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CASE REPORT

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Coronary artery intramural hematoma causing myocardial infarction mimicking pseudoaneurysm or dissection from trauma: A case report

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Key Clinical Message

Blunt chest trauma caused ST-segment elevation myocardial infarction. Diagnosis of intramural hematoma (IMH) using computed tomography was confirmed using electrocardiography, cardiac marker tests, and subsequent coronary angiography. After conservative treatment, the hematoma was completely resolved 1 year later. Differentiating IMH from other arterial injuries is critical for appropriate management.

KEYWORDS

blunt trauma, computed tomography, coronary angiography, coronary artery disease, intramural hematoma

1 | INTRODUCTION

Blunt trauma to the chest is associated with potentially high mortality and can cause injury to the heart, lungs, and coronary vessels, including dissection, contusion, and intramural hematoma (IMH). Coronary angiography, along with coronary computed tomography (CT), can be used to locate and characterize the nature of coronary artery injuries on admission and during follow-up.[1–3]

IMH of the coronary artery and other coronary artery injuries resulting from trauma are extremely rare, potentially life-threatening, and can lead to myocardial infarction. IMH is characterized by the accumulation of blood within the arterial wall due to rupture of the vasa vasorum. IMH can occur spontaneously and may develop in patients with blunt trauma to the chest, leading to myocardial infarction. Differentiating IMH from other arterial injuries, such as dissection or pseudoaneurysm, is critical, as their management plans and prognoses differ significantly.[4–7]

This article reports the case of a previously healthy 32-year-old male patient presenting with a rare trauma-induced IMH. In reporting this case, we aim to emphasize the importance of (1) differentiating between IMH and other traumatic arterial injuries and (2) distinguishing healing of coexisting multiple varying durations in the left anterior descending artery (LAD) with trauma in complex and atypical cases. This report emphasizes the importance of accurate diagnosis, the role of radiological imaging in differentiating LAD IMH from dissections and pseudoaneurysms, and the role of percutaneous coronary intervention in confirming diagnoses.

2 | CASE HISTORY AND EXAMINATION

2.1 | Medical history

A 32-year-old male patient with an unremarkable medical history presented to the emergency department after a car accident. The patient was the driver of the vehicle and was wearing a seatbelt during the accident. He reported a sudden onset of severe substernal chest pain and dyspnea immediately after impact. The patient denied loss of consciousness, headache, or neck pain. He had no history of cardiovascular disease, hypertension, diabetes, or hyperlipidemia. He was a nonsmoker and did not consume alcohol or illicit drugs. The patient had no family history of early cardiovascular disease or sudden cardiac death.

2.2 | Physical examination

Vital signs on presentation were as follows: blood pressure, 110/70 mmHg; heart rate, 90 beats per minute; respiratory rate, 20 breaths per minute; oxygen saturation, 98% on room air; and temperature, 37°C. Chest pain caused the patient moderate distress. The chest wall exhibited mild contusions over the left anterior chest without crepitus, subcutaneous emphysema, or deformity. Heart auscultation revealed a regular heart rate and rhythm, without murmurs. The lungs were clear on percussion and auscultation, and the abdomen was soft and nontender. The extremities showed no signs of trauma, and the pulses were equal and symmetrical in all four limbs. No cyanosis, clubbing, or edema was observed.

2.3 | Initial care

Upon presentation, the patient was initially managed according to standard trauma protocols. This included stabilization of vital signs, administration of pain relief, and thorough physical examination to assess the extent of injury.

3 | DIFFERENTIAL DIAGNOSIS AND INVESTIGATION

Initial laboratory test results, including complete blood count, basic metabolic levels, and coagulation profiles, were within normal limits. The electrocardiogram and echocardiogram are part of our institution protocol for trauma patients, especially if they have signs and symptoms of blunt chest trauma. However, the emergency physicians assumed that the chest pain and dyspnea were related to rib fractures, and therefore, an electrocardiogram or echocardiogram was not performed initially. We followed our institution's trauma protocol and conducted a pan-CT scan of the brain and cervical spine without contrast and one of the thorax, abdomen, and pelvis with contrast, utilizing arterial and portal venous phases. The scans showed an incidental subendocardial hypo-enhancing region. This involved the apical part of the left ventricle, which corresponded to the LAD territory. This finding was questionable because the patient was in distress and noncooperative, the study was not electrocardiogram-gated, and the study was suboptimal due to motion artifacts. We advised an ECG-gated CT coronary angiography with more analgesia to be given to the patient to adjust any possible motion abnormality in the following study. A dedicated CT coronary angiography was performed later; the angiogram confirmed the presence of a circumferential hypoattenuating lesion involving the proximal LAD and causing mild stenosis with no evidence of atherosclerotic changes in the rest of the coronary arteries or dissecting flap. These findings most likely represented IMH or, less likely, noncalcified plaque (Figure 1). The radiologist

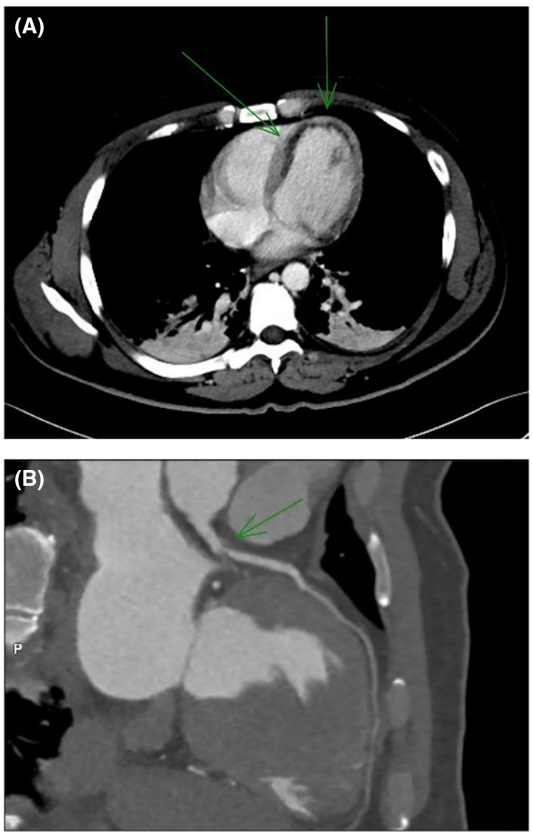

FIGURE 1 Computed tomography (CT) angiography images at (A) on admission shows a septal and apical wall subendocardial hypo-enhancing region is present along the region of the left anterior descending artery. The CT angiogram at (B) shows the proximal left anterior descending artery with the short segment of the circumferential hypoattenuating lesion, representing an intramural hematoma (most likely) or a noncalcified plaque (less likely).

advised a correlation between the electrocardiogram and cardiac enzyme tests, which showed elevated cardiac biomarkers and ST-segment elevation in the anterior leads (Figure 2). The findings were consistent with acute ST-elevation myocardial infarction. Emergency coronary angiography confirmed IMH with no evidence of dissection. Hence, the primary cardiology team decided to treat the patient conservatively with no interventional procedure and with 1 week follow-up using CT coronary angiogram.

After 1 week, follow-up CT revealed a new outpouching structure that was worrisome for dissection or pseudoaneurysm. The patient underwent coronary angiography, and the presence of a distal left main hematoma compressing the ostial LAD (Figure 3) was confirmed using intravascular ultrasound (IVUS) and optical coherence tomography (OCT). IMH without dissection or pseudoaneurysm was diagnosed.

4 | TREATMENT

No intervention was needed because the flow in the LAD was classified as a thrombolysis in myocardial infarction (TIMI) grade 3 flow. Subsequently, improvements in the patient's clinical symptoms, cardiac enzymes, and electrocardiogram results were observed. The patient was discharged in good condition.

5 | FOLLOW-UP

A follow-up CT coronary angiography 1 month after presentation to the clinic (Figure 4) revealed significant improvement in the IMH, with a 30% residual narrowing of the ostial LAD and, once again, an outpouching. A few days later, the interventional cardiologist admitted the patient for diagnostic and follow-up purposes regarding the persistent outpouching, and another coronary angiography was performed. The angiogram showed significant improvement of the IMH with no stenosis, dissecting flap, or pseudoaneurysm on IVUS and OCT. The cardiologist determined that no intervention was necessary in this case. Follow-up was conducted 1 year later, and a CT coronary angiography scan showed resolution of the outpouching with no residual stenosis (Figure 5).

6 | DISCUSSION

6.1 | Intramural hematoma in trauma patients

IMH after trauma is an extremely rare and fatal phenomenon. Based on our literature review, only four case reports have described IMH of the LAD in patients.[1–3,6] Traumatic IMH may result from blunt trauma to the chest caused by, for example, motor vehicle accidents or direct blows to the chest during contact sports.[3] The proposed mechanisms of injury include compression of the coronary artery between the heart and chest wall, rapid deceleration forces, and direct laceration of the artery.[7,8]

Acute ST-elevation myocardial infarction is a very rare complication of blunt chest trauma.[9–11] The LAD is the most frequently impacted coronary artery compared with other coronary arteries, such as the left circumflex and right coronary arteries.[12] Patients with traumatic IMH often present with nonspecific signs and symptoms of cardiac and coronary injuries, including chest pain, dyspnea, and signs of myocardial ischemia or infarction. Due to the similarities in clinical presentation, differentiation between IMH and LAD dissection relies on imaging studies.[13]

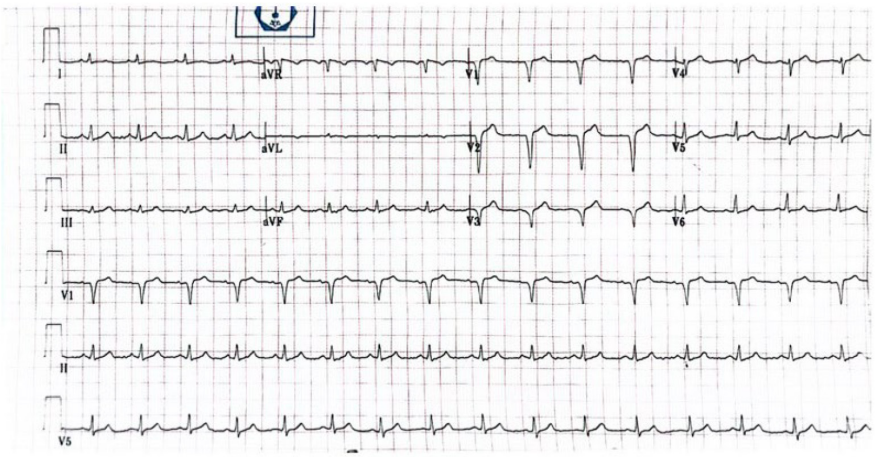

FIGURE 2 A 12-lead electrocardiogram demonstrating ST-segment elevation in V1, V2, and V3 on admission.

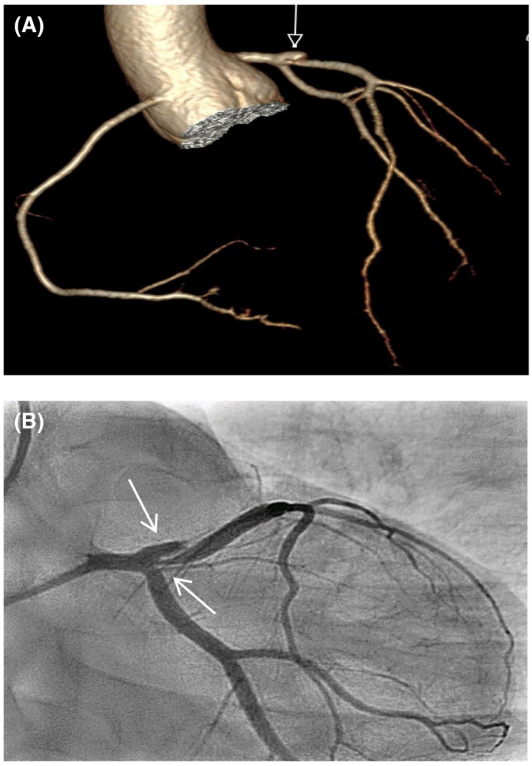

FIGURE 3 First follow-up study, 1 week after initial presentation. The coronary angiography at image (A) with three-dimensional reconstruction at image (B) shows the left main intramural hematoma continues to compress the ostial left anterior descending artery. Significant narrowing as well as a new outpouching, likely representing a dissection or pseudoaneurysm, is present.

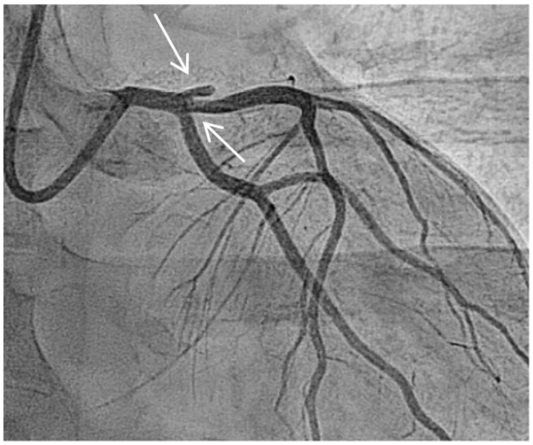

FIGURE 4 Second follow-up study, 2 months after initial presentation. The coronary angiography scan captured at the second follow-up shows partial resolution of the intramural hematoma with the residual ostial left anterior descending artery, 30% stenosis, and an outpouching.

6.2 | Differentiation using CT angiography

CT angiography is a noninvasive imaging modality that provides high-resolution images of the coronary arteries. This technology has emerged as a useful tool for diagnosing traumatic and nontraumatic cardiac and coronary artery conditions, including, but not limited to, IMH and dissections.

In the case reported herein, we observed that the presence of high circumferential attenuation within the arterial wall in noncontrast images may be a helpful way to differentiate between IMH and dissection, particularly when correlated with a patient's history of trauma and the absence of high blood pressure and atherosclerotic changes. The findings we observed might be attributed to rapid deceleration forces and compression of the artery between the heart and chest wall during a traumatic event.[7,8] In contrast to our findings of an IMH, coronary artery dissections can present with an eccentric high-attenuation area within the arterial wall in noncontrast CT angiography images. In cases with typical findings, a clear distinction between true and false lumens separated by an intimal flap may be observed in the contrast study. However, a pseudoaneurysm presents as an outpouching collection with a clearly defined neck that connects to the parent artery.[14] Importantly, these observations regarding the IMH and dissections are based on our own analyses and interpretations. Our observations provide a potential means of differentiating IMH from coronary artery dissection in the context of traumatic events. Additionally, the resolution of luminal stenosis and the disappearance of the outpouching on serial imaging provided evidence for our diagnosis of LAD IMH. Contrastingly, spontaneous resolution is not characteristic of arterial dissections or pseudoaneurysms, which represent irreversible arterial injuries that typically require intervention. Additional research is required to confirm or refute this hypothesis and to improve our understanding of the underlying mechanisms contributing to these conditions.

Despite the potential utility of the imaging features that we have described in differentiating between IMH, pseudoaneurysm, and dissection, in some complex and atypical cases, these imaging characteristics may be similar, posing challenges in making a definitive diagnosis, as in our case. In such situations, invasive imaging techniques, including coronary angiography, IVUS, and OCT, may be required to provide additional information and facilitate an accurate diagnosis.[15]

6.3 | Coronary angiography IVUS and OCT

During coronary angiography, using invasive imaging modalities such as IVUS and OCT can provide high-resolution images of the coronary artery wall, allowing for possible differentiation between IMH, pseudoaneurysm, and dissection. IMH appears as a hypoechoic area on IVUS and as a low-signal

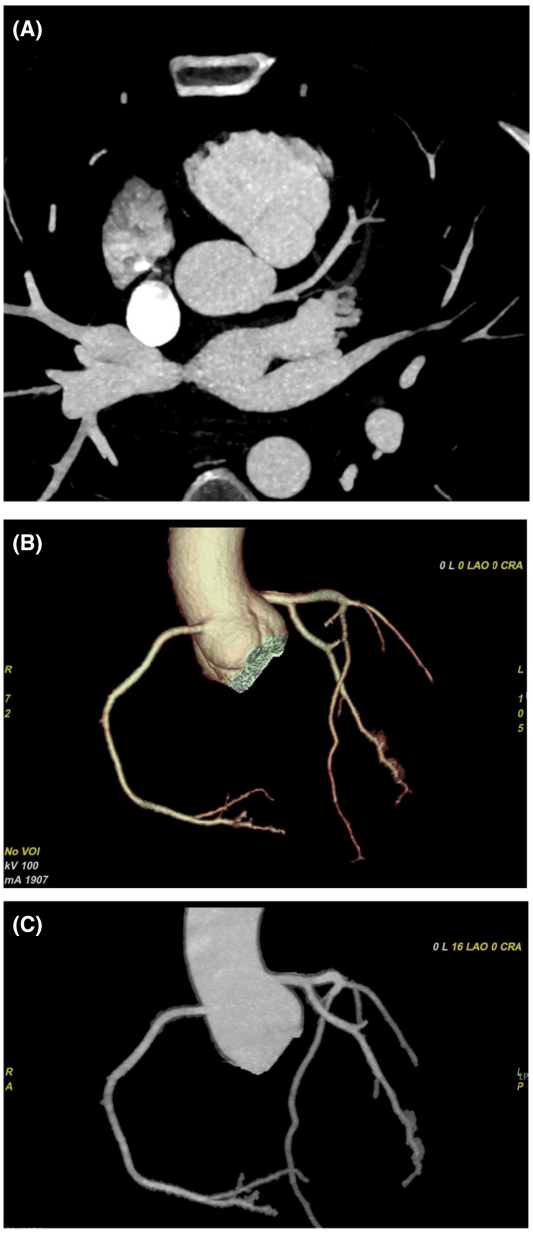

FIGURE 5 Final follow-up, 1 year after initial presentation. A coronary computed tomography scan with three-dimensional reconstruction at images (A–C, and) shows complete interval resolution of the previously visualized left anterior descending artery intramural hematoma, with resolution of the outpouching structure.

region on OCT. Furthermore, using IVUS and OCT, LAD dissection is characterized by the presence of an IMH with a dissection flap and false lumen.[16] Pseudoaneurysm, however, presents as a collection of outpouchings connected by the adjacent artery.[4,5] These imaging techniques can be used during percutaneous coronary intervention to guide appropriate interventions and management.[13]

Taking all the aforementioned factors into consideration, this case was especially challenging due to possibility of multiple stages of disease healing, which resulted in a diverse range of imaging appearances.[17] This variability in imaging findings further complicates the process of differentiating between IMH, pseudoaneurysm, and dissections and highlights the need for a comprehensive assessment of the patient's clinical history, symptoms, and risk factors, in addition to imaging findings. When multiple healing stages coexist, adopting a holistic approach to evaluate the patient's condition and consider all available evidence is crucial to arrive at the most accurate diagnosis. This approach includes correlating noninvasive imaging techniques with invasive techniques when the noninvasive techniques provide inconclusive or conflicting findings.

7 | CONCLUSION

IMH and coronary artery dissection secondary to trauma are extremely rare and fatal phenomena that can present with similar clinical features, making an accurate diagnosis challenging. This case report highlights the importance of correct diagnosis, which affects the patient's management plan. Radiological imaging, particularly CT angiography, is crucial for differentiating between IMH and LAD dissection. However, in complex and atypical cases, invasive imaging modalities, such as coronary angiography with IVUS and OCT, may be necessary to confirm the diagnosis and guide appropriate management. Therefore, further research is needed; for example, retrospective cohort studies may help improve our understanding of multiple stages of healing, and comparative imaging studies may help refine the imaging criteria used for differentiation.

AUTHOR CONTRIBUTIONS

Abdulilah Z. Albriek: Data curation; investigation; writing – original draft. **Saad Alamri:** Visualization. **Faisal Hamad:** Project administration. **Mostafa Alshamiri:** Writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest and that they have conducted the research and prepared the case report with honesty, integrity, and transparency.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this case report are available in the article. Anonymized data that do not compromise the patient's identity are available from the corresponding author upon reasonable request and with the patient's consent.

ETHICS STATEMENT

Ethical approval was not required, as this report was based on a retrospective analysis of a single patient's clinical data and did not involve any experimental procedures. However, the authors took the necessary steps to ensure that the patient's privacy and confidentiality were maintained by obtaining written informed consent from the patient for writing and publishing this case report, including the use of relevant images. All personal identifiers were removed or altered to protect patient privacy, and no identifiable information was included in the published case report.

The authors adhered to the ethical guidelines and principles outlined in the Declaration of Helsinki and the International Committee of Medical Journal Editors (ICMJE). We also followed the CARE guidelines for case reports.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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