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Case Report

Nitroglycerin in Cardiac Arrest Before Transcatheter Aortic Valve Implantation

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Abstract

We present a 75-year-old male patient having aortic stenosis for which transcatheter aortic valve implantation (TAVI) had been planned. Patient developed cardiac arrest before TAVI. Cardiopulmonary resuscitation (CPR) followed by 10 mg intravenous bolus nitroglycerine administration at the 40 min was per-formed. Patient was conscious and cooperated at the 80th hour following CPR and was stable hemodynamically. TAVI was applied on the 8th day and patient was discharged to home from the cardiology clinic on the 6th day after TAVI. Bolus nitroglycerine administration may have a place in CPR protocols, which needs to be evaluated in further clinical studies.

Keywords: Aortic Stenosis, nitroglycerine, transcatheter aortic valve implantation

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Around 45% of deaths throughout the world develop due to cardiovascular diseases among which aortic stenosis is an important cause for cardiac mortality and morbidity.[1] Transcatheter aortic valve implantation (TAVI) is the preferred therapeutic option in the treat-ment of aortic stenosis, particularly for patients with multiple severe comorbidities, for those having expected high perioperative mortality, or for those having contraindication for conven-tional cardiac surgery.[2–3]

Vasodilators such as nitroglycerine or nitroprusside may provide hemodynamic im-provement in patients with advanced cardiac failure.[4, 5] Use of these agents in conditions such as cardiac arrest is limited because they cause severe decrease in systemic blood pressure. Its use during cardiopulmonary resuscitation (CPR) is still controversial.[6–8]

We present the case of a patient in whom in-hospital cardiac arrest developed before planned TAVI application and TAVI could be applied after a successful CPR application using nitroglycerine. The patient was finally discharged in a healthy condition.

The patient reviewed the case report and gave written permission for the authors to pub-lish the report.

Case Report

TTAVI application had been planned for a 75-year-old male patient having severe aortic stenosis. Standard laboratory tests and consultations were made preoperatively. When the patient was waiting in the outpatient clinic of cardiology developed sudden cardiac arrest. CPR was im-mediately started but no response was obtained for ten minutes. Thus the patient was rapidly transported to cardiac angiography laboratory without interrupting the CPR application. Arterial cannula was inserted for invasive arterial monitorization from left brachial artery. Persistant ven-tricular fibrillation was seen during CPR. Defibrillation procedure was performed for six times. Intravenous (iv) administration of lidocaine 100 mg and amiodarone 300 mg was performed for persistant ventricular fibrillation.

At the 40th min of CPR 10 mg iv bolus nitroglycerine was

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administered for the purpose of coronary dilatation and for decreasing cardiac preload, afterload, and pulmonary artery pres-sure, considering that preload of the right and left heart may have further increased due to the coronary ischemia. The maximum gradient of aortic valve was 72 mmHg average gradient was 42 mmHg ejection fraction was 30 %, systolic pulmonary artery pressure was 50 mmHg, and aortic width was 23 mm. Return to normal sinus rhythm occurred at the 50th min of resuscita-tion. Totally, 14 mg adrenalin was administered by iv route during the 50 min of CPR.

Arterial blood gas specimen was taken twice during CPR with the following outcome: first measurement: pH 7.29, pCO_2 39, pO_2 99, HCO_3 18.8, base excess −7.3, lactate 8.3 and se-cond measurement: pH 7.22, pCO_2 59, pO_2 69, HCO_3 21.3, base excess −4.4, lactate 4.3.

For severe aortic stenosis, percutaneous aortic valvuloplasty with 8 mm. peripheral bal-loon was performed under urgent conditions by the cardiology team because aortic balloon was not available. Infusion of 7 µg/kg/min dopamine and 0.02 µg/kg/min nitroglycerine were started after considering the response to CPR. Later the patient was taken to the intensive care unit of anesthesia for the purpose of mechanical ventilation and supportive treatment.

Anti edema treatment was started with 1% mannitol 3×100 mL. The daily administra-tion of 3×20 mg methylprednisolone and 8 mg dexamethasone were continued during the treatment in intensive care unit. Cold application with ice was made for 6–8 h on the head and neck region in order to slow down cerebral oxygen requirement and metabolism. Intravenous infusion of midazolam 3 mg/h and morphine 1 mg/h was continued for sedation purpose during the first two days after admission to intensive care unit. Weaning was planned after the cessation of sedations on the 3rd day.

The patient was conscious and cooperated at the 80th hour following CPR application and was also hemodynamically stable. Then he was extubated. There was a mild tendency to sleep. The patient was evaluated for cognitive functions and emotional status by neurologist on the 5th day of admission to intensive care unit. Any neurological disorder was detected. TAVI was applied to the patient under general anesthesia on the 8th day. The patient, who was extubat-ed after the procedure, was monitored for hemodynamic parameters for 48 h. The patient was hemodynamically stable and didn't have any neurological deficit at the end of 48 h. He was transported to the cardiology clinic.

The patient was discharged to home from the cardiology clinic on the 6th day after TAVI application. Echocardiography after three months revealed that ejection fraction was 60, there was no gradient on the aortic valve and systolic pulmonary artery pressure was 38 mmHg.

Discussion

In literature nitroglycerin administration during CPR was first successfully used on a fe-male patient on whom cardiac arrest had developed secondary to myocardial infarction in 1984. During subsequent years Guglina[7] reported in their case series of 22 patients that they used high dose nitroglycerine during CPR. Very fast recovery was emphasized following high dose nitroglycerine administration, and the cause of cardiac arrest in patients was infarction or severe cardiac failure. They suggested that quite low blood pressure values were determined in all the cases; moreover, arterial blood pressure values of 18 patients could not be measured non-invasively.[7] Guglina furthermore reported that blood pressure values were quickly raised or became measurable in 20 of 22 patients to whom they had administered iv bolus nitroglycer-ine, and as a result, 13 patients had recovered completely.

In a study on pigs it has been shown that giving iv bolus nitroglycerine after epinephrine application in prolonged CPR led to significantly higher arterial blood pressure and cerebral blood pressure values compared with the group on which only epinephrine was applied; in ad-dition, the recovery of spontaneous circulation occurred at a very high ratio (on 11 of 12 ani-mals) in this group.[9]

Guglina[8] reported that sudden cardiac arrest had developed in an 86 year old patient having a history of coronary artery disease, hypertension and hyperlipidemia in waiting room during routine outpatient clinic control in the hospital; they obtained a successful result with high dose nitroglycerine used on this patient during CPR. However, Guglina[8] reported that ven-tricular tachycardia had developed 15 min later; thus, they gave 4 mg iv bolus nitroglycerine in addition to epinephrine, vasopressin, amiodarone, lidocaine, magnesium, and bicarbonate for 50 min. The blood pressure was 137/58 mmHg along with return to normal sinus rhythm after 3 min. Guglina[8] also indicated that the patient was extubated at the end of the 2nd day, and they discharged the patient in a healthy status on the 18th day following cardiac treatment.

The possible advantage of nitroglycerine administration for hemodynamic parameters can be explained with increased cardiac output caused by rapidly developed vasodilation in our case. It has been accepted that vasodilating agents help by increasing cardiac index and de-creasing left ventricular filling pressure and systemic vascular resistance in cardiac failure ac-companied by acute myocardial infarction or in cardiac failure alone.[10, 11] Moreover, it has been indicated

that when failure is severe, the efficiency of vasodilators is more.[12, 13] Decreased pre-load because of iv bolus nitroglycerine administration could provide healing by causing left ven-tricular filling and increasing cardiac output in this case.[14–18] Nitroglycerine administration dur-ing CPR may also show positive influences on cerebral perfusion because it can provide near-normal blood pressure values.[19] In fact, near-complete neurological recovery occurred with a quite high ratio in cases reported in literature where iv bolus nitroglycerine was administered during CPR.[14, 20, 21] However, the advantage of cold application to head and neck or angioedema treatment should not be disregarded.

In conclusion, here, we applied iv bolus nitroglycerine at the end of 40 min of CPR com-plying with current protocols in a case of cardiac arrest developed due to an underlying cardiac pathology. However, we cannot conclude that successful resuscitation application is related to iv bolus nitroglycerine administration. On the other hand, we suggest that the questions "Does iv bolus nitroglycerine administration have a place in CPR?" and "At what dose and time will its application be more useful?" are worth answering in further clinical studies.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report.

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