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Professional paper

HEART BLOCK AS A COMPLICATION OF ACUTE MYOCARDIAL INFARCTION, CLINICAL ASSESSMENT AND APPROACH. A CASE REPORT

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Abstract

Optimal treatment for acute ST-elevation myocardial infarction (STEMI) within 12 hours after symptom onset includes primary percutaneous coronary intervention (PCI) or thrombolytic therapy. For STEMI patients who present later than 12 hours, current guidelines do not recommend PCI except the presence of hemodynamic or electrical instability or continuing ischemic symptoms.
Thus, our intention is to show that early reperfusion may also play a role in the early recovery of AV block that may occur as a complication of myocardial infarction (MI), more commonly inferior MI.
Patient 49 years old patient (male) presented in our department with weakness, dizziness, short-term instability and nausea. The symptoms started one day before admission. The ECG on admission showed a total AV block with a heart rate approximately 33 b/min and ST segment elevation in the inferior leads. Laboratory tests were normal except for an extreme elevated high sensitive troponin. The echo showed normal finding with the exception of the slightly reduced kinetics of the apex, base and mid segment of the lower-posterior wall of the IVS. Coronary angiography was immediately performed, showing 100% stenosis of the rPDA. A stent is placed on the corresponding coronary artery. The total block was present all the time, and following the recommendations, a temporary pacemaker was placed in the patient due to hemodynamic instability and bradycardia. Despite reperfusion, the block persisted 7 days after the intervention, during which a permanent pacemaker was implanted and the patient was discharged for home treatment.
This case highlights the importance and ways of early reperfusion to improve outcomes in patients with STEMI. Early reperfusion may also play a role in the early recovery of AV block that may occur as a complication of MI, more commonly inferior MI.

Keywords: heart block, myocardial infarction, percutaneous coronary intervention

Introduction

Acute myocardial infarction (AMI) is a clinical condition which occurs due to reduction of blood supply to the heart muscle area, resulting in acute tissue damage because of oxygen deprivation (Hamm CW, Bassand JP, Agewall S et al., 2011).

More than 3 million individuals develop STE-MI (ST segment Elevation-Myocardial Infarction) each year, and more than 4 million people represent STE-MI pathology (Salari, N., Morddarvanjoghi, F., Abdolmaleki, A. et al., 2023). Although MI is mainly detected in developed countries, it is also detected commonly in developing countries (Goldberg RJ, et al, 2001). In a published study with 19,781 CAD patients, the MI prevalence was found 23.3% (Dyrbuś K, et al., 2019). While in North Macedonia according to WHO data, ischemic heart disease are the second leading cause of death occurring 231 death per 100,000 inhabitants of male population and the third leading cause occurring in 194 females in 100,000 inhabitants of female population (WHO, 2023).

Sedentary lifestyle and fast food eating manners associated with obesity, hypertriglyceridemia, or inflammation markers (such as high-sensitivity C-reactive protein, are mostly independent cardiovascular risk factors associated with insulin (Zarich S, et al.,2006). But surprisingly, even though there are a lot of

data representing a general increase in the prevalence of cardiovascular risk factors (especially diabetes, high cholesterol, obesity, and even smoking), exists a considerable decreasing trend in STE-MI incidence detected in European countries and the United States (Dégano IR, et al.,2015; Gerber Y, et al, 215).

The range of consequences that will remain after AMI are many, but also depending on the time from the beginning of the occlusion to the percutaneous intervention in the cardiac cath lab. Heart block is the complication that may accompany AMI, especially if it is in the inferior wall as in our case and in most of the cases this manifestation may be transitory but sometimes the complete atrioventricular block (CAVB) should be considered seriously as a turning point in the treatment of the lesion, once a pacemaker implantation may prove to be necessary during the thrombolytic therapy. Previous reports show that the incidence of CAVB is 3% to 11% (Goldberg RJ, Zevallos JC, Yarzebski J, et al., 1992; Clemmensen P, Bates ER, Califf RM, et al., 1991).

A study by Alpin et al., reported that STEMI patients with CAVB had a higher mortality irrespective of their infarct locations in the thrombolytic era.

The recommended approach for managing STEMI promptly within 12 hours of symptom onset involves two main treatment options: primary percutaneous coronary intervention (PCI) or thrombolytic therapy. According to current guidelines, primary percutaneous coronary intervention (PCI) is not typically recommended for patients with ST-elevation myocardial infarction (STEMI) who present more than 12 hours after the onset of symptoms, unless they exhibit hemodynamic or electrical instability or ongoing ischemic symptoms (Ibanez B et al. 2017).

In this case report, we present the clinical details of a patient who experienced heart block as a complication of acute myocardial infarction aiming to generously contribute in designing a score or protocol how to approach this cases and also involve guidelines with clinical recommendations in our practice for management and treatment in order to reduce the morbidity and mortality of these high risk group patients in our community.

Case report

A 49 years old male patient presented in our clinic with the following symptoms: weakness, dizziness, short-term instability and nausea. The symptoms started one day before admission to hospital and the ECG showed a total AV block with a heart rate approximately 33 bpm (beats per minute) and ST segment elevation in the inferior leads (Figure 1), blood pressure 165/100 mmHg, respiratory rate 16/min and an oxygen saturation of 95% on ambient air with no alterations in the cardiac or pulmonary auscultation. Also a good peripheral perfusion in extremities was noted.

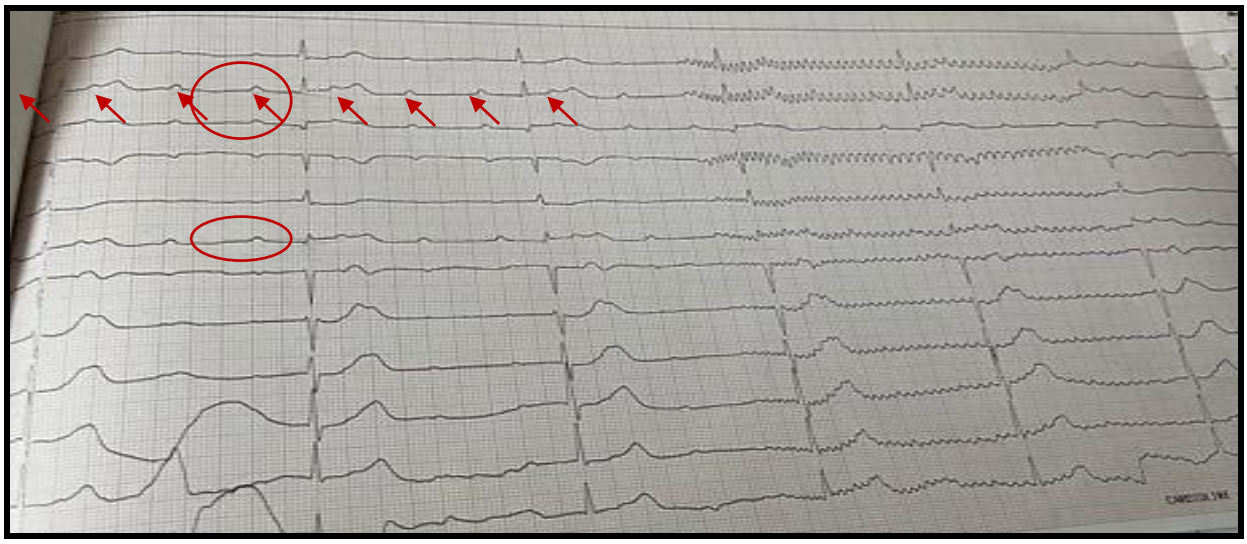

Figure 1. Total A-V block (p waves showed with arrows not conducted), HR – 33b/min, ST segment elevation in the inferior leads (marked with circles)

After hospitalization two different laboratory packages were taken from the patient (the first and the second part analyzes), which almost all of them were in normal ranges except the high sensitive troponin, which was extremely elevated (42,659 ng/L, normal ranges <34,2 ng/L for males). Transthoracic echocardiography was also performed showing showed normal findings structurally accompanied by slightly reduced kinetics of the apex, base and mid segment of the lower-posterior wall of the interventricular septum of the heart.
After all, the patient was fully loaded with 300 mg aspirin, 600 mg clopidogrel, rosuvastatin 40 mg and 7500 IU i.v bolus unfractionated Heparin. Patient was immediately admitted to the cardiac catheterization laboratory to perform coronary angiography which showed 100 % stenosis of the rPDA (posterior descending artery). A stent was placed on the corresponding coronary artery (Figure 2).

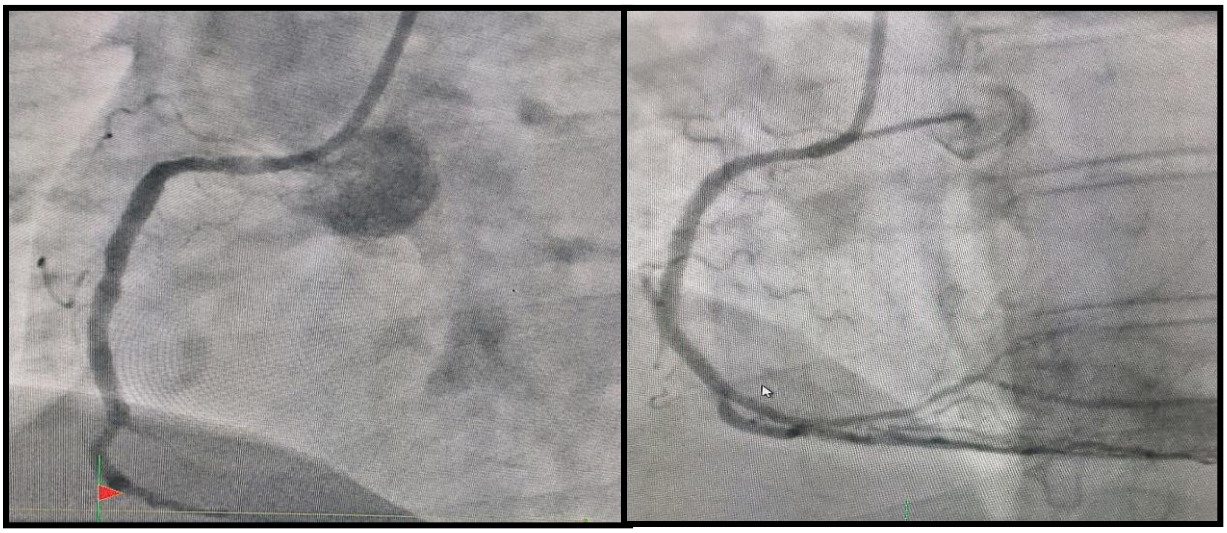

Figure 2. Before and After coronary angiography and PCI stenting to rPDA

The total block was present all the time, from the admission to the hospital and even after percutaneous coronary intervention by which was reached to revascularization and it was not temporary as it may be presented in the most of the cases but remained after revascularization procedure. Following the

recommendations of the European Society of Cardiology, American Heart Association and American College of Cardiology, a temporary pacemaker, accessed form the right subclavian vein was placed in the patient due to hemodynamic instability and bradycardia up to 33 bpm.
Because the complete AV block persisted 7 days after the intervention, electrophysiologist was consulted and it was decided to implant a permanent pacemaker, procedure which underwent orderly. An ECG was performed after procedure and it is presented in (Figure 3).
The patient was discharged for home treatment in overall good condition and hemodynamically stable.

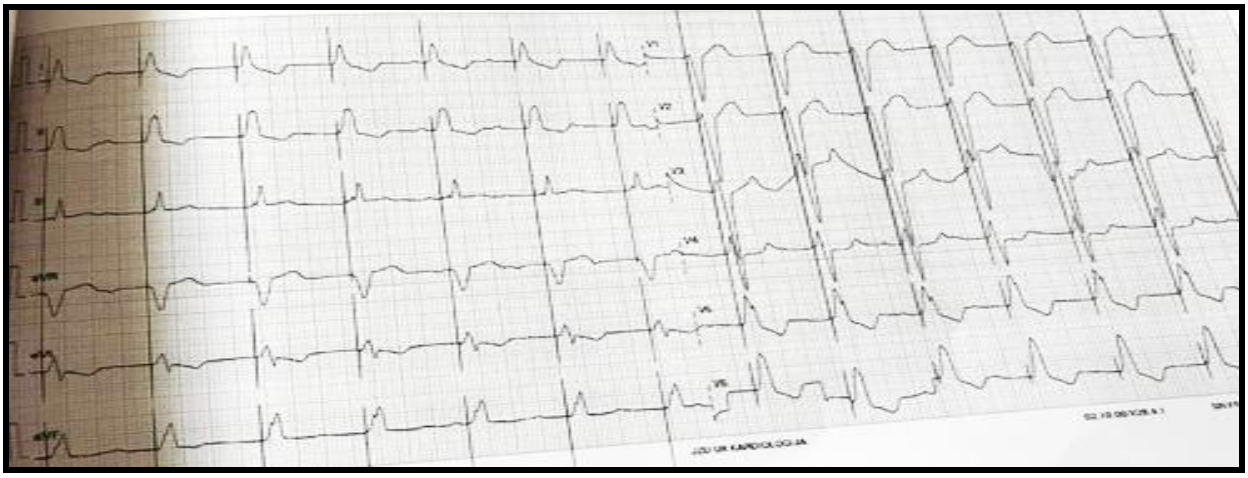

Figure 3. ECG after PM implantation

Discussion

One of the most important thing after noticing a heart block (HB) in ECG associated with AMI is identifying what is the degree of the heart block, because that is necessary for determining treatment options and predicting its likely clinical course. Anatomical and physiological variations of the arteries responsible for supplying the sinoatrial (SA) or atrioventricular (AV) node is very important in terms of the clinical presentation of HB in the context of AMI.
In our case, we had a third degree AV block so we will discuss the anatomical variations of the arteries supplying the AV node. The AV node is supplied by an artery which derives from the AV nodal artery, a branch of the right coronary artery (RCA) in 85–90% of cases and a branch of the left circumflex (LCx) coronary artery in the remaining 10–15% (Katz, 2006). The bundle of His and proximal RBB and LBB frequently receive a dual blood supply, usually via the AV nodal artery and the first septal branch of the LAD coronary artery (Frink and James, 1973). In approximately 90% of hearts, the posterior descending artery (PDA) branches from the right coronary artery to supply the posterior wall. In the remaining 10%, the PDA is a branch of the circumflex artery, variations are described as right or left dominant, respectively (Katz, 2006).
The exact mechanism (Hashmi KA et al., 2018) for the development of complete AV block still remains unclear:

- *1st one is increased parasympathetic tone*
- *2nd one is the AV nodal ischemia*

In CAVB, there is complete dissociation between atrial and ventricular electrical activity as shown in the ECG presented in the figure 1, where P-waves and QRS-complexes appear at regular intervals, but are independent of one another.
Patients with significant CAVB associated with acute inferior STEMI are expected to improve with primary angioplasty, thus, permanent pacemaker often is not required (Epstein AE, DiMarco JP, Ellenbogen KA, et

al., 2008). In our case, however, the pacemaker was implanted because of late presentation of inferior STEMI (>24h), so the ischemia has caused irreversible changes that could not be restored, so when we say "time is muscle" in terms of kinetics and the onset of heart failure, we should not forget that "time is conduction" in terms of well-function of the conduction system of the heart. The literature also suggests that early reperfusion can save the conduction system of the heart and the CAVB could be transitory if reperfusion is established at the right time.

The study conducted by Fan X. et al., aimed to investigate the impact of primary percutaneous coronary intervention (PCI) on the restoration of atrioventricular (AV) block in patients with late presentation of inferior ST-elevation myocardial infarction (STEMI). They analyzed data from a single center's 10-year experience and found that primary PCI had a positive effect on the recovery of AV block in these patients. The study provided valuable insights into the management and outcomes of late-presenting inferior STEMI patients undergoing primary PCI. A simple linear analysis model is presented in figure 4, where time to PCI is very important and positively correlated to the appearance and improvement of atrioventricular blocks.

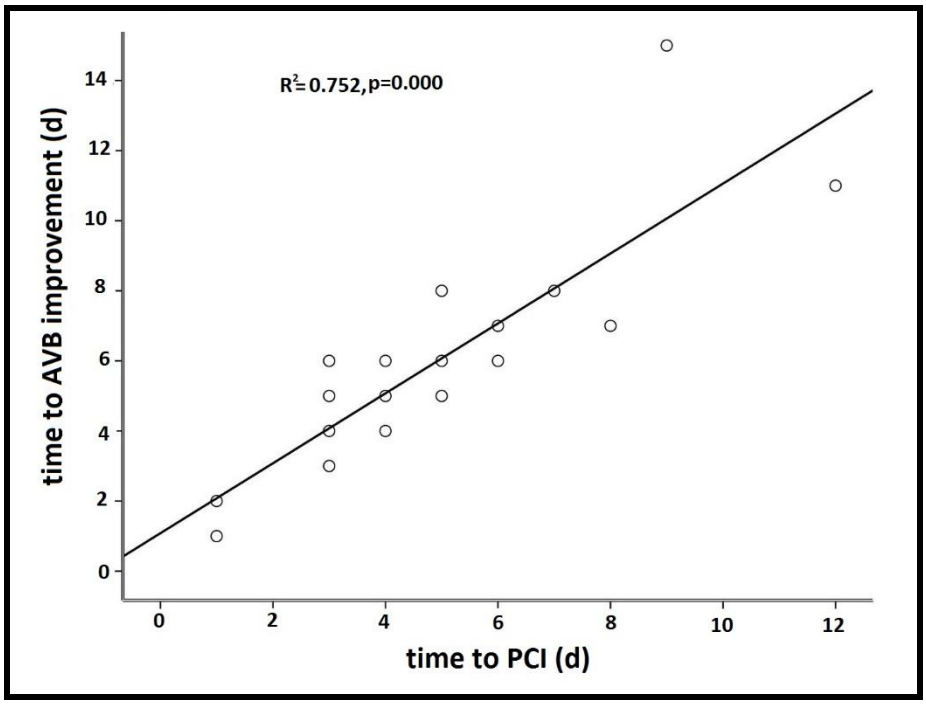

Figure 4. Simple linear analysis model between time to PCI and time to AVB getting improvement in the postoperative group. The y-axis represents the time to AVB getting improvement after symptom onset. The x-axis represents the time to PCI after symptom onset. Twenty-eight patients in the postoperative group were enrolled in the analysis (R2=0.752, 95% CI of slope 0.767 to 1.229, p=0.000). AVB, atrioventricular block; PCI, percutaneous coronary intervention. Source: Fan X et al., J Investig Med. 2020.

The case report authored by John TJ. et al., highlighted the management of an individual with an inferior STEMI using a pharmacoinvasive strategy and a conservative approach for delayed AVB. The case demonstrated successful outcomes with the chosen treatment approach, which involved administering thrombolytic therapy followed by coronary angiography and conservative management of the AVB. The report provided valuable insights into the management of inferior STEMI and emphasized the significance of individualized treatment strategies for optimal patient outcomes.

Conclusion

Early identification of inferior STEMI and its potential complications, also requires an individualized approach for every patient, for better outcome and reducing mortality.
Early reperfusion may also play a role in the early recovery of AV block that may occur as a complication of MI, more commonly the inferior MI.
Decisions regarding the implantation of permanent pacemakers should be delayed 5-10 days and should be based on the likelihood of recovery of normal AV conduction.
And last but not least, a well-designed score or protocol with added recommendations of treating options for reducing the morbidity and mortality.
Further randomized controlled trials and well-designed studies should be conducted in order to define clinical pathways and recommendations for such conditions.

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