Jagua Publication

www.jpub.org

Journal of Applied Health Sciences and Medicine 3(6) (2023): 10 –16

Research Article

Concurrent STEMI and Intracranial Hemorrhage; the Challenge

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How to cite:
Memon et al. 2023. "Concurrent STEMI and Intracranial Hemorrhage; The Challenge". *Journal of Applied Health Sciences and Medicine* 3(6): 10 – 16.
https://doi.org/10.58614/jahsm362

Abstract: ST-elevation myocardial infarction (STEMI) and intracranial hemorrhage (ICH) conjoint presentation are alarming, necessitating a multidisciplinary approach and diligent management. Herewith we report a case of a 45-year-old male with Inferior STEMI and an ICH, highlighting the pathophysiology and complexity of this conundrum and reinforcing the need for further futuristic research in a more structured algorithmic guideline.

Keywords: ST-elevation myocardial infarction, intracranial hemorrhage, simultaneous, coronary revascularization, cardiology, neurosurgery,

Received:
May 2, 2023
Accepted:
June 10, 2023
Published:
June 17, 2023

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1. Introduction

Acute myocardial infarction (AMI) and ICH are the leading causes of death [1,2]. In patients with acute myocardial infarction (AMI), ICH is rare, yet it carries catastrophic complications [3,4]. There is a clear association between MI and ICH and their risk factors [5]. The simultaneous presentation of STEMI and ICH is sporadic, with a reported incidence of 0.2% in patients with acute coronary syndrome (ACS) [6]. AMI with concurrent ICH is associated with a higher in-hospital mortality rate [7,8]. The management of concomitant STEMI and ICH poses significant challenges, as the standard treatment for STEMI (revascularization and antithrombotic therapy) is contraindicated in patients with ICH due to the increased risk of bleed exacerbation [9]. This report presents the challenge of treating a 45-year-male with concurrent STEMI and ICH.

2. Case report

A 45-year-male who's a heavy smoker, known to have bronchial asthma on inhalers and hypertension with a history of non-compliance to his medication, presented to the emergency department with a history of sudden onset of both fascial and hand numbness with nonspecific chest discomfort over the past three days and high blood pressure readings of 189/131 mmHg at the time of presentation. Furthermore, his heart rate was 80; the physical examination was notable for a mild decrease in power 4/5 power of his left hand.

The patient was initially sent to the radiological department for CT brain, which revealed a small right thalamic/Posterior limb of the internal capsule intracerebral acute bleeding Figure 1. However, the patient was admitted to our intensive care unit as a case of Hypertensive emergency with hemorrhagic stroke, prompt blood pressure control was initiated with IV labetalol. Our Neurosurgery department was consulted, and they assessed the patient with no current neurosurgical intervention from their side to be offered for the patient.

Initial workup tests showed a normal complete blood count, liver function test, Basic screen, and renal profile. However, the first set of high-sensitivity troponin was mildly elevated at 57.6 ng/L (Normal values are below 34ng/L in males) with normal CK-MB and creatine kinase levels of 1.7 and 99, respectively. His initial ECG showed NSR with no ischemic changes Figure 2.

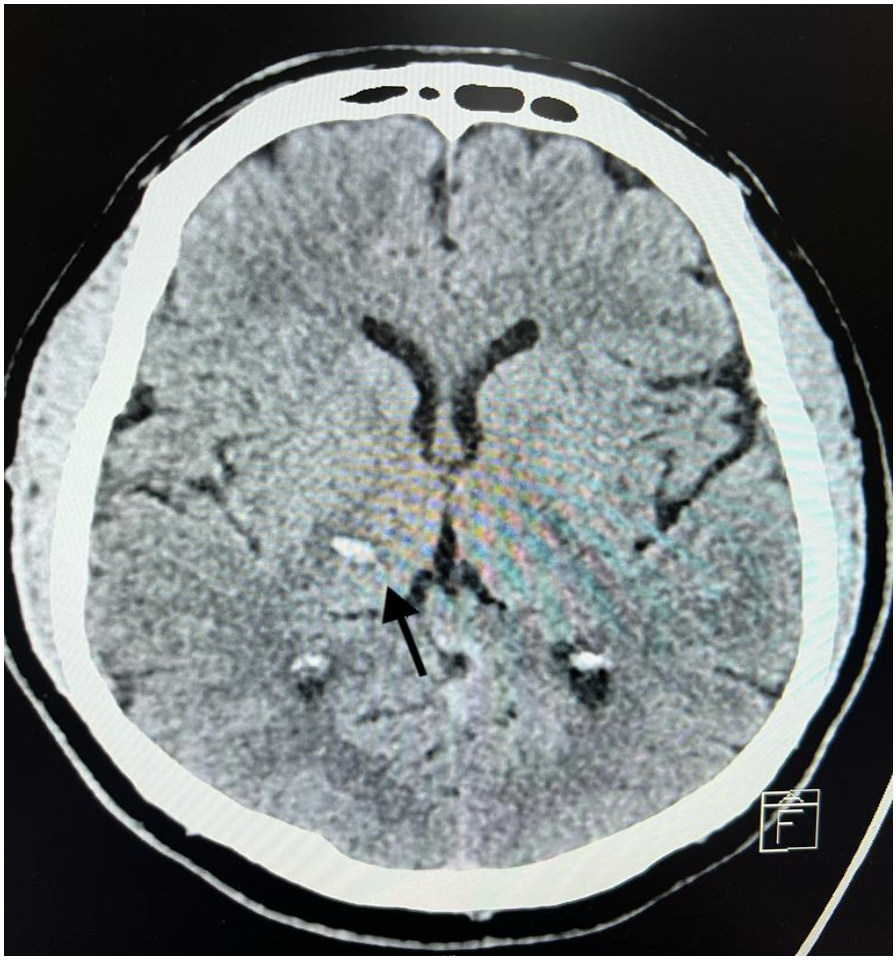

Figure 1. Small right thalamic/posterior limb of the internal capsule intracerebral acute bleeding.

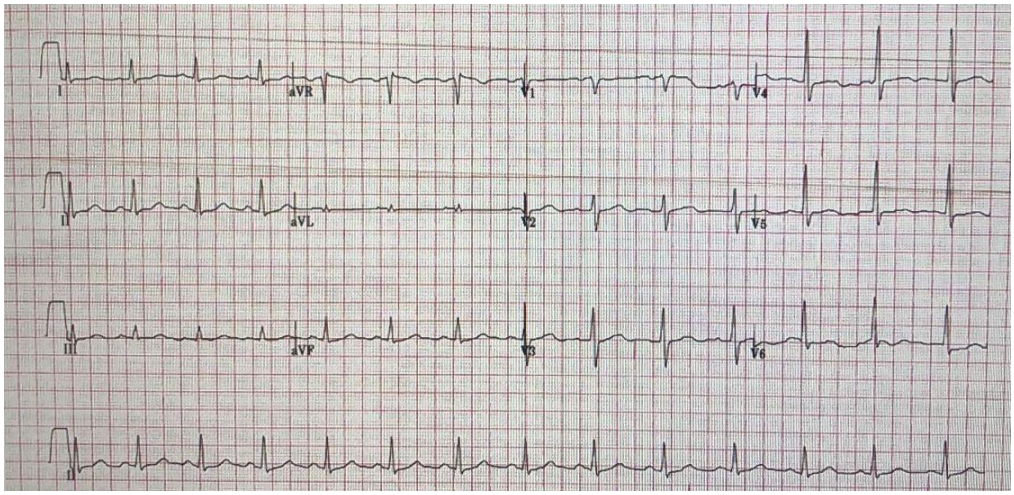

Figure 2. Normal sinus rhythm.

On the same day, a few hours later, his blood pressure readings were on the higher side consistently despite the IV blood pressure-lowering agents he was on. Unexpectedly, the patient started to experience a sudden onset of sharp left-sided chest pain. This burning sensation radiated to his back, and he could not answer all the questions because of his chest pain. Moreover, ECG showed ST-elevation in inferior leads, reciprocal changes in high lateral leads, and inverted T wave in septal leads Figure 3. His Chest X-ray showed an atelectatic band over the right lower zone. By the mentioned above, history and findings, aortic dissection is suspected, and the cardiology and vascular team were involved.

Cardiac enzymes were extracted, and the patient was rushed to the radiology department for CT-angiogram, which showed unremarkable and negative study for aortic dissection. In addition, Echocardiography showed mildly impaired systolic function with EF 45-50% with hypokinesia of the inferior walls. High sensitivity troponin three sets were taken and dramatically increased to 10413, 39768, and > 50000 ng/L, respectively. Conversely, an Inferior STEMI diagnosis was confirmed, and the patient was managed conservatively by analgesia and beta blocker due to fear of expanding the intracerebral bleeding. Coronary revascularization, anticoagulation, and antiplatelet were not preferred due to the risk of intracerebral bleeding.

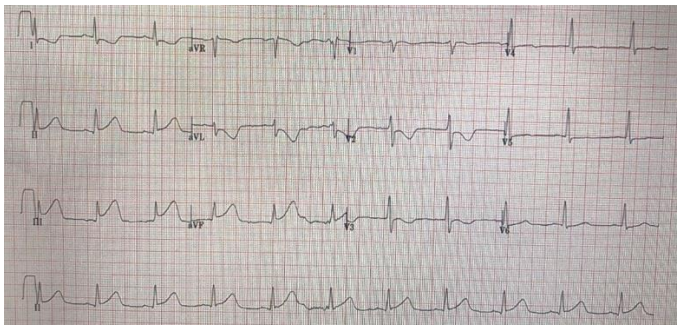

Figure 3. ST-elevation in inferior leads, reciprocal changes in high lateral leads, and inverted T wave in septal leads.

On the 2nd day of admission, patient symptoms improved conventionally with analgesia, and tight control of blood pressure readings was achieved to less than

150/80 mmHg. A follow-up CT brain was done the next day, showing non-significant interval changes from the previous study. Subsequently, antiplatelet (Aspirin 81 PO OD) was introduced combined with prophylactic heparin 5000 IU SC twice a day—fortunately, no significant complications were confronted after the risk and benefits discussion with both neurosurgery and the patient.

During the next few days, he makes an excellent gradual recovery conservatively. CT-brain was repeated on the 6th day of admission, showing no changes from the previous studies.

Eventually, dual antiplatelets of aspirin and clopidogrel were initiated. The patient was discharged the next day of his 7th day of admission after being vitally and clinically stable with a plan of close cardiology outpatient clinic follow-up. The patient showed marked improvement during his first month of follow-up at our cardiology and subsequently underwent a coronary angiogram, revealing 90% occluded RCA, stented successfully with TIMI III flow.

3. Discussion

The simultaneous occurrence of STEMI and ICH is a rare and challenging clinical scenario. AMI and acute ICH require contradictory therapies, and STEMI requires urgent reperfusion therapy to restore blood flow to the myocardium. Still, thrombolytic therapy or percutaneous coronary intervention also carries a risk of worsening an intracranial hemorrhage. Similarly, interventions to stop or control intracranial bleeding could exacerbate myocardial ischemia if STEMI is not addressed promptly.

The simultaneous presentation of STEMI and ICH is sporadic, with a reported incidence of 0.2% in patients with acute coronary syndrome (ACS) [6]. The pathophysiology of this coincidence is not well understood; however, some potential explanations include:

1. Shared risk factors: STEMI and ICH share common risk factors, such as hypertension, smoking, diabetes, and dyslipidemia [10]. In this case, the patient had a history of hypertension and smoking, which could have predisposed to both conditions.
2. Hemodynamic instability: Hemodynamic changes during STEMI-induced cardiogenic shock can lead to alterations in cerebral blood flow, potentially causing hemorrhagic 3. transformation or the development of ICH [11-13].
3. Thrombolytic therapy: Systemic thrombolytic therapy for STEMI increases the risk of ICH, especially in patients with uncontrolled hypertension or other risk factors for bleeding [14].

The timing and sequence of interventions are critical but complex in these cases. Choosing whether to treat AMI or ICH first is difficult; emergency treatment for either condition could aggravate the other. Reperfusion for STEMI should be completed on time, but intracranial hemorrhage must also be addressed urgently. Close coordination between cardiology, neurology, and neurosurgery teams is essential for the size and location of the intracranial hemorrhage matter. Small, non-expanding hemorrhages in

less critical areas may allow for percutaneous coronary intervention with close monitoring. Large, expanding hemorrhages or those in the brainstem require neurosurgical intervention, and reperfusion therapy may need to be withheld.

Blood pressure management is essential for both conditions, but goals may differ. For STEMI, maintaining adequate coronary perfusion pressure is critical, but for intracranial hemorrhage, aggressive blood pressure lowering is often needed. A balanced approach is required. The choice of antiplatelet/anticoagulant therapy requires consideration of the risks of both thrombosis and bleeding. More potent agents may worsen intracranial hemorrhage but are often needed for stent placement. Risks and benefits must be weighed for each medication. An individualized approach considering risks and benefits in each case is required, followed by a multidisciplinary effort to manage both acute presentations.

The management of concomitant STEMI and ICH poses significant challenges, as the standard treatment for STEMI (revascularization and antithrombotic therapy) is contraindicated in patients with ICH due to the increased risk of exacerbating the bleeding [9]. In this case, a tailored approach was necessary to balance the risks and benefits of treatment. This case highlights the management challenges when two life-threatening conditions present simultaneously. Considering a recent study on 'cardio cerebral infarction' [15], facilitating the decision regarding whether to begin cardiac or brain rescue first should be based on the patient's hemodynamic stability.

The prognosis of patients with concomitant STEMI and ICH is generally poor, with a high rate of in-hospital mortality and significant long-term morbidity. However, outcomes seem to be improving over time with advances in care. With prompt diagnosis and coordinated management of both AMI and ICH, survival can still be achieved in selected cases.

A case was reported of a 48-year-old woman with an acute inferior-posterior myocardial infarction with right ventricular involvement coexisting with subarachnoid hemorrhage (SAH). A percutaneous coronary intervention without stenting was intended to balance the risk of a conservative strategy against anticoagulant therapy followed by surgical clipping of the aneurysm, as coiling was not considered possible for this patient. The patient survived, and Six months after discharge, the patient's memory and orientation had almost completely recovered; however, A left ventricle echocardiogram revealed hypokinetic inferior walls and impaired residual function [16].

In another case where initial therapy for the myocardial infarction was limited to aspirin, aneurysm coiling was successfully performed the next day, after which low-molecular-weight heparin and a β-blocker were added. The patient died a week after admission after a sudden cardiac arrest despite attempts at reanimation [16].

Based on these cases, reperfusion therapy is imperative to myocardial salvage and reduced mortality in patients with large ST-elevation myocardial infarctions. Whenever possible, coiling of aneurysms should be followed by percutaneous coronary intervention, followed by antithrombotic medication.

Recently, Schoenfeld and Obagi reported a good outcome for a young man who underwent PCI with rapid plain-old balloon angioplasty (POBA) to restore flow to a

100% occluded LAD (left anterior descending) artery without the administration of antithrombotic or antiplatelet agents following concurrent cardiac arrest and ICH, suggesting that ICH is not an absolute contraindication to PCI [17]. According to this new treatment algorithm, performing cardiac catheterization without antithrombotic or antiplatelet agents may be feasible in patients with unstable hemodynamics or STEMI following acute ICH.

In our case, the patient's condition remained stable, and he was discharged with a plan for close follow-up and aggressive management of cardiovascular risk factors. Further research is needed to understand better the pathophysiology and optimal management of patients with concomitant STEMI and ICH. In addition, the development of safer antithrombotic strategies and advances in endovascular revascularization techniques may improve the prognosis of these patients in the future.

4. Conclusion

It is rare for STEMI and ICH to coincide, which entails significant challenges and dilemmas for physicians. Treatments for the two conditions are contradictory and require a multidisciplinary team approach. To treat these conditions effectively, it is essential to carefully assess the patient's condition, weigh the risks and benefits of different treatment options, and tailor the treatment plan to the patient's requirements. Identifying the best practices for managing these conditions simultaneously and improving outcomes for patients who experience these emergencies will require further research.

Ethical approval

The study was approved by King Abdullah International Medical Research Center (KAIMRC), reference number NRA23A/019/05

Conflict of Interest

No conflict of interest.

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