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Case Report
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Devil and the Deep Blue Sea: Concomitant Coronary Artery Dissection and Intracranial Hemorrhage in a Trauma Patient

Serene Goh Si Ning[1,2], Abdul Kareem Saleem Ahmed[1] and Teo Li Tserng[1]*

[1]Department of General Surgery, Tan Tock Seng Hospital, Singapore

[2]MOH Holdings, 1 Maritime Square, Singapore

Abstract

Introduction: Coronary Artery Dissection (CAD) is an uncommon complication of BCI with less than 20 cases reported in literature. Conservative management maybe successful in selected patients, whilst others require coronary artery stenting, bypass and/or anticoagulation. The management of traumatic CAD becomes more complex in patients with concomitant injuries with risk of bleeding.

Methods: A 65-year-old lady sustained CAD of the Left Circumflex Artery (LCx) with concomitant intracranial hemorrhage following a Motor-Vehicle Accident (MVA). She had momentary loss of consciousness and complained of chest pain. On examination she had tenderness to the left of her sternum. FAST was negative and Chest XR demonstrated left 10th rib fracture with no hemopneumothorax. Electrocardiogram demonstrated ST-T segment elevation in leads II, III, aVF and ST segment depression in V1-V3 compatible with posterior STEMI. She was given aspirin prior to brain imaging. CT brain showed hemorrhagic contusion in the right cingulate gyrus and trace sub-arachnoid hemorrhage. She underwent cardiac catherization, diagnostic angiogram revealed complete occlusion of the Left Circumflex Artery (LCx) suggestive of dissection. Plain angioplasty did not restore flow and stenting was not performed in view of contraindications to antiplatelet therapy.

Discussion/Conclusion: CAD following blunt chest trauma is rare but potentially devastating, requiring high index of suspicion. We performed a literature search of relevant articles in English on PubMed as there is currently no consensus on the evaluation and management of traumatic CAD with concomitant injuries. We suggest a flowchart for management of multi-injured patients based on hemodynamic status.

Keywords: Coronary artery dissection; Blunt cardiac injury; Polytrauma

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Correspondence:
Serene Goh Si Ning, Department of General Surgery, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, S308433, Singapore, Tel: 6591006954; E-mail: serene.goh@mohh.com.sg

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Introduction

Blunt Cardiac Injury (BCI) comprises a spectrum of injuries from clinically silent, transient arrhythmias to fatal cardiac wall ruptures. Coronary Artery Dissection (CAD) is an uncommon complication of BCI with less than 20 cases reported in literature of which Left Circumflex Artery (LCx) dissection has been reported only 3 times [1]. Management depends on the mechanism of injury, co-morbidities of patient, hemodynamic stability, concomitant injuries, location of lesion and risk of bleeding [1,2]. Conservative management of traumatic CAD maybe successful in select patients, others may require coronary artery stenting, bypass and/or anticoagulation [2]. The management of traumatic CAD becomes more complex in patients with concomitant injuries. We review the case of a 65-year-old lady who sustained CAD of the Left Circumflex Artery (LCx) with concomitant intracranial hemorrhage following a Motor-Vehicle Accident (MVA).

Case Presentation

A 65-year old lady with no past medical history was brought in by ambulance following a MVA. She was a restrained front seat passenger who was involved in a T-bone collision with another vehicle while travelling at 70 km/hr. Paramedics reported that airbags were deployed but windshield was intact. There was momentary loss of consciousness. She complained of severe chest pain on arrival to the emergency department.

Figure 1: Electrocardiogram showing posterior STEMI.

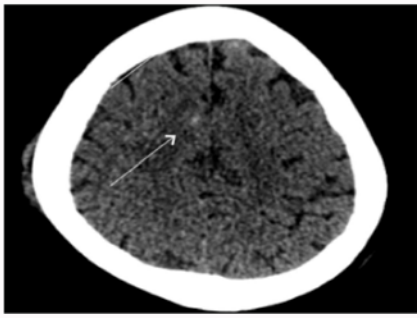

Figure 2: Computed Tomography of the Brain demonstrating 2 mm hemorrhagic lesion in right cingulate gyrus.

Primary survey was unremarkable except for tenderness over left chest wall and sternum with no open wound or deformity. Heart sounds were dual and breath sounds were equal bilaterally with saturations of 98% on room air. She was hemodynamically stable with a blood pressure of 123/68 and heart rate of 77. Her Glasgow coma scale was 15 and had no focal neurological signs. Secondary survey revealed a right temporal superficial laceration of 3 cm.

Focused assessment with sonography for trauma was negative for free fluid or pericardial fluid. Chest X-ray demonstrated an undisplaced left 10th rib fracture with no hemothorax or pneumothorax. Pelvic X-ray was unremarkable. Electrocardiogram (ECG) demonstrated ST-segment elevation in leads II, III, aVF and ST-segment depression in V1-V3 compatible with posterior STEMI (Figure 1).

After initial resuscitation, the patient was loaded with 300 mg of aspirin and Computed Tomography (CT) of the brain was arranged. CT brain showed hemorrhagic contusion in the right cingulate gyrus and trace acute sub-arachnoid hemorrhage over the right frontal sulci (Figure 2).

She underwent emergent cardiac catherization. Diagnostic angiogram revealed complete occlusion of the LCx suggestive of dissection (Figure 3). The rest of the coronary vessels were normal. An attempt was made to restore flow by wiring the culprit vessel and attempting plain angioplasty. However, the flow was only restored transiently and re-occluded rapidly.

After discussion with the neurosurgery team, decision was made not to insert a stent due to potential risk of anti-platelets and heparin worsening the hemorrhage. She was monitored in coronary care unit for 2 days. Repeat CT brain showed resolution of intracranial hemorrhage and she was started on aspirin subsequently. She was discharged from hospital one week later.

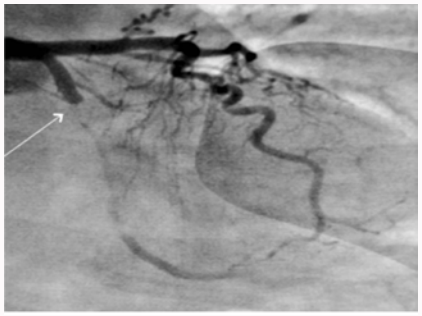

Figure 3: Coronary angiogram showing complete occlusion of the left circumflex artery.

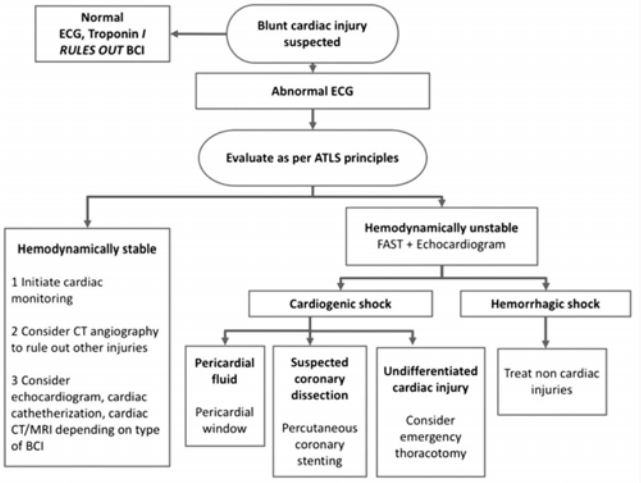

Figure 4: Management of blunt cardiac injury.

Discussion

The incidence of BCI varies from 8% to 71% and is contributory in 20% of all MVA related deaths [3]. Coronary artery dissections are more common in left anterior descending artery (76%), less common in right coronary artery (12%), and they rarely occur in LCx (6%) [4]. The most common etiology include MVAs, followed by fall from height and crush injuries [3,5]. BCI with ST-segment elevations on Electrocardiogram (ECG) may easily be overlooked as a primary cardiac event resulting in MVAs especially in elderly with cardiac history. In our patient this was less likely given that she has no significant cardiac history or cardiovascular risk factors and was a front seat passenger during the accident. She suffered an LCx dissection with coronary artery occlusion in absence of cardiac failure, which amounts to a BCI of American Association for Surgery of Trauma (AAST) Injury Scale Grade III [6]. The proposed mechanism of acute coronary occlusion in our patient is likely related to rapid deceleration forces causing shear stress to intima of coronary vessels and subsequent thrombosis. Other mechanisms of trauma-induced myocardial infarction including vascular rupture, spasm, embolism to coronary arteries or fissuring of atherosclerotic plaque with dislodgement [7].

We suggest a flowchart (Figure 4) of management of BCI in line with guidelines published by The Eastern Association for the Surgery of Trauma (EAST) [8]. BCI is often associated with thoracic injuries and should be evaluated as part of multi-system trauma as per principles of Advanced Trauma Life Support [9]. If blunt cardiac

Table 1: Review of case reports on traumatic coronary artery dissection with concomitant injuries.

Author/Journal	Mechanism	Type of coronary artery injury	Concomitant injuries	Treatment	Outcome
Leong/Emerg Med J -2006 [14]	Motor vehicle collision	Left anterior descending coronary artery dissection	Facial and right femoral fracture	Heparin, Bare metal stent	Discharge
Nan YY/Eur J Cardiothorac Surg -2006 [17]	Motor vehicle collision	Left main coronary artery dissection	Sternal fracture, mediastinal hematoma	Off pump coronary artery bypass (day 7)	Discharge
Pawlik/J Trauma -2007 [18]	Motor vehicle collision	Left anterior descending coronary artery dissection	Carotid rupture	Angioplasty and stenting Carotid aneurysm resection and bypass	Discharge
Redondo/Am J Emerg Surg, (2009) [19]	Motor vehicle collision	Right coronary artery dissection	Splenic and hepatic injury	Heparin, Angioplasty	Death from intra-abdominal bleeding

injury is suspected, an ECG and troponin I should be obtained. BCI is ruled out in the presence of a normal ECG result and normal troponin I level. The trauma team should be activated for all blunt cardiac injuries as it signifies a high impact injury. It is the responsibility of the trauma team to coordinate care between the interventional cardiologists and other specialists who may have differing opinions. For isolated BCI with new arrhythmias or raised troponin I, telemetry ward admission is recommended. If the arrhythmia persists or the patient is hemodynamically unstable, an echocardiogram should be obtained and cardiac failure should be differentiated from hemorrhagic shock. In cases where etiology of cardiac manifestation is uncertain, Cardiac CT/MRI or CT angiography may assist in differentiating acute myocardial infarction from BCI. This helps to determine the need for catheterization and anti-coagulation for the trauma patient. However, the role these imaging modalities maybe limited in the context of a trauma patient who is hemodynamically unstable. For BCI with other non-cardiac injuries, echocardiogram and cardiac imaging may be considered at suitable timings, bearing in mind the urgency of other injuries, patients' hemodynamic stability and suitability for transport. There should be a low threshold to perform a CT trauma angiogram in these patients as there is high risk of missed injuries given the high energy accident and interventions such as anti-platelet and anti-coagulation may lead to hemorrhage in case of missed injuries. The risks of thrombosis and bleeding should be weighed for each patient prior to decision for cardiac catheterization and anticoagulation.

Till date there are several case reports describing isolated traumatic CAD [10-14], heightening awareness to this entity requiring early diagnosis and treatment. Isolated CAD in the left circumflex artery can be treated with stenting and anticoagulation as compared to patients with left main coronary artery lesions or those with high-risk of bleeding who will likely require coronary bypass [15,16]. However, there is a paucity of literature on the evaluation and management of complex cases with concomitant injuries in addition to traumatic CAD. A literature search was performed on PubMed and articles in English describing the management and outcomes of traumatic CAD with concomitant injuries were compiled as a series in Table 1 [14,17-21].

Redondo et al. described a case of traumatic CAD treated with stenting, prophylactic intra-aortic balloon pump and anticoagulation. The patient eventually died due to intraabdominal hemorrhage from concealed liver and splenic injuries and severe coagulopathy [19]. This highlights the importance of evaluation of injuries according to ATLS principles to minimize overlooking crucial diagnoses and underestimating the bleeding risks of the trauma patient. Reflecting on our case, it may have been arguable that aspirin be withheld till CT of the brain has ruled out intracranial bleeding. This is especially so considering the risk of intracranial hemorrhage given the patient's age, history of loss of consciousness and physical signs of head injury.

Our case report adds to the current literature the complexity of managing traumatic myocardial infarction from CAD in a trauma patient with intracerebral hemorrhage. The decision to withhold coronary artery stenting and anticoagulation was to avoid expansion of intracranial hemorrhage and serious neurologic sequele which can lead to long term morbidity or mortality. On the other hand, foregoing immediate revascularization of the LCx may risk ischemic to a small fraction of myocardium, given her remaining coronary arteries were patent and not diseased. A similar case report by Nan et al. described a delayed approach to revascularization of left main coronary artery dissection and anticoagulation in a patient who had flail chest and mediastinal hematoma requiring a week of ventilatory support [17]. In contrast, Michael et al. described anticoagulation with low molecular weight heparin after coronary stenting of a dissected proximal left anterior descending artery in a young trauma patient who also had a right internal carotid artery dissection, despite retrobulbar hematoma and cerebral contusion [18]. There is currently no consensus on whether a conservative or more active approach would yield better outcomes and management decisions should be individualized.

Facing the daunting dilemma of salvaging myocardium but avoiding compromise of other vital organs, we suggest a simple strategy for management of multi-injured patients with CAD based on hemodynamical status. In a hemodynamically unstable patient, an echocardiogram might be a useful tool in differentiating cardiac and hypovolemic cause of hypotension. If cardiac ischemia is the culprit, care should be undertaken to minimize systemic risks to other injuries during revascularization techniques. In a hemodynamically stable patient, consider delaying PCI or CABG till other significant injuries have stabilized and bleeding risks reduced.

Conclusion

Coronary artery dissection following blunt chest trauma is a rare but potentially devastating complication requiring high index of suspicion. The management of BCI should take into account multisystem injuries and bleeding risks of the trauma patient.

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