2007 <sup>28</sup>	M	21	None	LAD	Car driver	Not specified	Stent	Yes
Redondo <i>et al.</i> , 2009 <sup>29</sup>	F	41	None	L main and RCA	Car driver	Immediate	Angioplasty	No
Lima <i>et al.</i> , 2009 <sup>30</sup>	M	29	None	LAD	Car driver	1 month	Conservative	Yes
Chang <i>et al.</i> , 2010 <sup>31</sup>	M	24	None	L main and LAD	Motorcycle	21 days	Angioplasty and stent	Yes
Adler <i>et al.</i> , 2010 <sup>32</sup>	M	48	None	RCA	Car driver	6 days	Stent	Yes
James <i>et al.</i> , 2010 <sup>33</sup>	M	37	Not specified	L main	Car driver	Immediate	Bypass	Yes
Ney <i>et al.</i> , 2011 <sup>34</sup>	M	20	None	LAD	Car driver	Immediate	Stent	Yes
Guo <i>et al.</i> , 2011 <sup>35</sup>	F	56	Not specified	LAD	Hit by object in chest	3 weeks	Angioplasty and stent	Yes
Lin <i>et al.</i> , 2011 <sup>36</sup>	M	50	Not specified	L main and LAD	Motorcycle	Immediate	Stent	Yes
Lobay <i>et al.</i> , 2012 <sup>37</sup>	F	50	Not specified	L main and LAD	Car driver	Immediate	Stent	Yes
Shao <i>et al.</i> , 2012 <sup>38</sup>	M	43	Smoking	LAD and RCA	Car accident	3 months	Stent	Yes
Da Silva <i>et al.</i> , 2012 <sup>39</sup>	M	43	None	LAD and LCx	Motorcycle	Immediate	Stent	Yes
Hamonc <i>et al.</i> , 2012 <sup>40</sup>	M	37	Not specified	LAD	Motorcycle	12 hours	Stent	Yes
Brugger <i>et al.</i> , 2012 <sup>41</sup>	M	35	Smoking	LAD	Parachute jump	1 hour	Stent	Yes
Gottam <i>et al.</i> , 2012 <sup>42</sup>	M	26	None	LAD	Kicked	2 days	Conservative	Yes
Fradley <i>et al.</i> , 2012 <sup>43</sup>	F	69	Hypertension	RCA	Car passenger	3-4 weeks	Conservative	Yes
Kotsovolis <i>et al.</i> , 2013 <sup>44</sup>	M	58	Hypertension	RCA	Car passenger	5 hours	Stent	No
Han <i>et al.</i> , 2013 <sup>45</sup>	F	60	Not specified	RCA	Car driver	Immediate	Stent	Yes
Radojevic <i>et al.</i> , 2014 <sup>46</sup>	M	69	Not specified	LAD	Car driver	Dead on the scene		No
Li <i>et al.</i> , 2014 <sup>47</sup>	M	24	None	LAD	Falling	Immediate	Angioplasty and stent	Yes
Own case	M	56	No info	LAD	Car driver	One hour	Stent	No



**IMAGE 2.** **A** – Coronary dissection, haematoxylin-eosin stain, 50×. **B** – Epicardial haemorrhagic infiltrate, haematoxylin-eosin stain, 50×.

## DISCUSSION

We searched several databases (PubMed, KoreaMed, ScienceDirect) for “traumatic coronary dissection” and found 46 cases of traumatic coronary dissection published during a 27-year period, between 1988 and 2014 (Table 1).

As other studies confirm, the most frequently affected was the LAD artery (56.5%), followed by the right coronary artery (26.1%) and the left main coronary artery (21.7%). Due to its anatomical position, the least affected vessel was the left circumflex coronary artery (involved in 13% of the cases). In 9 cases (19.6%), more than one artery was affected.<sup>2-4</sup>

The patients from these 46 cases had a mean age of  $38 \pm 14$  years (range 14–69 years). Regarding the patients’ gender, 78.2% were male and 21.8% female. Car and motorcycle accidents where the patients were involved as drivers were the most frequent cause of coronary dissection (52.1%). Regarding the survival rate, 41 (89.1%) of the 46 cases survived the myocardial infarction due to coronary artery dissection, and were discharged from the hospital in stable condition.

There were two important issues regarding cases with traumatic coronary artery dissection in the literature: (1) the delayed onset of MI symptoms, and (2) the controversial and not clearly defined management of patients with myocardial infarction due to coronary artery dissection. The management options include coronary bypass, balloon angioplasty with or without stenting, or conservative medical treatment.

In almost half of the cases ( $n = 21$ ), the first symptoms of acute myocardial infarction occurred after more than 12 hours. We analyzed the presence of comorbidities, in order to explain the delayed occurrence of symptoms. We found a documented cardiovascular risk factor such as smoking, hypertension or hyperlipidemia in only 7 cases

(15.2%), and the MI symptoms were delayed in 4 of the 7 cases, with no statistically significant differences between the symptom delay and the presence of comorbidities ( $p = 0.68$ , Fisher’s exact test, Epi Info Software).

As far as treatment is concerned, a stent was placed in 50% of the studied cases ( $n = 23$ ), a bypass was performed on 17.4% of the patients, a conservative treatment was chosen in 23.9% of the cases, angioplasty alone was chosen in 6.5% of the cases ( $n = 3$ ), and one patient died at the accident site, no treatment being applied. Besides the patient who died on the scene, the other 4 patients who died were treated as follows: one with stent placing, one with coronary bypass, one with angioplasty and one conservatively.

Recent studies suggest that in order to provide optimal treatment in patients with a coronary artery dissection involving the left main trunk and/ or extensive dissections of the proximal LAD artery, coronary artery bypass grafting should be considered. In limited dissections resulting in a <50% narrowing of the arterial lumen, angioplasty with stent deployment is considered reasonable, while in certain limited cases, thrombolysis might be useful.<sup>48</sup>

## CONCLUSION

Post-traumatic coronary artery dissection is a rare, severe and challenging entity for both the surgeon and interventional cardiologist. Young male patients are more frequently involved, and in many cases, the delayed onset of MI symptoms carries important repercussions, even though the initial trauma was not considered severe. Even in a minor chest trauma, patients should be carefully assessed, given the risk of coronary artery dissection. Although the initial treatment is not standardized, physicians have various therapeutic options, with a low mortality rate.

## CONFLICT OF INTEREST

Nothing to declare.

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