

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 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

Cite this article as: Sadr-Ameli MA, Amiri E, PouraliAkbar H, Heidarali M. Left anterior descending coronary artery dissection after blunt chest trauma. *Arch Iran Med.* 2014; **17(1)**: 86 – 90.

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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Accepted for publication: 19 November 2013

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, O₂ 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

Table 1. Review of the reported coronary artery dissections, treatment strategies, and outcomes

Author/Journal	Patient Age/ Sex	Mechanism	Injury	Treatment	Outcome
Redondo, et al. ¹¹ <i>Am J Emerg Surg</i> , 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 <i>Heart</i> , 2009	47/male	Motor Vehicle Collision	LMCA extending to LAD dissection	Unknown(no thrombolytic)	unknown
Harada, et al. ⁸ <i>Ann Thorac Surg</i> , 2002	14/male	Motorcycle Collision	LMCA dissection with left ventricular aneurysm	Supportive care with surgical patch angioplasty and aneurysmectomy, mitralvalvuloplasty and tricuspid annuloplasty 3 weeks later	Discharged home; doing well 4 years post-operatively
Cini, et al. ¹⁵ <i>Interact Cardiovasc ThoracSurg</i> , 2008	43/female	Spontaneous	LMCA dissection	Surgical revascularization	Discharged home
Rogers, et al. <i>ClinCardiol</i> , 2007	37/female	Spontaneous	LMCA with LAD involvement	Surgical revascularization	Discharged home
Hazeleger, et al. ⁵ <i>Circulation</i> , 2001	29/male	Tackle in football 2 months prior to arrival	LAD dissection; OM dissection	Stenting	Discharged home
Smayra, et al. ¹⁰ <i>Am J Thorac Cardiovasc Surg</i> , 2007	17/male	Unrestrained motor vehicle collision 1 month prior to symptoms	LAD dissection	Surgical revascularization	Discharged home
Korach, et al. ⁹ <i>Interact Cardiovasc ThoracSurg</i> , 2008	40/male	Pedestrian struck by automobile	LAD dissection	Surgical revascularization	Discharged home
Greenberg, et al. ⁴ <i>Chest</i> , 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 <i>J Invasive Cardiol</i> , 2009	34/male	Spontaneous	RCA dissection	Stenting, Heparin, Clopidogrel, Tirofiban, Aspirin	Discharged home
Hobelmann ⁶ <i>Emerg Med J</i> , 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 reason-

able 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 football⁷ and high-speed impacts such as motorcycle⁵ or motor vehicle accidents⁸ 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 %) 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



Figure 2. 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 erythematosus, 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 echo-

cardiogram.

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. Hobelmann¹⁵ 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. Hazeleger⁷ reported an LAD dissection two months after a tackle in football, which was successfully treated with stenting. Elsewhere in the literature,

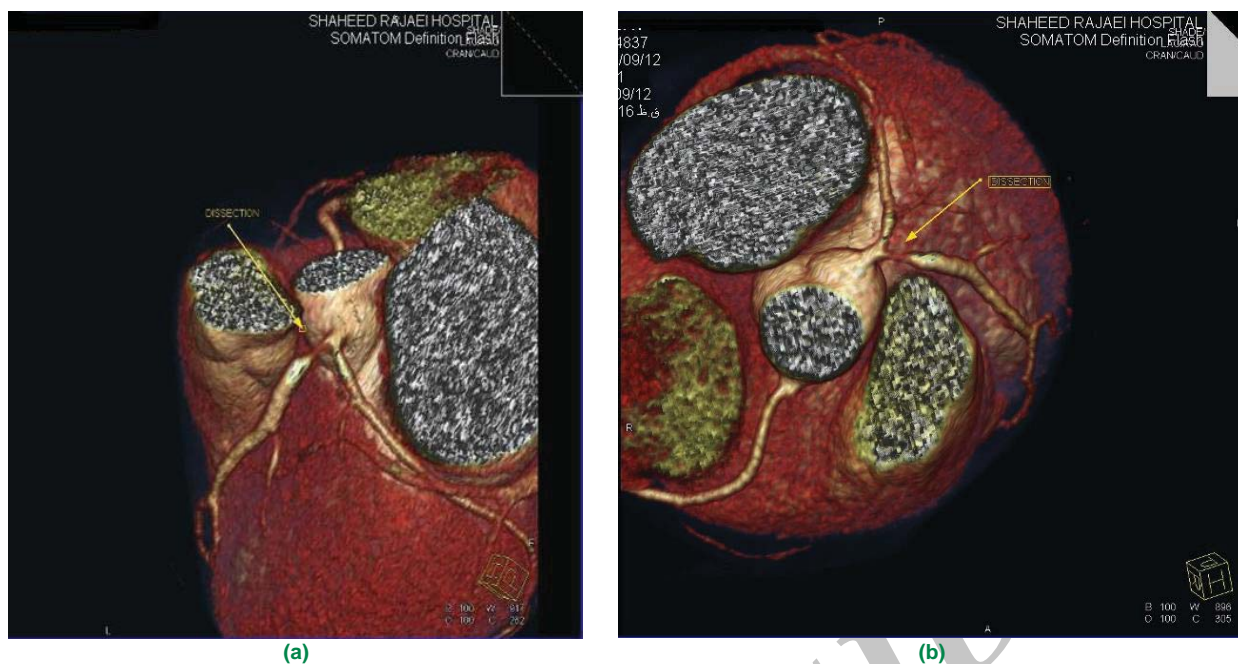


Figure 3. a, b) Multiplanar reconstruction of the CTR angiography of the left anterior descending artery, showing spiral dissection with an intimal flap and double lumens at the middle segment of the left descending coronary artery with good LAD run-off

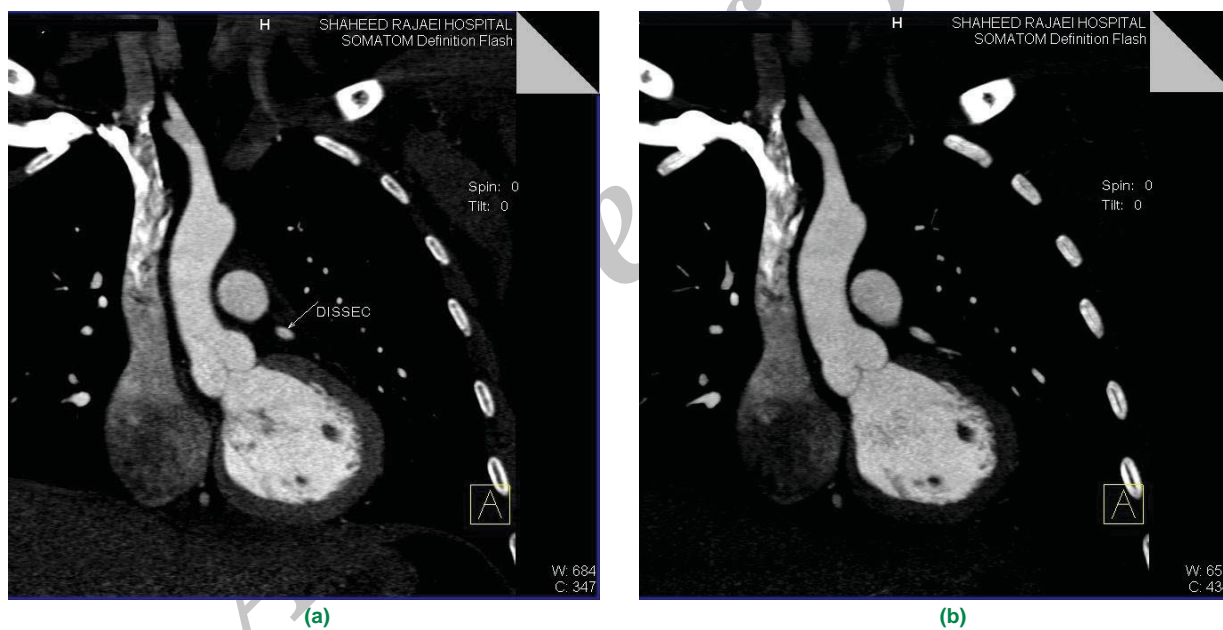


Figure 4. a, b) Cross-sectional CT imaging of the left descending coronary artery at the proximal and middle segments: at the proximal portion, there is thrombosis of the false lumen. Segment B shows double lumens.

there is a report of an LAD lesion, which responded well to stent placement.¹⁶ Razavi¹⁷ 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 Harada¹⁹ 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-

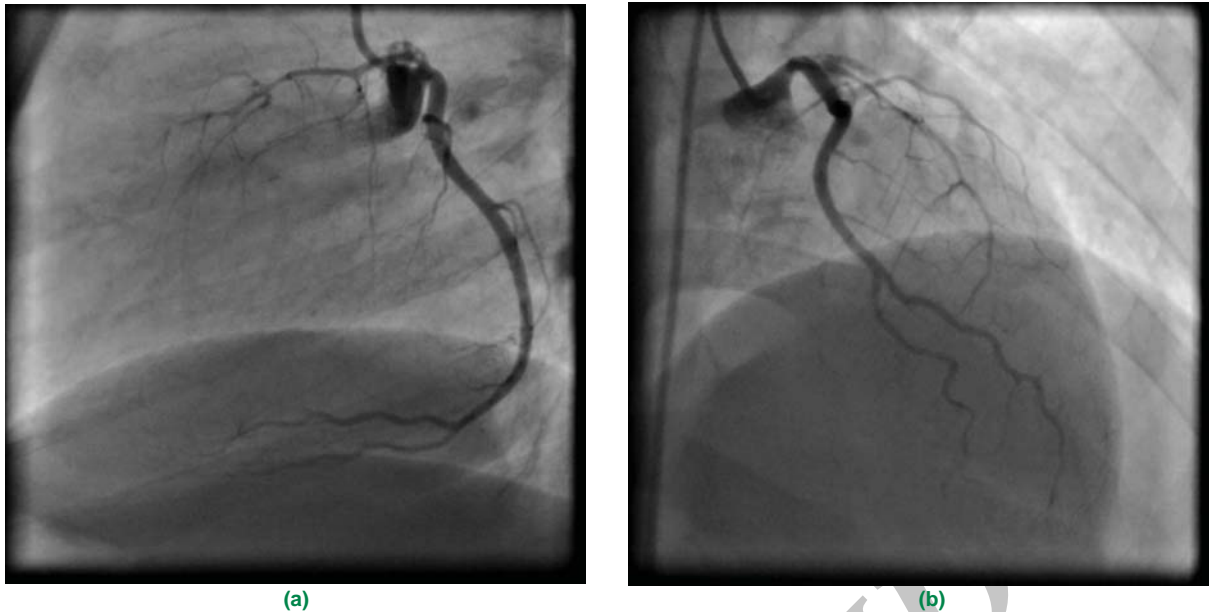


Figure 5. a, b) The spiral dissection at the proximal part of the LAD and thrombus formation precluded percutaneous coronary intervention

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.

Acknowledgment

We thank Mr. Farshad Amouzadeh for editing the manuscript.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

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