

Treatment of Acute RVMI Complicated by High-Grade Bradycardia-Induced Shock Using Pacing-PTCA-ICT Combination

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ABSTRACT

Acute Right Ventricular Myocardial Infarction (RVMI), which would be possibly followed by bradycardia-induced shock, may perpetuate a vicious circle very quickly and result in short-term adverse outcomes as cardiac arrest and long-term outcomes as angina pectoris or recurrent myocardial infarction. In order to block this circle, emergent combination of temporary pacing and Percutaneous Transluminal Coronary Angioplasty (PTCA) may be necessary and especially, in unexpected case that the occluded lesion is long, another addition of Intracoronary Thrombolysis (ICT) may improve outcomes. We introduce the successful case of combined interventions of temporary pacing, PTCA and ICT to prevent cardiac death in the 65-old man who admitted with the diagnosis of acute RVMI and high-grade bradycardia-induced shock. In cases of high-grade bradycardia-induced shock following acute inferior myocardial infarction by occlusion of right artery, the combination of temporary pacing, PTCA and ICT may be the good choice for resuscitation and prognosis.

Keywords: Bradycardia-Induced Shock, Intracoronary thrombolysis, Percutaneous transluminal coronary angioplasty, Right ventricular myocardial infarction.

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INTRODUCTION

Acute Myocardial Infarction (AMI) may block blood supply not only to the generalized cardiac muscle cells of certain area, but also to the specialized cardiac muscle cells which compose cardiac conduction system so that it can occurs life-threatening arrhythmia. Oppositely, severe cardiac dysrhythmia decreases cardiac ejection function and furthermore, disturbs coronary artery circulation so that ischemic heart disease may be worse. Especially, blood flow block to the Right Coronary Artery (RCA) may cause inactivation of specialized cardiac conduction system as Sinoatrial (SA) node, Atrioventricular (AV) node and His bundle, which is generally followed by sinus bradycardia or Complete Heart Block (CHB). As the most commonly seen dysrhythmia in inferior MI, sinus bradycardia occurs in up to 40% of patients within the 1st 2 hr after attack, decreasing to 20% until 24 hr.^[1] AMI-induced high-grade bradycardia gets very high risk of death when bradycardia-induced cardiogenic shock is complicated and early intervention to block this vicious cycle can be the only salvage measure.

We introduce a successful case of combined intervention of temporary pacing and PTCA which was added with intracoronary thrombolytic therapy (which means ICT) to re-perfuse the in-operation re-occlusion coronary artery in acute inferior MI patient complicated with high-grade bradycardia-induced shock.

CASE REPORT

In June 2022, a 65-year-old male presented to emergency department of our hospital with severe chest pain, which he had suffered since an hour ago. (Pre-hospital system delay was 60 min) He had previously taken nitroglycerin at home, but the pain seemed to be getting more severe. He had an-8 month history of gripping pain and no history of diabetes mellitus or hypertension. He smoked more than 20 cigarettes a day and drank over 30 g of alcohol a day for about 30 years. At the first physical examination, his blood pressure was 110/70 mmHg, pulse rate was 62 bpm and an ECG study showed ST elevation of over 1 mm in II, III and AVF leads, respectively (Figure 1). Based on the characteristics of the chest pain and ECG results, his diagnosis was suggestive of acute inferior wall myocardial infarction.

10 min after arriving at the emergency department, the patient's heartbeat started to slow down, leading to sudden syncope and decreased to a minimum of 25 bpm, accompanied by cardiogenic shock with low blood pressure of 60/40 mmHg. Following a



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written informed consent for emergent PCI, the patient was taken to angiographic lab. Soon after his arrival at the laboratory, ventricular fibrillation occurred, necessitating electrical cardioversion at 300 joules and all resuscitative approaches. Since ischemic SAN-induced bradycardia did not improve, PTCA was halted and a temporary pacing electrode was inserted into RV wall through the right subclavian vein, achieving a heartbeat of 80 bpm and blood pressure of 90/60 mmHg.

The PTCA-guide wire was cannulated through the femoral artery to the Right Coronary Artery (RCA) and the first angiographic finding was obtained. First angiography showed a complete obstruction of the first segment of RCA (Figure 2, TIMI 0 flow), therefore, a 3.0 mm×15 mm balloon was dilated to restore the flow in about 6 cm of thromboembolic RCA, relieving the chest pain. However, the second angiographic finding after ballooning showed irregularities in the vessel, indicating a high possibility of re-obstruction of the vessel (Figure 3, TIMI 2 flow). As the third angiographic picture, taken 5 min after second angiography showed re-obstruction of the first segment of RCA (Figure 4, TIMI 0 flow), the vessel was dilated again (Door-to-balloon time was measured at the time as 120 min).

In order to maintain the flow in the vessel, 400,000 units of urokinase was infused into the RCA over 25 min. Fourth angiographic picture after ICT confirmed the complete flow of RCA (Figure 5, TIMI 3 flow). During angiography, there were 8 episodes of ventricular fibrillation, which were stabilized by electrical cardioversion.

Post-operative management was addressed on anti-shock and anti-arrhythmia therapy, continuous oxygen therapy, thrombolytic therapy, antibiotics and treatments for adverse reactions. Temporary pacing electrode was removed 3 days after admission and the patient discharged from CCU, 5 days after admission. At that time, he had no complaints, but showed a QS complex in III and aVF leads of the ECG and an LVEF of 66.7%, with a hypokinetic finding of the posterior wall on the echocardiogram.

DISCUSSION

Several interventional approaches such as PTCA for recanalization of myocardial infarction, temporary pacing for restoration of sinus bradycardia and ICT for improvement of local thrombolytic effect is no longer considered new techniques. A randomized

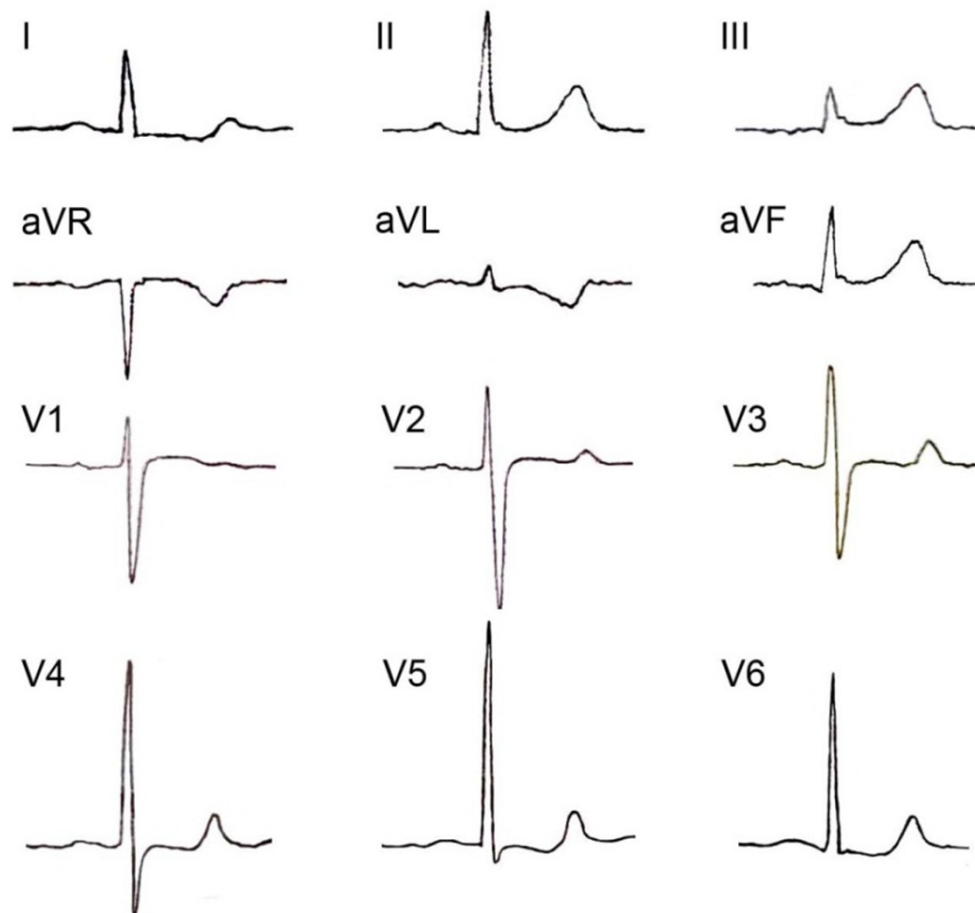


Figure 1: ECG findings on admission (ST elevation in II, III, aVF leads).

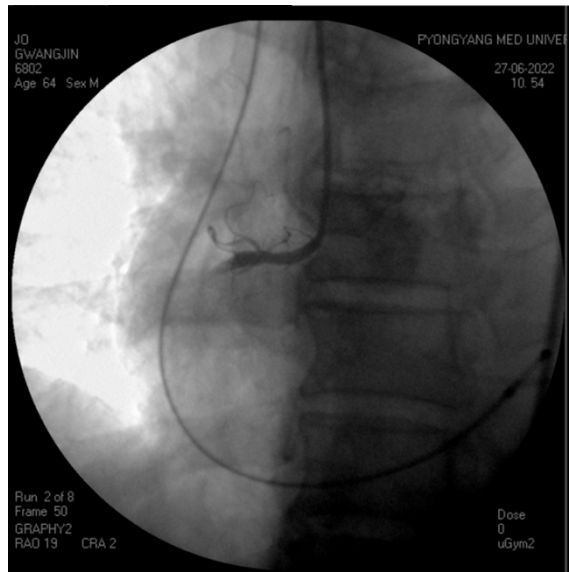


Figure 2: First angiography (Complete occlusion of first segment of RCA, TIMI).



Figure 4: Third angiography (Re-occlusion after ballooning, TIMI 0 flow).

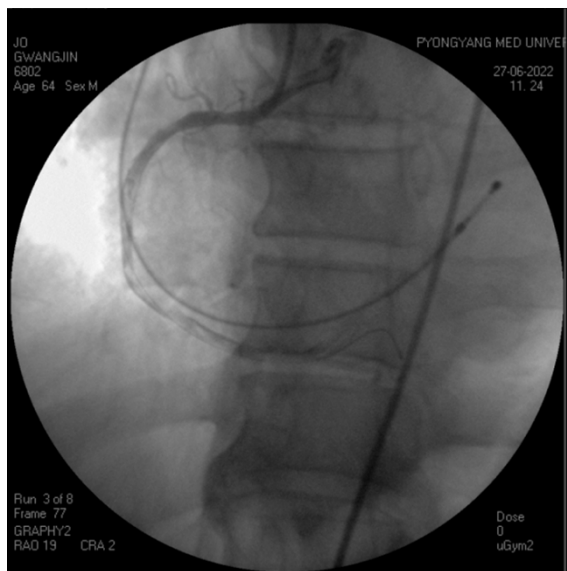


Figure 3: Second angiography (Irregular texture of RCA, TIMI 2 flow).

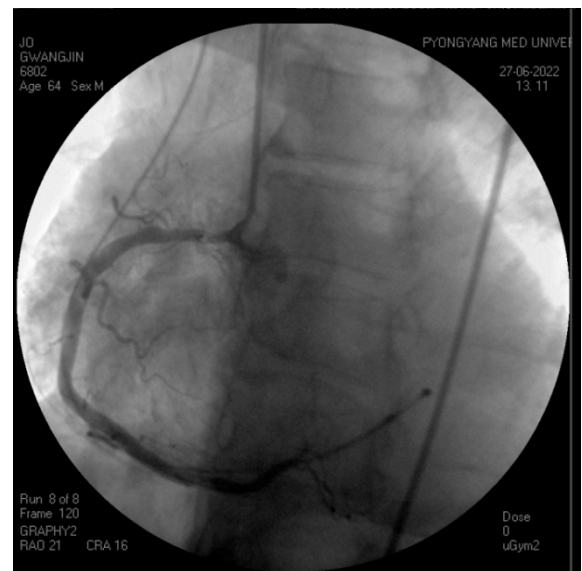


Figure 5: Fourth angiography (Complete flow after ICT, TIMI 3 flow).

controlled trial was studied to evaluate the efficacy of temporary pacing-combined PTCA, however, most of 379 cases in this study were of preventive pacing before PTCA (in twice of interventional processes), except only one case was of simultaneous pacing-PTCA combination (in once of interventional process).^[2] Several studies to assess the efficacy of PTCA-ICT combined intervention has evaluated that this combination was more effective than PTCA alone in the prevention of thromboembolic complications.^[3,4] The index case shows the limitations of pacing-PTCA combination in special case of acute RVMI complicated with high-grade bradycardia-induced shock and the possibility of resuscitation by pacing-PTCA-ICT combination.

Acute RVMI patients are at higher risk of bradycardia-induced shock compared to those with inferior MI alone and would have short-term adverse outcomes.^[5,6] Bradycardia which is often accompanied by hypotension raises the Bezold-Jarisch reflexes through the vagal afferents in ischemic RV wall and LV inferior-posterior wall,^[7] and these reflexes exacerbate bradycardia-hypotension process. In such cases, temporary pacing would be often taken as the first approach to such patients to block this vicious cycle of bradycardia-hypotension, whereas emergent combination of PTCA would be the essential causative therapy to prevent cardiac death and to improve the outcomes of myocardial infarction. In this particular case, we could primarily achieve transient reperfusion by pacing-PTCA combination

in emergent situation possible of cardiac arrest, but the length of parietal thrombus was so long that we failed to prevent re-occlusion (again in-operation re-occlusion). PTCA-ICT combination was reported to have higher efficacy in preventing the thromboembolic complication than PTCA alone.^[3] However, re-occlusion occurred within 5 min after first balloon dilation (because of long length of parietal thrombus), then we again tried balloon dilation (PTCA) and ICT until we achieved complete reperfusion. This shows that PTCA and ICT combination is a good choice in the treatment of STEMI.

Door-to-balloon time (D2B time) was one of the effective indices in predicting outcome of PTCA for myocardial infarction and was related with in-hospital mortality, which was significantly higher in D2B time of >90 min than of ≤90 min.^[8-15] In this case, D2B time was around 120 min being little longer than used to be, this was why we spent more time for temporary pacing and cardiac resuscitation before PCI. This patient had hemodynamic instability until 5 days after procedure, stirring our imagination that D2B time prolongation was related to the length of patient's restoration. Further studies are necessary to evaluate the relationship between D2B time and some clinical parameters.

Finally, in some special clinical cases of high-grade bradycardia-induced shock following acute RVMI, the combination of temporary pacing, PTCA and ICT may be the good choice for resuscitation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

RVMI: Acute Right Ventricular Myocardial Infarction; **PTCA:** Percutaneous Transluminal Coronary Angioplasty; **ICT:** Intracoronary Thrombolysis; **RCA:** Right Coronary Artery.

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