

Myocardial Injury after Noncardiac Surgery: A Case Report of Acute Chest Pain and Elevated Troponin Levels, Challenges and Management Strategies

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ABSTRACT

Background: Perioperative myocardial injury is a common complication following noncardiac surgery, linked to significant morbidity and mortality. With over 300 million surgeries performed worldwide annually, this number has increased by more than 100 million in the past two decades.

Case: A 42-year-old woman underwent elective craniotomy for a right cerebellar hemangioblastoma and was admitted to the ICU postoperatively. On day three, she developed typical chest pain, inferior ST-elevation myocardial infarction (STEMI), and cardiogenic shock. Her medical history included the use of euthyrox following a total thyroidectomy 15 years prior, with no prior cardiac issues. On examination, she was conscious, but with low blood pressure (58/41 mmHg), elevated heart rate (103 bpm), and cold extremities. Her troponin I level was elevated at 9383.0 ng/mL. The diagnosis was major postoperative myocardial infarction.

Therapy: The patient received aspirin, atorvastatin, heparin, norepinephrine, and dobutamine for shock management, with close hemodynamic monitoring. By day six, her condition improved, and her electrocardiogram (ECG) was normal. By day nine, she was transferred to the high care unit.

Discussion: Myocardial injury after noncardiac surgery (MINS) includes both myocardial infarction and ischemic myocardial injury, which may not meet the Universal Definition of Myocardial Infarction. MINS usually occurs within 30 days of surgery, especially within the first 72 hours. Its causes are multifactorial, including plaque rupture, oxygen supply-demand imbalance, arrhythmias, and pulmonary embolism. Studies suggest that cardiovascular therapy, including aspirin and statins, is effective. Aspirin reduces 30-day mortality, while statins offer long-term benefits through anti-inflammatory effects. Low-dose aspirin, statins, and Renin-Angiotensin System inhibitors are recommended.

Conclusion: MINS is a serious postoperative complication, even in patients without a history of cardiovascular disease, as demonstrated in this case. Prompt recognition and appropriate therapy with aspirin, heparin, and statins, along with close monitoring, can lead to significant clinical improvement.

Keywords: chest pain; MINS; myocardial infarction; myocardial injury; STEMI

INTRODUCTION

Perioperative myocardial injury is a relatively common complication following noncardiac surgery that is associated with significant morbidity and mortality.¹ It is estimated that more than 300 million patients worldwide undergo surgery each year, an increase of more than 100 million compared to two decades ago.^{2,3} Among them, approximately 3 percent are estimated to experience adverse cardiovascular and cerebrovascular events before discharge or within 30 days.⁴

Although significant advancements have been made in preoperative screening, surgical techniques, and patient monitoring, myocardial infarction remains a predominant factor contributing to high rates of cardiovascular morbidity and mortality within 30 days after surgery.⁵ Atherothrombosis serves as the primary trigger for non-operative myocardial

infarction; however, myocardial injury in non-cardiac surgery (MINS), including perioperative myocardial infarction, arises from complex and multifaceted mechanisms that remain challenging to pinpoint in routine clinical practice.⁶ From a theoretical perspective, myocardial injury can arise through four distinct mechanisms. First, it may result from the rupture of a coronary plaque, triggering thrombotic occlusion and impairing blood flow. Second, an imbalance between myocardial oxygen supply and demand can lead to ischemic stress, particularly in patients with underlying cardiovascular compromise. Third, non-ischemic cardiac abnormalities, such as atrial fibrillation episodes, may contribute to myocardial dysfunction. Lastly, non-cardiac conditions, including pulmonary embolism, can indirectly induce myocardial injury by compromising oxygenation and hemodynamic stability.⁷

CASE

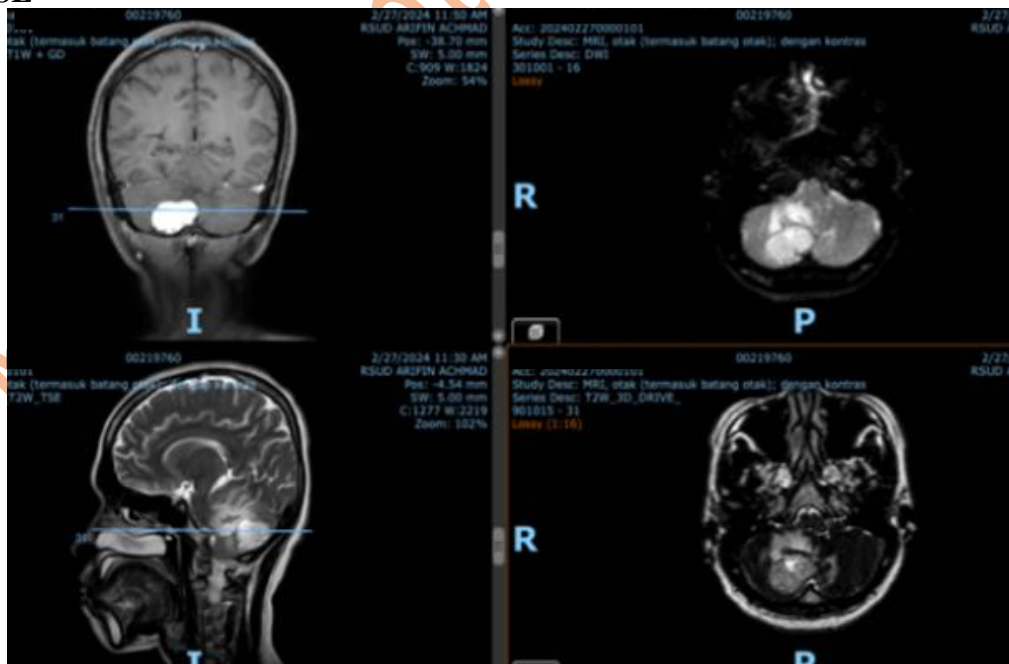


Figure 1. Head CT scan

A 42-year-old woman was admitted to the intensive care unit (ICU) after undergoing elective craniotomy for right cerebellar hemangioblastoma. On the third postoperative day, she suddenly developed typical chest pain, ST-elevation myocardial infarction (STEMI) on monitor, and cardiogenic shock. The patient had a history of euthyrox use after total thyroidectomy 15 years ago, with no prior history of cardiac disease, chest pain, or deep vein thrombosis (DVT).

On physical examination, the patient was fully alert, with a blood pressure of 58/41 mm Hg, a heart rate of 103 beats per minute, an oxygen saturation of 95% via nasal cannula at 4 lpm, and spontaneous respirations at 20 breaths per minute. No murmurs, gallops, rales, or wheezes were noted on cardiac auscultation, and his extremities were cool. A 12-lead electrocardiogram (ECG) showed STEMI in the inferior leads, ischemic changes in the anterolateral leads, and elevated cardiac enzymes with a troponin I level of 9383.0 ng/mL.

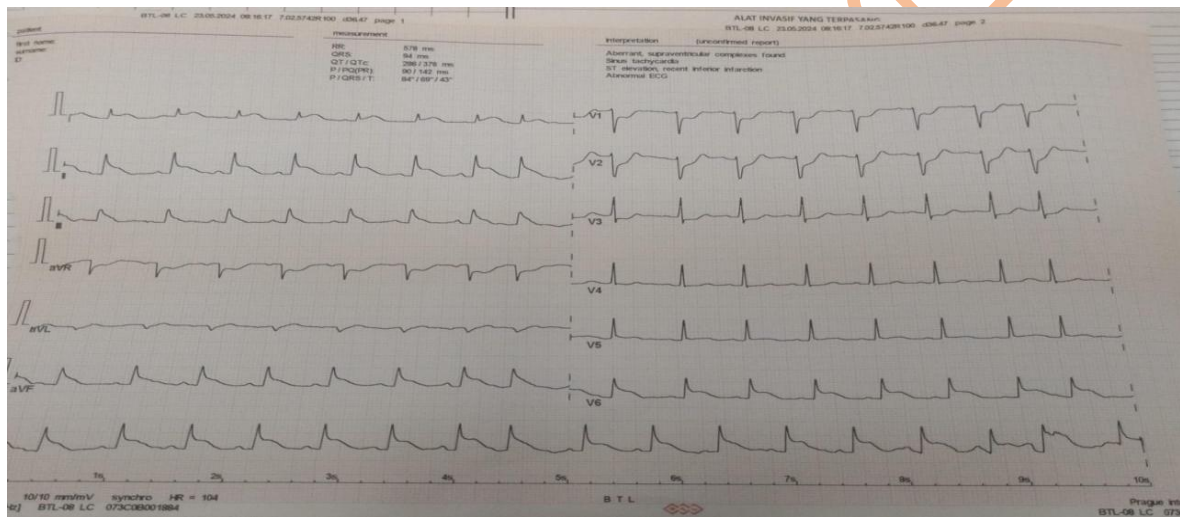


Figure 2. Monitor during an acute chest pain attack

Based on history, physical examination, ECG findings, and laboratory tests, a diagnosis of major postoperative myocardial infarction (after craniotomy for tumor removal) was made. The patient received initial doses of aspirin, atorvastatin, and heparin therapy. Hemodynamic monitoring and prothrombin time (PT), international normalized ratio (INR), and a partial thromboplastin time (APTT) were performed to monitor the risk of

bleeding. For cardiogenic shock, the patient was given Norepinephrine 0.3 mcg/kg/min titrated and Dobutamine 15 mcg/kg/min titrated. Arterial blood pressure monitoring was performed for real-time hemodynamic monitoring. On the sixth day, her condition improved, and the ECG showed resolution of the abnormalities. The patient was transferred to the High Care Unit on the ninth day of admission.

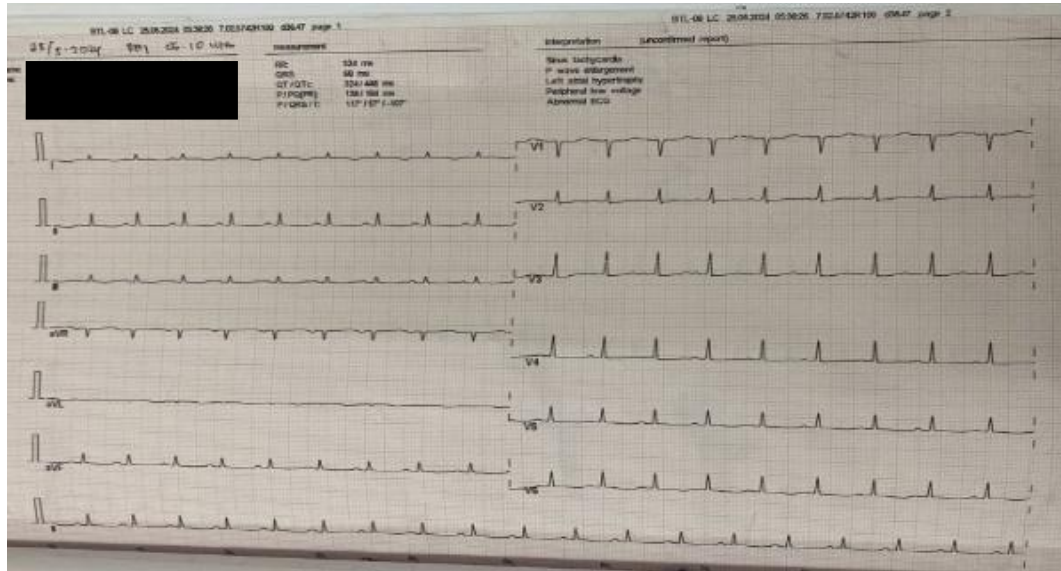


Figure 3. 12-lead EKG on the fifth day (first day post-therapy)

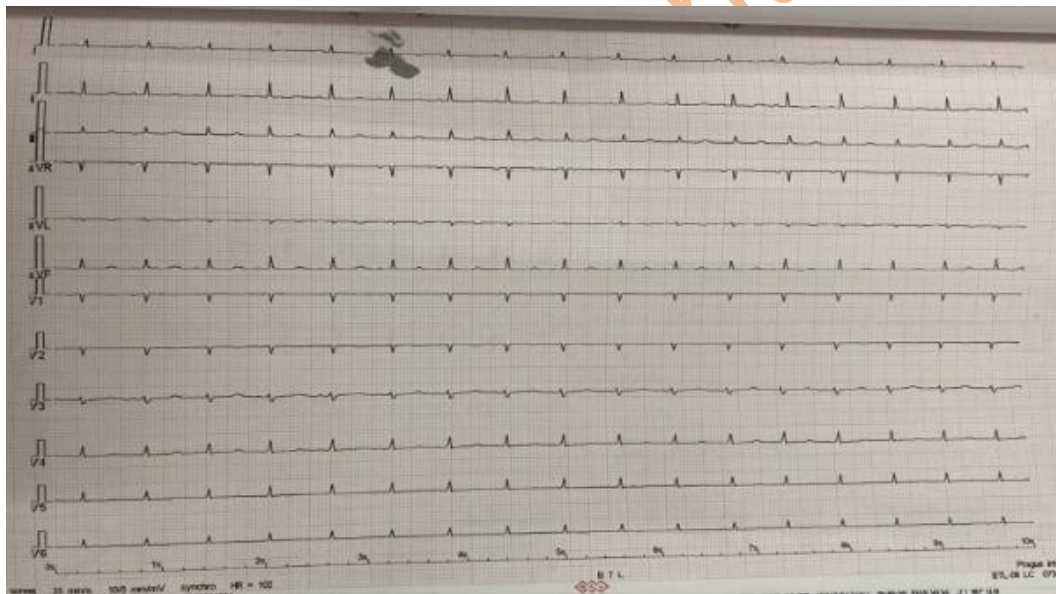


Figure 4. 12-lead EKG on the sixth day (second day post-therapy)

DISCUSSION

A woman with MINS after tumor removal via craniotomy is described in this case report. According to⁸ perioperative myocardial injury is a relatively common complication after noncardiac surgery that is associated with significant morbidity and mortality. Meanwhile, according to⁹ Patients who experience Perioperative Myocardial Injury within the first 7 days postoperatively have a higher risk of 30-day all-cause mortality than those who experience it within 8–29 days.² Each year, more than 300 million people undergo major noncardiac surgery worldwide. Despite advances in preoperative screening, surgical improvements, and improved patient monitoring, myocardial infarction remains a leading cause of cardiovascular morbidity and mortality within 30 days of surgery.

Myocardial injury after non-cardiac surgery (MINS) encompasses both myocardial infarction and ischemic myocardial injury that does not align with the universal definition of myocardial infarction. It is characterized by myocardial injury with a rise or fall in cardiac troponin (cTn) exceeding the 99th percentile of the upper reference limit, accompanied by at least one of the following indicators: ischemic symptoms, newly emerging ischemic electrocardiographic alterations, the formation of new pathological Q waves on ECG, imaging findings indicative of myocardial ischemia, or evidence of coronary thrombus confirmed through angiography or autopsy. MINS typically manifests within 30 days post-surgery, with the majority of cases occurring within the first 72 hours.^{2,10}

Atherothrombosis is the leading contributor to the majority of nonoperative myocardial infarctions. However, MINS, including perioperative myocardial infarction, arises from a complex interplay of multiple factors. These mechanisms involve hemodynamic instability, inflammatory responses, and prothrombotic states, making it challenging to pinpoint specific causes in routine clinical practice.¹¹ Theoretically, myocardial injury can arise through four distinct mechanisms. First, it may result from the rupture of a coronary plaque, leading to thrombotic obstruction and impaired myocardial perfusion. Second, an imbalance between myocardial oxygen supply and demand can provoke ischemic stress, particularly in patients with preexisting cardiovascular conditions. Third, non-ischemic cardiac abnormalities, such as atrial fibrillation episodes, can contribute to myocardial dysfunction by disrupting normal cardiac rhythm and hemodynamics. Lastly, non-cardiac factors, including pulmonary embolism, may indirectly induce myocardial injury by impairing oxygenation and circulatory stability. These diverse pathways underscore the complexity of myocardial injury and the challenges associated with its diagnosis and management.¹² However, the angiographic, histologic, or imaging studies necessary to identify all etiological mechanisms of MINS are difficult to apply to all patients undergoing noncardiac surgery.¹³ A better understanding of the causes of MINS may help develop potential preventive and therapeutic interventions.¹⁴

Observational studies have found that cardiovascular medical treatment is effective.¹⁵ Increased doses or early administration of cardiovascular drugs such as antiplatelets, statins, beta-blockers, and angiotensin-converting enzyme (ACE) inhibitors have shown positive results in patients with MINS.¹⁶ Aspirin has been linked to a reduced risk of 30-day mortality in a subgroup analysis of the perioperative ischemic evaluation (POISE) trial.¹⁷ Statins, on the other hand, have demonstrated long-term benefits for patients who survive the perioperative myocardial injury and are discharged alive after MINS.¹⁸ The positive effects of statins may extend beyond their lipid-lowering capabilities, potentially involving anti-inflammatory properties, as elevated levels of C-reactive protein at discharge have been correlated with higher mortality rates in this group.¹⁹ Given these findings, the use of low-dose aspirin and statins is strongly recommended. Additionally, renin-angiotensin-aldosterone system inhibitors, including ACE inhibitors and angiotensin receptor blockers, which are commonly prescribed to hypertensive patients with comorbidities, have also been shown to offer significant benefits in this context.^{20,21}

CONCLUSION

Myocardial Injury after Noncardiac Surgery (MINS) is a known complication that has significant implications for patient outcomes, as highlighted by the case of a 42-year-old woman who underwent craniotomy for the removal of a cerebellar tumor. Despite no history of cardiovascular disease, she developed acute postoperative chest pain, with elevated cTn levels confirming myocardial injury consistent with MINS. Prompt initiation of aspirin, heparin, and statin therapy, along with careful monitoring, resulted

in improved clinical outcomes and decreased troponin levels. This case highlights the challenges in diagnosing and managing MINS in noncardiac surgical patients, emphasizing the importance of early recognition and tailored treatment strategies to optimize patient care.

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