Case Report

# Left Anterior Descending Coronary Artery Dissection after Blunt Chest Trauma

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**Abstract**

Coronary artery dissection is a well-known albeit unusual complication of blunt chest trauma. It is also an uncommon cause of myocardial infarction. Only a few such cases have been reported, probably due to the high rate of sudden death. We report a case of left anterior descending (LAD) coronary artery dissection in a healthy 38-year-old female caused by blunt chest trauma. The patient was referred to our hospital with a complaint of chest pain. Electrocardiography showed T-wave inversion, echocardiography a revealed circumferential pericardial effusion, and the coronary angiogram demonstrated a thrombotic dissection of the LAD. Troponin I was the only biomarker with elevated level. CT coronary angiography was performed using the subtotal occlusion of the LAD and illustrated a relatively good LAD run-off, and thallium scintigraphy displayed viable myocardium in this territory. Despite the total occlusion of the LAD in our case, myocardial injury was not significant due to the relatively good LAD run-off. She underwent coronary artery bypass graft surgery with an excellent result.

**Keywords:** Blunt chest trauma, coronary angiography, coronary dissection, LAD, myocardial infarction

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## Introduction

Blunt chest trauma, commonly encountered by trauma surgeons, has a different clinical sequences.[1] Traumatic coronary artery dissection and myocardial infarction (MI)[2] following blunt chest trauma is particularly rare, and its incidence rate remains unknown to date.[3] Coronary artery injuries, including lacerations, intimal dissections, thromboses, arteriovenous fistulas, and pseudoaneurysms, are infrequently occurring following blunt trauma.[4] The possible mechanisms for coronary artery dissection include intimal tearing from deceleration injury, compression of the artery between the heart and the sternum, and coronary spasm. Moreover, a dissection flap or a superimposed thrombosis can impair coronary flow.[4]

We herein report the case of a woman who sustained blunt chest trauma in a car accident, resulting in the dissection of the left anterior descending (LAD) coronary artery in the proximal segment. The case underscores the importance of electrocardiography and computed tomography (CT) angiography in the risk stratification of chest trauma and describes alternative therapeutic options for its managements.

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## Case Report

A 38-year-old woman with no history of connective tissue disorders, cardiovascular disease, or pregnancy was referred to our tertiary center with chest discomfort. Two days earlier, she had sustained anterior chest wall trauma during a car accident, causing chest pain with a short period of unconsciousness. The patient had no risk factors for ischemic heart disease, nor did she have a history of alcohol consumption. However, she had been taking levothyroxine for at least two years for hypothyroidism.

Physical examination showed no stridor, equal bilateral breath sounds, blood pressure of 110/80 mm Hg, and pulse of 75 beats per minute, $O_2$ saturation of 98 %, and normal carotid and jugular venous pulsations with no bruits or evidence of distention. The patient was neurologically intact with a Glasgow Coma Score of 15. Chest X-ray findings were within the normal limit. Electrocardiography (ECG) demonstrated T-wave inversion in the precordial leads as well as in leads I and aVL (Figures 1 and 2). Troponin I (cTnI) level raised to approximately 0.1ng/mL.

On the third day of hospitalization, the patient still suffered from chest pain. In addition, echocardiography revealed normal-sized cardiac chambers, normal systolic function (ejection fraction > 50 %), pulmonary artery pressure of 25 mm Hg, trivial tricuspid regurgitation (22 mm Hg), mild mitral regurgitation, small circumferential pericardial effusion, and normal left and right ventricular size and function.

Informed consent was obtained from the patient for subsequent procedures. Coronary angiography demonstrated an intraluminal thrombus, a proximal dissection flap at the proximal part of the LAD with subtotal occlusion, and completely normal left main, circumflex, and right coronary artery segments. Ventriculography

**Table1.** Review of the reported coronary artery dissections, treatment strategies, and outcomes

| Author/Journal | Patient Age/ Sex | Mechanism | Injury | Treatment | Outcome |
|---|---|---|---|---|---|
| **Redondo, et al.[11] Am J Emerg Surg, 2009** | 45/female | Motor Vehicle Collision | LMCA; Focal stenosis dissection; RCA dissection | Angioplasty and Heparin | Death secondary due to abdominal hemorrhage |
| **Goyal, et al.[12] Heart, 2009** | 47/male | Motor Vehicle Collision | LMCA extending to LAD dissection | Unknown(no thrombolytic) | unknown |
| **Harada, et al.[8] Ann Thorac Surg, 2002** | 14/male | Motorcycle Collision | LMCA dissection with left ventricular aneurysm | Supportive care with surgical patch angioplasty and anuerysmectomy, mitralvalvuloplasty and tricuspid annuloplasty 3 weeks later | Discharged home; doing well 4 years post-operatively |
| **Cini, et al.[15] Interact Cardiovasc ThoracSurg, 2008** | 43/female | Spontaneous | LMCA dissection | Surgical revascularization | Discharged home |
| **Rogers, et al. ClinCardiol, 2007** | 37/female | Spontaneous | LMCA with LAD involvement | Surgical revascularization | Discharged home |
| **Hazeleger, et al.[5] Circulation, 2001** | 29/male | Tackle in football 2 months prior to arrival | LAD dissection; OM dissection | Stenting | Discharged home |
| **Smayra, et al.[10] Am J Thorac Cardiovasc Surg, 2007** | 17/male | Unrestrained motor vehicle collision 1 month prior to symptoms | LAD dissection | Surgical revascularization | Discharged home |
| **Korach, et al.[9] Interact Cardiovasc ThoracSurg, 2008** | 40/male | Pedestrian struck by automobile | LAD dissection | Surgical revascularization | Discharged home |
| **Greenberg, et al.[4] Chest, 1998** | 35/female | Water-skiing 2 days prior to arrival | Circumflex artery dissection with moderate occlusion | Angiogram without intervention | Death due to brain death secondary to Vfib arrest prior to emergency department arrival |
| **De Macedo, et al.[17] J Invasive Cardiol, 2009** | 34/male | Spontaneous | RCA dissection | Stenting, Heparin, Clopidogrel, Tirofiban, Aspirin | Discharged home |
| **Hobelmann[6] Emerg Med J, 2006** | 32/male | Elbow to chest in basketball | RCA dissection | Eptifibitide and Heparin, stent X2 | Discharged home |
| **Present case** | 38/female | Motor Vehicle Collision, chest wall trauma | LAD | Revascularization, CABG Warfarin, Clopidogrel | Discharged home |

LAD: Left coronary artery dissection; RCA: Right coronary artery dissection; CABG: coronary artery bypass graft.

proved normal. CT coronary angiography was performed using the subtotal occlusion of the LAD and illustrated a relatively good LAD run-off. Finally, myocardial scintigraphy revealed viable LAD territory.

The patient remained hemodynamically stable without dyspnea and was treated with ASA, atorvastatin, metoprolol succinate, and losartan. The medications improved her symptoms gradually. Coronary angiography revealed spiral dissection at the proximal part of the LAD; however, thrombus formation precluded percutaneous coronary intervention (Figures 3a and 3b). Myocardial perfusion scan showed viable tissue in the LAD territory. The patient, therefore, underwent coronary artery bypass graft surgery (CABG), which revealed that the proximal part of the LAD was edematous and discolored. The LAD was subsequently dissected, showing recent clot associated with dissection throughout its length. The clot was extracted, and the dissected layers were then carefully examined and approximated when grafting the left internal mammary artery to the LAD.

Axial CT scan images of the proximal and mid LAD segments were obtained (Figures 4a, 4b), showing that the formation of the false lumen and thrombosis had created significant stenosis at the proximal segment of the LAD (Figures 5a and 5b), with a reasonable LAD run-off.

The patient was discharged on the tenth day after admission with an ejection fraction of 50 % – 55 %. Table 1 presents a review of the reported cases of coronary artery dissection, treatment strategies, and outcomes in different studies including the present one. The patient has no complaint 14 months after surgery.

## Discussion

Blunt chest trauma is the cause of 2 % of all coronary artery injuries, associated with high mortality and morbidity rates,[5] and a possible cause of coronary artery dissection.[6] Coronary artery dissection is most common in the LAD (76 %), right coronary artery (12 %), and circumflex coronary artery (6%).[7] Contact sports such as football[7] and high-speed impacts such as motorcycle[5] or motor vehicle accidents[8] are other causes of coronary artery dissection.[1] Etiologies reported in the literature are listed in Table 1.

Fewer than 150 cases of spontaneous coronary artery dissection have been reported, most of them occurred in women (80 %)[9] at a mean age of 40 years.[6] The most common acquired non-atherosclerotic coronary artery disease, in terms of necropsy, is spontaneous coronary artery dissection, and the LAD is the most


**Figure 1**. Inverted T in the precordial leads ($V_{1}$-$_{6}$), normal sinus rhythm, and no significant ST changes


**Figure2.** Inverted T in the precordial leads (I and aVL), normal sinus rhythm, and NL axis

frequently involved coronary artery.[6] Exercise, arteriosclerosis, cardiovascular disease, use of oral contraceptives, Marfan's syndrome, systemic lupus erythematosis, and connective tissue disease are other possible risk factors,[6] none of which were found in our patient.

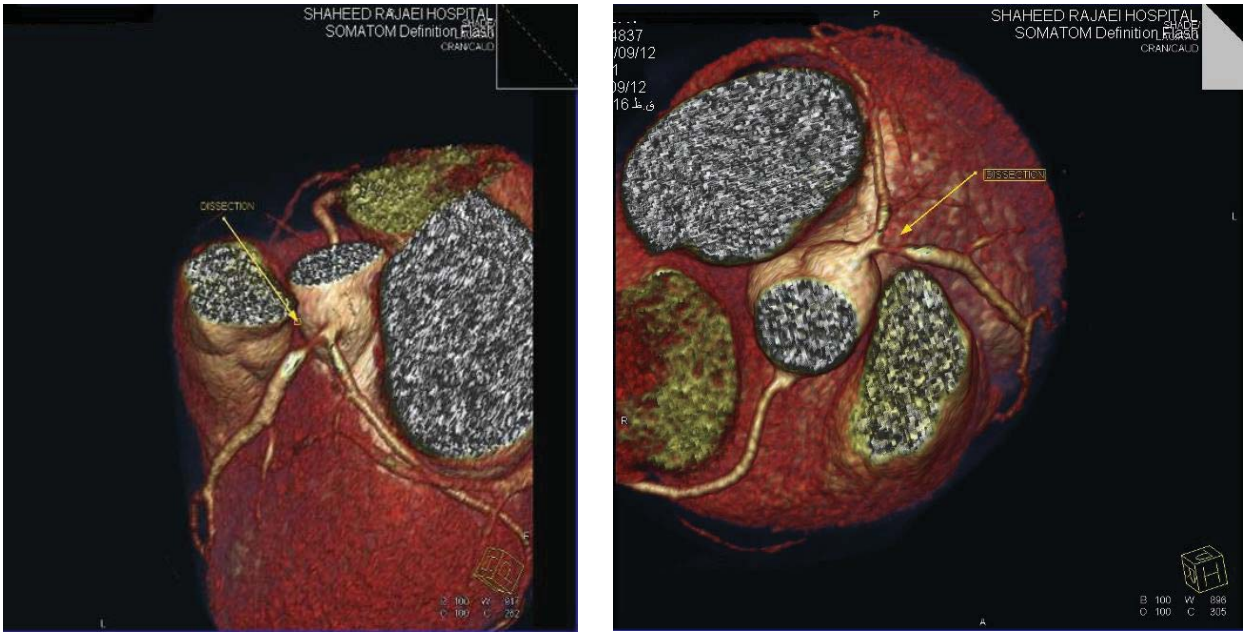
Spontaneous coronary artery dissection, arteriovenous fistulas, and pseudoaneurysms can lead to acute myocardial infarction.[3] Although these injuries are rare, they can significantly increase the mortality rate in acute myocardial infarction.[3,6] Performing ECG is critical in screening cardiac complications of blunt chest trauma, particularly when the patient is unable to communicate.[5] According to the Eastern Association for the Surgery of Trauma (EAST), any patient suspicious for cardiac injury after chest trauma should have an ECG on arrival (level 1).[9] Abnormal ECGs on admission should be followed by 24-hour cardiac monitoring until the patient is hemodynamically stable.[1] Patients with normal ECGs and no symptoms can be discharged after a short period of observation. Over 80 % of patients who develop clinically significant arrhythmias could have ECG changes on admission, suggesting that obtaining an ECG could be considered a reasonable screening examination.[10] The ECG of our patient exhibited T-wave changes, necessitating evaluation of troponin level. Biffle, et al.[11] in their study, found creatinine phosphokinase and troponin level elevation in most of the 359 patients with blunt chest injury.

Echocardiograms may show regional abnormalities in wall motion, but they cannot reliably distinguish cardiac contusion from ischemia associated with coronary artery dissection.[5] Despite the LAD dissection, our patient was normotensive with only mild pericardial effusion and a normal ejection fraction on the echocardiogram.

Incremental myocardial damage occurs when necessary revascularization is delayed. Therefore, early recognition of the LAD dissection is crucial. CT coronary angiography has a potentially diagnostic role in suspected traumatic coronary artery dissection.[5] In our patient, CT coronary angiography showed spiral dissection with an intimal flap and double lumens at the middle segment of the LAD with a good run-off after the dissection (Figures 4a, 4b and 5a, 5b).

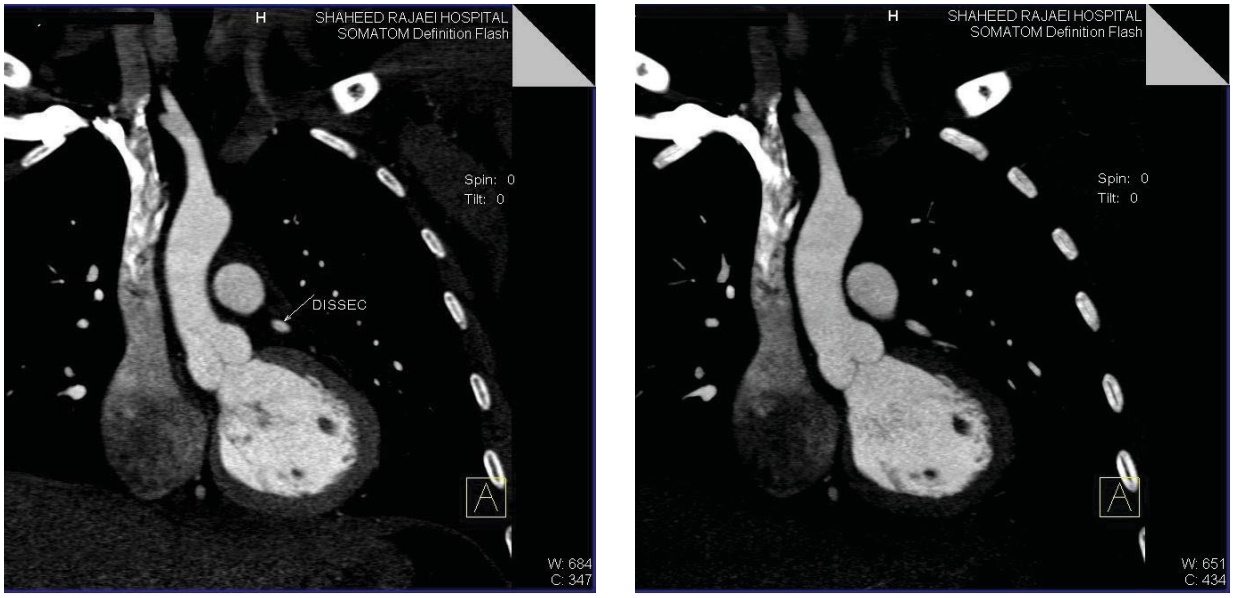
Reperfusion therapies have obvious benefits of treating a complete vessel occlusion after a coronary artery injury.[12] Treatment modalities consist of percutaneous coronary intervention and CABG,[12] and some authors have recommended surgery for all patients.[13,14] Irrespective of the etiology of the dissection, treatment depends on the lesion location. Patients with left main coronary artery lesions or those prone to high-risk bleeding will need to undergo CABG. Emergency revascularization is the only treatment modality for patients with acute left main coronary artery dissection.[6] Lesions limited to the LAD or the right coronary artery and isolated chest trauma can be treated by percutaneous techniques.[1]

Coronary artery dissection after blunt chest trauma has been successfully treated with a more conservative approach. Hobelmann[15] reported a 32-year-old male who suffered from right coronary artery dissection after blunt chest trauma during basketball game. The dissection was successfully treated with eptifibatide, heparin, and stenting. It is also worthy of note that a focal right coronary artery lesion can be successfully stented. Hazeleger[7] reported an LAD dissection two months after a tackle in football, which was successfully treated with stenting. Elsewhere in the literature,




(a) (b)

**Figure 3. a, b)** Multiplantar reconstruction of the CTR angiography of the left anterior descending artery, showing spiral dissection with an intimal flap and double lumens at the middle segment of the left descending coronary artery with good LAD run-off



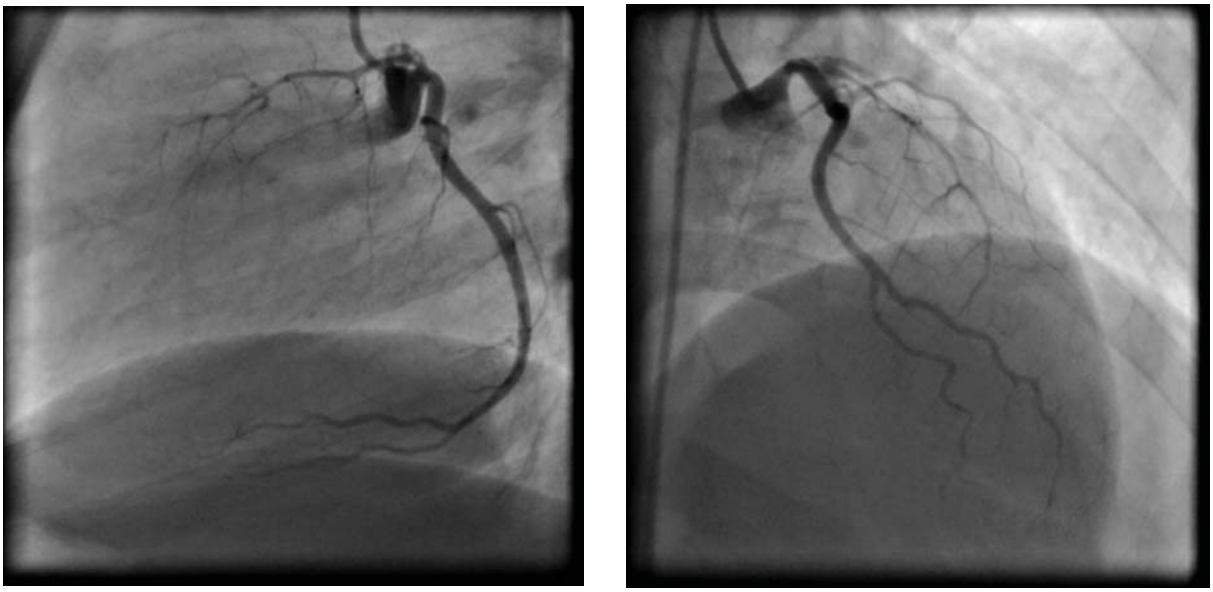

(a) (b)

**Figure 4. a, b)** Cross-sectional CT imaging of the left descending coronary artery at the proximal and middle segments: at the proximal portion, there is thrombosis of the false lumen. Segment B shows double lumens.

there is a report of an LAD lesion, which responded well to stent placement.[16] Razavi[17] reported the case of the first patient undergoing CABG and also receive a left internal mammary artery graft for the LAD, circumflex coronary artery, and left main coronary artery dissection. Thayer, et al.[18] treated the LAD and the left main coronary artery via CABG with a left internal mammary artery graft but without native artery ligation. The left main coronary artery dissection is believed to respond better to surgery.[16] One study reported cases of motor vehicle collisions with resultant LAD dissection that were successfully treated with CABG.[8] The Harada[19] study reported a similar success rate, but the dissection was in the left main coronary artery. Our patient received left internal mammary artery grafts (LIMA) graft to her dissected LAD. Furukawa, et al.[20] presented a case of RCA dissection after blunt chest trauma from a traffic accident which was complicated by chest compression due to resuscitation: the patient died 4 hours later. Our patient survived her coronary dissection because of a faint LAD run-off and absence of life-threatening arrhythmias. She also required no cardiopulmonary resuscitation.

What should be borne in mind, however, is that whereas some authors have reported good outcomes after medical therapy alone for spontaneous coronary artery dissection,[7] there are others who have recommended surgery for all patients.[21–23]

Prompt coronary angiography should be considered in patients with chest trauma who have symptoms and electrocardiographic changes. In our case, there was clear evidence of a causal relation-



(a) (b)

**Figure 5. a, b)** The spiral dissection at the proximal part of the LAD and thrombus formation precluded percutaneous coronary intervention

ship among chest trauma, dissection of the proximal part of the LAD, and intraluminal thrombus. Further management depends on angiographic findings. Although our patient had subtotal occlusion of the LAD, her good LAD run-off rendered the myocardial injury insignificant.

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## Conflict of Interest

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