MARMARA
MEDICAL JOURNAL

Case Report

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Immediately after CABG surgery, diffuse ST-segment elevation on ECG: Is it a fact or a myth?

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Submitted: 25.02.2025 **Accepted:** 12.05.2025

ABSTRACT
Electrocardiography (ECG) is an easy and feasible tool for detecting and evaluating cardiac ischemia and other diseases, such as arrhythmia. ECG can diagnose the pathology and the process following treatment.
Electrocardiogram changes after coronary artery bypass grafting (CABG) are common; they do not mainly indicate a critical condition. Diffuse ST-segment elevation after CABG is a rare condition that raises several differential diagnoses, such as perioperative myocardial infarction, pericarditis, acute graft thrombosis following surgery, and inadequate myocardial protection. The management of widespread ST-segment elevation following cardiac surgery can be challenging.
In this article, we present a case with widespread ST-segment elevation following CABG surgery and hereby discuss the management and differential diagnosis.
Keywords: CABG, Precarditis, MI, ST-elevation, PPS

1. INTRODUCTION

ST-segment changes and T-wave abnormalities on electrocardiogram (ECG) are the earliest and most significant parameters detecting myocardial infarction (MI)[1,2]. Despite their high sensitivity, they are not specific. They can be associated with various cardiac and non-cardiac factors [3]. Cardiac surgeons frequently encounter ST-segment elevations after cardiac surgery, especially following CABG. While, ST-segment changes in patients are often associated with MI, in postoperative patients who underwent cardiac surgery, ECG changes may be non-specific and related to pericardial or myocardial inflammation [4].

This paper will present a case report discussing the differential diagnosis and management of diffuse ST-segment elevation after CABG, outlining the steps taken and the process.

2. CASE REPORT

A 62-year-old male patient was referred to our clinic with stable angina pectoris. Medical history included hypertension, hyperlipidemia, and benign prostatic hyperplasia. His family history revealed that his father had suffered from a MI. Coronary angiography was performed, which revealed multivessel coronary artery disease. The heart team decided on the optimal therapy. The preoperative ECG showed normal sinus rhythm with no ST-segment changes. The ECG reported an ejection fraction (EF) of 65%, and no valvular disease. There were no abnormalities in the blood tests.

The patient underwent a five-vessel bypass surgery via median sternotomy, using the Del Nido cardioplegia solution, on cardiopulmonary bypass (CPB) under mild hypothermia (30°C). Anastomoses were performed using standard surgical techniques. The patient was weaned from CPB without inotropic support. During the surgical procedure, there were no pathological ECG changes. After the operation, the patient was transferred to the intensive care unit (ICU) with stable hemodynamic parameters.

How to cite this article: Ture O, Demirbas E, Ozturk F, Ak K. Immediately after CABG surgery, diffuse ST-segment elevation on ECG: Is it a fact or a myth? Marmara Med J 2025;38 (2): doi: 10.5472/marumj.1709084

ISSN: 1309-9469

http://doi.org/10.5472/marumj.1709084
Marmara Med J 2025;38(2): 186-189

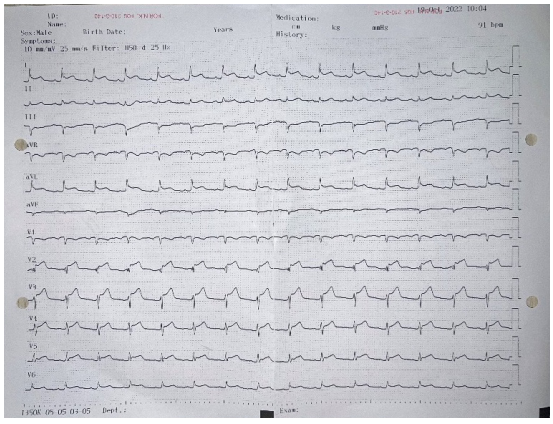

Figure 1. *The patient's initial monitoring of the electrocardiogram revealed widespread ST-segment elevations (V1-V6) in the ICU after CABG surgery.*

In the ICU, the initial monitoring revealed widespread ST-segment elevations (V1-V6) on the patient's ECG (Figure 1). The patient's hemodynamic parameters were stable, with a blood pressure around 125/70 mm/Hg, a normal sinus rhythm at 80 beats per minute, and a central venous pressure between 9-11 mmHg. During the postoperative follow-up, there was no need for inotropic support. The postoperative blood tests revealed a troponin T level of 678 ng/l. Subsequent troponin T levels decreased, with results of 457 ng/l and 372 ng/l, respectively. Despite the regression of troponin T levels, the ST-segment elevation in V1-V6 derivations continued (Figure 2).

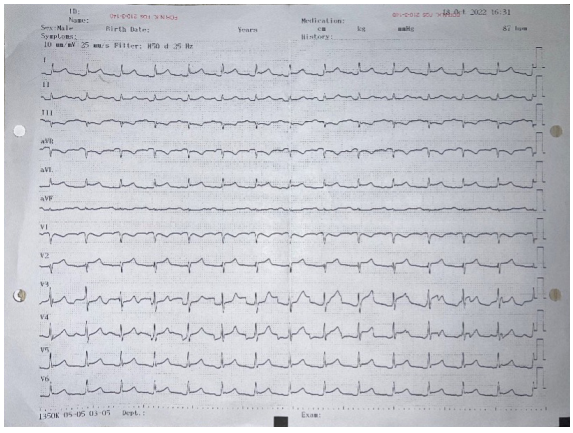

Figure 2. *The patient's ST-segment elevation in V1-V6 derivations continued postoperatively.*

Due to the persistent ST-segment elevation, a cardiology consultation was requested. Postoperative echocardiography showed no segmental wall motion abnormalities; the EF was 65%. There was no significant sign of ischemia; however, the persistent ST – segment elevation remained confusing and disturbing. It was necessary to diagnose perioperative MI, inadequate myocardial protection, or postoperative early graft thrombosis or occlusion at the anastomosis site. We decided to perform coronary angiography to evaluate especially graft failure since, it may cause complications in the long term. The coronary angiography showed no evidence of graft thrombosis, stenosis, flow limitation at the anastomosis, or any pathology that could cause circulation disturbance or ischemia in the left anterior descending (LAD) territory (Figure 4).

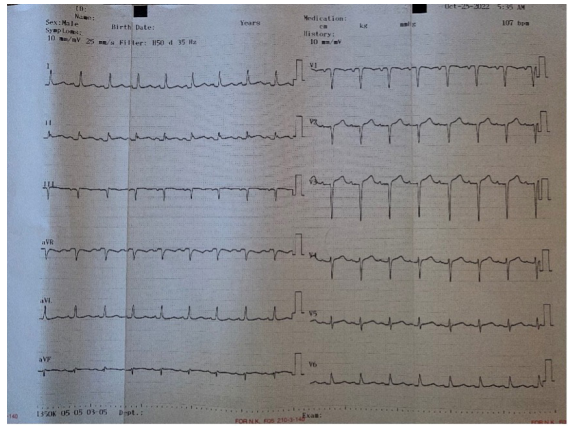

Figure 3. *The patient's ECG results were utterly normal on the fifth postoperative day after the coronary angiography.*

After the coronary angiography, the patient was extubated and transferred to service the following day. Daily monitoring of troponin T levels and ECG was continued. The troponin T levels continued to decrease, and the ST-segment elevation gradually regressed. The ECG results were utterly normal on the fifth postoperative day (Figure 3).

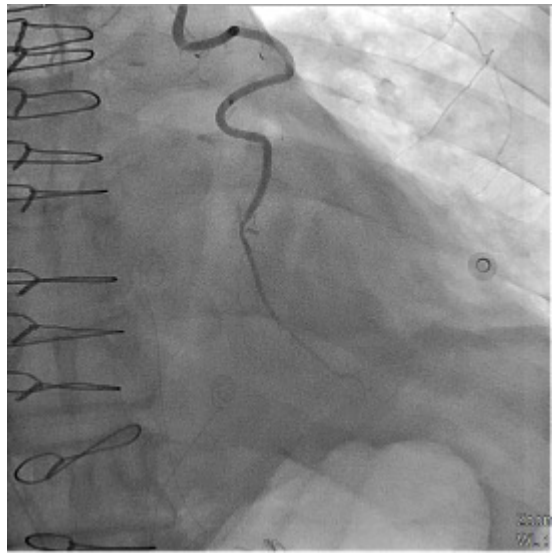

Figure 4. *The patient's coronary angiography showed no evidence of any pathology that could cause circulation disturbance or ischemia in the left anterior descending territory.*

http://doi.org/10.5472/marumj.1709084
Marmara Med J 2025;38(2): 186-189

3. DISCUSSION

Electrocardiography is a noninvasive, easy, and effective method to detect ischemic regions of the heart. It is a must to follow a patient after cardiac surgery. Usually, surgeons see an ECG daily, but it may be more frequent if there are any signs of ischemia. Despite being highly sensitive, there is also a rate of false positivity, just like any other method. If the clinical signs do not match ECG results, as in our case, physicians need to use other methods to ensure diagnosis. Therefore, as the clinical signs of our patients did not match his ECG results, it was essential to rule out the underlying pathology. Several differential diagnoses, such as perioperative MI, pericarditis, acute graft thrombosis following surgery, and inadequate myocardial protection must be assessed. As it was a complicated case we needed a prompt further investigation. We considered to perform coronary angiography in our patient. However, coronary angiography is an invasive method that can cause complications (such as acute kidney injury or vascular complications) in a patient who underwent cardiac surgery. So it must be a decision made by a heart team [5,6].

Nowadays, there are no longer discussions but common knowledge regarding the necessity of forming a heart team and managing cases based on the decisions of the heart team [5]. In our case, we managed the situation by the decisions and advices of the heart team that included cardiologists and the cardiovascular surgeons.

Inıtially, we examined the patient's ECG (Figure 1), and our observation led us to three main differential diagnoses: Brugada syndrome, pericarditis (post-pericardiectomy syndrome), and anterior or anterolateral myocardial infarction [7].

Certainly, diagnosing Brugada syndrome in a patient who underwent cardiac surgery would not be realistic. Still, we examined preoperative ECG, which was normal. In Brugada syndrome, a 2 mm ST-segment elevation and T-wave inversion in leads V1-V3 or at least 1 mm saddleback ST-segment elevation, and biphasic or normal T – waves and also saddleback and coved ST-segment elevations, each less than 1 mm must be expected [8]. In our patient, widespread ST elevations were observed in leads V1-V6, saddleback or coved ST elevations were not present. We excluded Brugada syndrome.

One of the most common causes of postoperative ST-segment elevation is post-pericardiectomy syndrome (PPS) [9, 10]. When the ECG of acute pericarditis is examined, the characteristic finding is widespread ST-segment elevation [11-14]. Our patient had ECG changes consistent with pericarditis. Therefore, pericarditis was considered in the differential diagnosis. The ECG pattern in our patient could be due to inflammation resulting from the recent surgery (trauma). PPS is treated with colchicine, indomethacin, and dexamethasone [15]. Colchicine may also be preferred for primary prevention of PPS. There is no need for an invasive approach. We excluded PPC since, it would not change our approach to the patient and there would be no permanent damage. It is also an exclusive diagnosis which led us to the third option.

The most important diagnosis was anterior or anterolateral MI, which may lead us to graft failure, early thrombosis, or occlusion of anastomosis sites. All of them can and should be treated as soon as possible. Anterior and anterolateral MI is characterized by ST-segment elevation in the V1-V6 as in our patient. In anteroseptal MI, ST-segment elevation is seen in the V1-V4 leads, in anteroapical MI in the V3-V4 leads, in anterolateral MI in the V3-V6 leads, and in extensive anterior MI in the V1-V6 leads [10]. Our patient's ST elevation in V1-V6 was consistent with extensive anterior MI. Trop levels should be measured regularly to confirm the diagnosis, but they would be significantly high secondary to cardiac surgery, which may cause a false diagnosis. So, further interventions such as coronary angiography should be considered. Therefore, we performed coronary angiography to rule out any pathology and ensure that there were no additional complications (Figure 4).

As shown in Figure 1, our patient had widespread ST-segment elevations in V1-V6. Given this ECG pattern and the fact that it appeared acutely following the CABG procedure, the primary differential diagnosis should be perioperative MI, with early graft thrombosis being another critical differential diagnosis. In their study, Xenogiannis et al., discussed the frequency of saphenous vein graft insufficiency [16]. It is not uncommon. So, it means we usually overlook the signs. In terms of lima LED failure; due to PREVENT IV trial, free IMA graft or in situ IMA graft might fail. If compared to each other in situ IMA grafts (8.5 %) fail much less than free IMA grafts (23.3 %) [17,18]. In our patient, ST segment changes were in the anterior and anterolateral regions, which may be related to graft failure.

In the early postoperative period, the decision for coronary angiography was challenging since, the patient had stable vitals and was in good condition. There was no inotropic support as well. However, to prevent the patient from entering a chronic, difficult-to-treat, potentially fatal course, such as heart failure, we decided to proceed with coronary angiography early on.

Another critical point is the contributions and differences between ECG and coronary angiography. While, ECG reflects MI, coronary angiography visualizes vascular anatomy [6] coronary angiography or grafts may be normal, as in our case, but it does not necessarily mean there were no complications during surgery. Inadequate myocardial protection or perioperative MI should be kept in mind. Therefore, we needed clinical and biological support to make a diagnosis. Koppen et al., demonstrated that fluctuations in trop T levels are significantly related to myocardial damage during CABG [11]. There are also some criteria for diagnosing perioperative MI in the literature [15, 16]. In our case, the patient was hemodynamically stable and did not meet the criteria for perioperative MI. We still monitored troponin T levels daily, even more frequently on the first day since there were ECG changes.

We believe the patient's management was detailed. Even though, there were no pathologic signs except ECG changes, it is still essential to evaluate any possible complications with care.

http://doi.org/10.5472/marumj.1709084
Marmara Med J 2025;38(2): 186-189

Conclusion

Although, ST-segment elevations on ECG following CABG do not always imply an ischemic condition, they should not be overlooked. The patient's clinical status is a crucial indicator in decision-making. Even, without definitive findings, it remains essential to monitor graft patency. As emphasized in all clinical settings, this case report demonstrates that working as a heart team ensures patient safety and more promising outcomes.

Compliance with Ethical Standards

Ethical standards: This work was conducted ethically in accordance with the World Medical Association's Declaration of Helsinki.

Patient consent: The patient gave his consent for clinical information and images relating to his case to be reported in a medical publication.

Conflict of interest: The authors declare that they have no conflict of interest.

Author contributions: OT: Writing and editing, ED: Editing, FO:Editing and supervising, KA: Supervising. All authors read and approved the final version of the manuscript.

REFERENCES

[1] Loeb HS, Gunnar WP, Thomas DD. Is new ST-segment elevation after coronary artery bypass of clinical importance in the absence of perioperative myocardial infarction? J Electrocardiol 2007;40:276-81. doi: 10.1016/j.jelectrocard.2006.08.098

[2] Kucuk U. Management of early postoperative ST elevation myocardial infarction after coronary artery bypass surgery. EJMO 2019;3:293-5. | doi: 10.14744/ejmo.2017.66375

[3] Coppola G, Carità P, Corrado E, Borrelli A, et al. ST segment elevations: Always a marker of acute myocardial infarction? Indian Heart J 2013;65:412-23. doi: 10.1016/j.ihj.2013.06.013

[4] Liu J, Birnbaum Y. ST-segment elevation following coronary artery bypass surgery. J Electrocardiol 2019;57:128-31. doi: 10.1016/j.jelectrocard.2019.09.010

[5] Young MN, Kolte D, Cadigan ME, et al. Multidisciplinary Heart Team approach for complex coronary artery disease: single center clinical presentation. J Am Heart Assoc 2020;9:e014738. doi: 10.1161/JAHA.119.014738

[6] Birnbaum Y, Drew BJ. The electrocardiogram in ST elevation acute myocardial infarction: correlation with coronary anatomy and prognosis. Postgrad Med J 2003;79:490-504. . doi: 10.1136/pmj.79.935.490

[7] Borgaonkar S, Birnbaum Y. ST-segment elevation soon after coronary artery bypass grafting. Tex Heart Inst J 2019;46:155-6. doi: 10.14503/THIJ-18-6783.

[8] Yıldırım MK, Orhan S, Karabacak P, Ceylan BG, Eroğlu F, Karabacak M. A rare case: Brugada syndrome. Turk J Intensive Care 2017;15:77-80.

[9] Snyder MJ, Bepko J, White M. Acute pericarditis: diagnosis and management. Am Fam Physician 2014;89:553-60.

[10] Bansal K, Gore M, Nalabothu P. Anterior myocardial infarction. StatPearls. Treasure Island (FL): StatPearls Publishing Copyright © 2022.

[11] Koppen E, Madsen E, Greiff G, et al. Perioperative factors associated with changes in troponin T during coronary artery bypass grafting. J Cardiothorac Vasc Anesth 2019;33:3309-19. doi: 10.1053/j.jvca.2019.06.029.

[12] Doctor NS, Shah AB, Coplan N, Kronzon I. Acute pericarditis. Prog Cardiovasc Dis 2017;59:349-59. doi: 10.1016/j.pcad.2016.12.001

[13] Liu J, Birnbaum Y. ST – segment elevation following coronary artery bypass surgery,J Electrocardiol 2019;57:128-31. doi: 10.1016/j.jelectrocard.2019.09.010.

[14] Devereaux P J, Whitlock R, Lamy A. Perioperative myocardial injury/infarction after cardiac surgery: The diagnostic criteria need to change. J Am Coll Cardiol 2023;82:1313-5. doi: 10.1016/j.jacc.2023.08.001.

[15] Gaudino M, Flather M, Capodanno D, et al. European Association of Cardio-Thoracic Surgery (EACTS) expert consensus statement on perioperative myocardial infarction after cardiac surgery, Eur J Cardiothorac Surg 2024;65:ezad415. doi: 10.1093/ejcts/ezad415.

[16] Xenogiannis I, Zenati M, Bhatt DL, et al. Saphenous vein graft failure: From pathophysiology to prevention and treatment strategies. Circulation 2021 Aug 31;144:728-745. doi: 10.1161/CIRCULATIONAHA.120.052163

[17] Giacinto O, Minati A, Lusini M, et al. Treatment and prophylaxis of post-pericardiotomy syndrome in cardiac surgery patients: a systematic review. Cardio Vasc Drug Ther 2023;37:771-9. doi: 10.1007/s10557.021.07261-4.

[18] Ranney D N, Williams J B, Mulder H, et al. Comparison of outcomes and frequency of graft failure with use of free versus ın situ ınternal mammary artery bypass conduits (from the PREVENT IV Trial). Am J Cardiol 2019;123:571-5. doi: 10.1016/j.amjcard.2018.11.029