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High degree atrioventricular block complicating acute myocardial infarction in the Emergency Department (ED)

A presentation of the patient with epigastric aching and concomitant hypotension to the Emergency Department (ED) requires a timely, effective diagnostic and therapeutic approach by the Emergency Physician (EP). Immediate consideration of potential causes, including both ischemic and non-ischemic etiologies, is essential. Possibilities range from the incidental gastrointestinal disorders to life-threatening heart diseases in hemodynamically unstable patients. Of the possible causes, acute myocardial infarction (particularly affecting inferoposterior wall) represents a significant portion of these presentations.

These patients are likely to be hemodynamically unstable at the initial assessment or develop hemodynamic embarrassment suddenly. It is necessary for the EP to bear in mind that the patient may quickly become a significant therapeutic problem.

CASE REPORT

A 78-year-old man with a history of chronic coronary disease developed emesis followed by weakness and mild epigastric discomfort. He was transported to the ED by Emergency Medical Service (EMS) via ambulance. Upon arrival to the ED he was alert with vital signs within normal limits except of notable hypotension (90/60). First EKG revealed normal sinus rhythm with regular wide QRS complex and non-specific ST segment and T wave changes. Partial inversion of T wave (negative-positive) was noticed in leads I and aVL but no increased ST segment was seen. Due to the past medical story and the present clinical findings the suspicion of developing inferior infarct was taken. Soon after the patient became unresponsive and developed cardiac arrest; the monitor revealed ventricular fibrillation (VF). Standard protocol of Advanced Cardiac Life Support (ACLS) was started immediately. The procedures included using Intermittent Positive Pressure Ventilation O₂ from the first minute. In the course of resuscitation, short periods of coordinated electrical activity with the presence of palpable pulse were reached, but their time was limited up to one minute and finally finished with re-occurred VF. As the standard pharmacological treatment: adrenaline, amiodarone, atropine and bicarbonate were used. As the resuscitation proceeds there appeared the periods of asystole after defibrillations, lasting up to two or three minutes, resistant to atropine, but successfully converted to VF by the use of intravenous adrenaline injections. After one hour of the resuscitation and performing over 30 cycles of the defibrillation the further EKG analysis revealed third-degree atrioventricular block (AVB). A transvenous temporary pacing wire was inserted immediately through the right subclavian vein. The procedure proceeded without any problem and

the patient was pacing satisfactorily. The paced rhythm was hemodynamically effective and caused the termination of ventricular dysrhythmias. During the next 30 min the patient's state stabilized and we could observe the restoration of the spontaneous breathing with plasma oxygen saturation above 90%. He was next detached from the respirator and left on oxygen insufflation to intubating tube. After two hours, counting from the beginning of cardiac arrest, he was transferred from ED to the Cardiology Ward with the symptoms of mental status restoration. The presence of myocardial infarction was confirmed by a significant growth of the typical markers, however first troponins taken at the presentation were negative. The recovery of the sinus rhythm was noted after 24 h. The same day patient was extubated. He was discharged after ten days from admission in stable state with the diagnosis of inferior wall infarct.

DISCUSSION

The presence of Acute Myocardial Infarction (AMI) with coexisting third-degree AVB usually results in appearance of its "popular" symptoms like: syncope, palpitations, dizziness, insufficient cardiac outcome or angina. However, this is not the rule. The clinical manifestation might also be very poor, particularly at elderly individuals. The patients when coming to ED may manifest only symptoms of weakness or fatigue. Unfortunately, the masked form of this state might be only a short-time illusion. These patients generally are either unstable at presentation or become unstable suddenly. Quick and certain diagnosis is essential for avoiding severe complications rapidly requiring emergency procedures.

The atrioventricular node and infranodal conduction system have a very rich vascular supply, via the atrioventricular nodal artery and collateral circulation. This vascular supply seems to be good prevention from ischemic injury associated with infarct. Therefore, complete heart block (CHB) is not a frequent finding in the context of AMI. During the last thirty years the global incidence rate of the third-degree atrioventricular block complicating myocardial infarction declined from 6.0% in the late seventies of the 20th century to 3.9% nowadays (12).

The risk of developing High Grade Atrioventricular Block (HAVB) in the course of AMI significantly differs depending upon infarct localization. The incidence rate of these complications reaches 10–15% of infarcts affecting inferoposterior wall and 2.3% of anterior AMIs (2). In general, the appearance of the high block in AMI occurs four times more frequently in association with inferoposterior infarct. In most of the cases, CHB appears as a complication of inferior myocardial infarction within the first hours after the event (4), frequently in ED. The appearance of CHB in AMI is found to be an independent predictor of in-hospital mortality (10, 11).

Sudden deaths in AMI's complicated by AV block are not rare. According to different reports in cases of HAVB complicating AMI in-hospital mortality reaches 24–31% and is always significantly higher (from 2 to 3.6 times) than in cases of AMI without the block (8,11). In the American study of over nine thousand individuals with validated AMI, the patients in whom CHB developed experienced three times higher hospital death rates (with their mortality exceeding even 46%) than patients in whom CHB did not develop (12). CHB is independently associated with short-term mortality (10, 11). This fact determines a particular role of early and effective realization of all needed emergency procedures in case of appearance of the threatened patient within ED.

The influence of thrombolytic treatment on the frequency of CHB, its duration and mortality is uncertain. According to some of the authors (1, 11) thrombolysis may be associated with an increase in the development of HAVB and even it may be considered as an independent risk factor for this severe complication. The reasons of this situation are not well understood and multifactorial, including:

reperfusion lesions, vasovagal phenomena induced by reperfusion, re-occlusion or a reduction of thrombolytic effect in hypotension and bradycardia. The opponents (3, 4) present that thrombolytic therapy can reduce the incidence of severe AVB, shorten its duration and decrease the mortality in the patients with AMI. The mechanism of these positive effects is associated probably with an increasing reperfusion flow after thrombolytic therapy and a decreasing coronary stenosis of the infarct-related artery (3). Because of the rich vascular supply of the nodal area, presumably restoration of even a partial flow in collateral vessels may have a positive influence on a nodal activity. Unfortunately, many hospitals do not have formal policies on giving thrombolytic treatment in the ED and do not give thrombolysis there. However, in questionnaire survey in the UK (6), most of the ED consultants believe that patients with acute myocardial infarction admitted to an emergency department should receive thrombolytic treatment there in order to reduce the "door to needle time". The influence of thrombolysis routinely given in the ED on the frequency of HAVB and the patient outcome need further study.

Appearance of HAVB is also considered to be an independent prognostic factor for developing other serious threats which might need rapid and aggressive procedures (11). Generally, the patients with HAVB in AMI present a higher incidence of the following complications: arrhythmias such as ventricular fibrillation, ventricular tachycardia; right ventricular failure; rupture of the free wall and cardiac tamponade; an increase in the size of the infarct or re-infarction; others: difficult-to-control angina; infectious processes and a higher incidence of hemorrhagic complications.

In total block (CHB) the danger of developing sudden cardiac arrest or cardiogenic shock within ED is extremely high. This higher incidence of complications associated with CHB leads to a greater need for the use of emergency procedures short after admission to the ED. The procedures include cardiopulmonary resuscitation, mechanical ventilation, cardioversion, echocardiography, central veins catheterization, or rapid placing of temporary pacemaker.

The presence of the rich vascular supply of the nodal and infranodal area is of importance for the range and effectiveness of undertaken emergency activities. At first, if the CHP occurs the extensive infarct must be immediately considered as the mechanism of the presentation. On the other hand, even if the critical complications appear, as for instance cardiac arrest, the consequent, stubborn realization of emergency protocols may stop vicious circle mechanisms (nodal ischemia-negative hemodynamic effect – progression of ischemia) and enable holding blood flow in collateral vessels at the level that keeps nodal tissues alive.

A specific therapy for CHP is the insertion of a temporary pacemaker. According to different reports, in patients with AMI temporary pacing is required in 50–74% cases of HAVB (the differences in reported frequency may be due to methodological differences between the studies, such as patient selection, the definition of HAVB, or the indications for pacing) (11). If the procedure is performed in ED the patient is usually unstable and conditions extremely difficult. Sometimes the dynamism of complications in a patient with CHB and AMI forces proceeding in a really rapid way. Therefore, the EP's must have a deep educational background and practical experience in performing required procedures.

Serious complications of insertion temporary pacemaker are not uncommon (22% of all patients), and can range from femoral hematoma (femoral access) or pneumothorax (subclavian access) to cardiac tamponade and even death (6%) (9). In some reports there were described: perforation of the right ventricular wall by temporary pacemaker wire and crossing the interventricular septum with getting the wire to the left ventricle (5, 7).

In some cases the electrode needed to be repositioned because of failure of sensing or loss of ventricular capture. This complication occurs more frequently when procedure is performed without

X-ray monitor and in emergency conditions concomitant with the realization of Advanced Cardiac Life Support procedures. It is not allowed to underestimate the importance of confirmation of the wire ending site by the use of the chest X-ray or echocardiography. Unfortunately, many a time such a control is not performed if on the spot a good pacing effect has been obtained. Recurrently it may result in unexpected return of pathological cardiac rhythm, in the presence of missed pacing.

The condition of success in similar situation is the execution of the emergency procedures standard, the good team-work and the persistence in sequenced, repeatable use of the entered algorithm.

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SUMMARY

A presentation of the patient with Acute Myocardial Infarction (AMI) with coexisting high degree atrioventricular block (HAVB) to the Emergency Department (ED) is considered to be a particular sort of challenge. These patients generally are either unstable at initial assessment or become unstable suddenly. Immediate recognizing of a life-threatening heart diseases and a timely, effective therapeutic approach by the Emergency Physicians, are essential. HAVB is not a frequent finding in a the context of AMI (the present incidence rate 3.9%). However, its appearance significantly increases the risk for the patient and is found to be an independent predictor of in-hospital short-term mortality.

In the article we have presented the current views to the possibilities of treatment of such cases in the Emergency Department – still the new quality in medical care in Poland.

Blok przedsionkowo-komorowy wysokiego stopnia wikłający ostry zawał serca
w szpitalnym oddziale ratunkowym

Pojawienie się pacjenta z ostrym zawałem serca ze współistniejącym blokiem przedsionkowo-komorowym wysokiego stopnia stanowi w szpitalnym oddziale ratunkowym (SOR) szczególny rodzaj wyzwania. Tacy pacjenci generalnie są albo niestabilni już w chwili wstępnej oceny, albo stają się niestabilni w sposób nagły i niespodziewany. Natychmiastowe rozpoznanie zagrożenia i podjęcie we właściwym momencie efektywnego podejścia terapeutycznego ma zasadnicze znaczenie. Wysoki blok przedsionkowo-komorowy wikła zawał serca rzadko (w ok. 3.9% przypadków), jednak jego pojawienie się znacznie zwiększa zagrożenie życia pacjenta, stanowiąc niezależny czynnik ryzyka krótkoterminowej śmiertelności wewnątrzszpitalnej. W pracy przedstawiono współczesne poglądy na możliwości leczenia takich przypadków w szpitalnym oddziale ratunkowym, który stanowi w Polsce ciągle nową jakość obsługi medycznej.