CASE REPORT

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Post-return of spontaneous circulation (ROSC) management in STEMI patient with COVID-19: a case report

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ABSTRACT

Background: The COVID-19 pandemic is still a global emergency that causes higher mortality in patients with comorbidities. Current data shows the mortality rate of STEMI patients with COVID-19 is higher than that of STEMI patients without COVID-19. This study aims to improve the knowledge and skills in managing cardiac arrest in COVID-19 patients and post-ROSC management in STEMI patients with COVID-19.

Case Presentation: A 43-year-old man came with a complaint of typical chest pain 3 days before admission, accompanied by symptoms of *orthopnea and dyspnea on exercise*, and had experienced syncope 3 days prior. History of diabetes mellitus and previous heart attack. The examination results showed tachycardia, tachypnea and oxygen desaturase. The supporting examinations were ESR 89, CRP 48.72, D-dimer: 2.04, and HbA1C 10.1%. Swab Polymerase Chain Reaction (PCR) SARS Cov-2 showed a positive result, with pulmonary edema that may be accompanied by pneumonia (CORADS-3), bilateral pleural effusions, calcification of the descending aorta and coronary arteries LAD, LCX, RCA on computed tomography (CT) imaging.) Thorax. On bedside echocardiography, EF 28%, LA-LV dilatation, anterior akinetic RWMA, and mild-moderate MR due to functional, mild TR were found. Patients diagnosed with STEMI anterior late onset Killip III, CCS IV, Grace 129, TIMI 9/14; ADHF on ACS; DM, Confirmed Covid-19, Hypoalbuminemia, Hypercoagulation state and had a heart attack and cardiac-respiratory arrest on the 14th day of treatment, performed cardiopulmonary resuscitation (CPR) and entered a state of return of spontaneous circulation (ROSC). The patient continued the treatment until day 23 and was referred to another hospital for further care.

Conclusion: In order to obtain good results in reducing mortality in STEMI patients with COVID-19, it is necessary to have the knowledge and skills of management of cardiac arrest in COVID-19 patients and post ROSC management in STEMI patients with COVID-19, as well as pay attention to and maintaining the safety of the rescuers.

Keywords: *cardiac arrest, cardiopulmonary resuscitation, COVID-19, ROSC, SARS-CoV-2.*

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INTRODUCTION

The COVID-19 pandemic is a global emergency that occurs due to COVID-19 infection worldwide. Until now, the number of confirmed cases of COVID-19 has reached 430 million people in the entire world, with a death toll of more than 5 million people.[1] It's quite common that patients coming to the hospital are patients with various complications or comorbidities and require comprehensive management. It is estimated that about 20 to 40% of deaths occur in COVID-19 patients who have complications or comorbidities. American Heart Association (AHA) recommends that medical personnel should be able to perform appropriate cardiopulmonary resuscitation (CPR) on patients.[2]

ST-segment Elevation Myocardial Infarction (STEMI) is the most common emergency that causes sudden death. The speed of revascularization of the occluded coronary arteries is the main key to the success of STEMI management, both in terms of reducing morbidity and mortality.[3] A study revealed that the mortality of patients admitted to hospitals with a diagnosis of STEMI with COVID-19 was 78.5% compared to those not exposed to COVID-19, which was around 46.1%. The researchers found similar findings when comparing the number of STEMI patients with COVID-19 and without COVID-19 from 2020 or patients with STEMI from 2019 before the onset of COVID-19.[4]

Prior to the COVID-19 pandemic, the prevalence of ROSC among cardiac arrest patients in America was 50%. Epidemiological studies related to cases of cardiac arrest with COVID-19 are still limited, but one study says that the prevalence of ROSC in patients with COVID-19 is around 13.2%. Asystole is the most common rhythm of ECG findings.[2]

From the available data, the mortality rate of STEMI patients with COVID-19 is higher than that of STEMI patients without COVID-19. Therefore, this case report was made to discuss the management of cardiac arrest in COVID-19 patients and post-ROSC management in STEMI

patients with COVID-19 with the intention of improving the knowledge and skills to handle these cases.

CASE REPORT

A 43-year-old patient came to the ER with complaints of chest pain 3 days before being admitted to the hospital. Chest pain feels heavy, feels pressured and radiates to the arm, accompanied by complaints of cold sweat, nausea and shortness of breath. Shortness of breath occurs when doing activities, lying straight and sleeping, which often wakes the patient due to shortness of breath. Had fainted 3 days ago. The patient also complained of cough (+) and fever (-) around 5 days prior. The patient previously had a history of diabetes mellitus and heart attack for 20 years. The latest heart attack was 2 years ago, and the patient was regularly taking Simvastatin 20 mg, Ramipril 10 mg, Spironolactone 50 mg, Concor 2.5 mg, Aspilet 80 mg and Clopidogrel 75 mg, Novorapid 10 units, and Lantus 12 units.

From the results of the examination, the patient appeared to be moderately ill with compos mentis consciousness, blood pressure 100/65, heart rate 112x/minute, respiratory rate 24x/minute, temperature 36.6 C, oxygen saturation 96% with oxygen supplementation 2 liters/minute nasal cannula. General status examination revealed no retractions, additional rhonchi in both lung fields, normal heart S1-S2 regular murmur (-) Gallop (-), liver and spleen were not palpably enlarged, warm extremities, capillary refill time < 2 seconds

From a complete blood laboratory examination, the results showed hemoglobin 11.6 g/dl, hematocrit 34.7%, leukocytes 12.070 L (81% neutrophils, 11% lymphocytes with NLR 7.4), platelets 348.000 l. ESR 89, CRP 48.72, D-dimer: 2.04, Albumin 3.13, urea level 39.1 mg/dL, serum creatinine 0.96 mg/dL, HbA1C 10.1%, sodium level 135 mmol/L, potassium 3.6 mmol/L, chloride 93 mmol/L. Swab Polymerase Chain Reaction (PCR) SARS Cov-2 showed positive results, with pulmonary edema that may be accompanied by pneumonia (CORADS-3), bilateral pleural effusion, heart not enlarged, calcification of descending aorta and coronary arteries LAD, LCX, RCA on imaging computed tomography (CT) Thorax. ECG results showed sinus rhythm with heart rate 114 x/min, PR interval 138 ms, narrow QRS 92 ms, pathological Q and ST elevation in leads V1-2, AVR moderate ST depression in leads I, II, aVL, V4-6. On bedside echocardiography, EDD 58, ESD 48, EF 28%, TAPSE 1.7cm, LA-LV dilatation, RWMA anterior akinetic, other segments normokinetic, MR mild-moderate due to functional, TR mild, TVG 20 mmHg, IVC 24/21, LVOT VTI 10.5, SV 33, CO 3.8, SCR 1115.

The patient was initially admitted to the High Care Unit (HCU) with a diagnosis of STEMI anterior late onset Killip III, CCS IV, Grace 129, TIMI 9/14; ADHF on ACS; DM, Confirmed Covid-19, Hypoalbuminemia, Hypercoagulation state and receiving oxygen therapy using nasal cannula 2-4 liters per minute, IV drip Furosemide 5mg/hour, Lovenox 2 x 0.6cc subcutaneous injection, Novorapid 3 x 10 units subcutaneous injection, Sansulin 1 x 12 units subcutaneous injection, Aspilet 80 mg, Clopidogrel 75 mg, Ramipril 10 mg, Spironolactone 50 mg, antibiotics Cefepim 3 x 1 gram and Levofloxacin 750 mg and other symptomatic drugs. In total, the patient received 23 days of care at Siloam General Hospital before being referred back to the Polri Hospital for further heart treatment.

During the initial treatment, the patient's condition was stable until, on the 14th day, the patient experienced severe chest pain and fell into a state of cardiac arrest. The ECG results showed ventricular tachycardia without a pulse. The patient underwent cardiopulmonary resuscitation for approximately 1 hour, with defibrillation 6 times and entered the state of return of spontaneous circulation (ROSC) 3 times. When the patient entered the ROSC condition, the patient appeared to be seriously ill with coma consciousness, blood pressure 107/60, heart rate 108x/minute with the drip of Dobutamine 15 mcg/kgBW/minute and Epinephrine 1 mcg/kg/minute, Amiodarone 600mg/24 hours, respiratory rate 24x/minute, 100% oxygen saturation with the intubated condition and the help of PSIMV 15/22/6/100% ventilator mode and a temperature of 35.6C. ECG results showed sinus rhythm with heart rate 106 x/min, PR interval 146 ms, narrow QRS 90 ms, ST elevation in leads V1-4, moderate AVR ST depression in leads I, II, avL, V4-6. On post-ROSC echocardiography examination, the dimensions of the heart chambers were not dilated, the LV wall was not thickened with akinetic LV movements at the base-mid (anterior, anteroseptal, anterolateral), hypokinetic at the mid-base (inferior, inferoseptal, inferolateral), moderate TR valve, Mild-moderate MR, severely decreased LV systolic function with EF 29.3%, good RV systolic function with TAPSE 17.2mm, grade III diastolic dysfunction, IVC dilatation and congestion 26/18mm, no thrombus, bilateral pleural effusion. Additional therapy is Heparin 15,000 units/24 hours, Amiodarone 600mg/24 hours, Digoxin 0.25mg, and Atorvastatin 40mg instead of Simvastatin 20mg. During treatment, the patient's vital signs are monitored with a target MAP of more than 70 mmHg, with a fluid limit of 1000cc/day and a negative fluid balance of 500 to 1000 cc/day. Antibiotic escalation was also carried out to Meropenem 3 x 1 gr and Amikacin 750 mg.

DISCUSSION

In STEMI patients, the complaints obtained from the history will be closely related to the presence of substernal chest pain, lasting > 20 minutes, accompanied by cold sweats as well as spreading to the left arm, back, jaw and solar plexus. In this case, the patient came with the chief complaint of chest pain. Characteristics of chest pain felt by the patient were severe chest pain, a feeling of suffocation and radiating to the arms accompanied by complaints of cold sweat, nausea and shortness of breath. The complaints felt by the patient were in accordance with the characteristics of typical chest pain in coronary heart disease.[5,6]

The risk factors for STEMI are patients with a history of uncontrolled hypertension, previous history of diabetes mellitus, obesity status, smoking habits, family history of coronary heart disease, lack of physical activity and consumption of fatty foods. In this case, the patient had a history of DM since 20 years ago and a history of heart attack 2 years ago. The patient is also taking routine medications

in the form of anti-dyslipidemia, antihypertensive, antiplatelet and insulin. From the anamnesis, the patient has a high enough risk factor for STEMI.[7,8]

After performing a complete physical examination, further investigations are needed to support the diagnosis of STEMI, such as an ECG where ST-segment elevation >1 mm is found at least in 2 adjacent leads, and there is an evolution on the 1 hour ECG accompanied by an abnormal increase in the CKMB enzyme and/or Troponin. The patient's ECG results in this case showed ST elevation in leads V1-2, AVR moderate ST depression in leads I, II, avL, V4-6. From the results of the ECG obtained, it can be concluded that the patient's diagnosis is STEMI.[6,9]

Meanwhile, if the patient is suspected of having COVID-19, the patient's complaints will be accompanied by fever, cough, runny nose, shortness of breath, sore throat and other symptoms that point to COVID-19. In addition, the diagnosis of COVID-19 is also supported if the patient has contact with a confirmed positive case of COVID-19. In this case report, the patient did not show any symptoms leading to the diagnosis of COVID-19 and had no contact with confirmed COVID-19 patients. A chest X-ray can be used as a reference to support the diagnosis of suspected COVID-19 if there is a picture of pneumonia and or a picture of Acute Respiratory Distress Syndrome (ARDS) or, if possible, supporting examinations such as the SARS COV2 rapid test, standard swab tests for COVID PCR tests and if possible can be carried out. /or CT scan of the lungs with ground glass opacity findings. The SARS COV-2 PCR swab was positive, with pulmonary edema possibly accompanied by pneumonia (CORADS-3) and bilateral pleural effusions. From the results of this examination, it can be concluded that the patient is confirmed to have COVID-19.[10,11]

All patients who meet the STEMI criteria with stable hemodynamics and signs of severe pneumonia are advised to undergo a fibrinolytic procedure in an isolation ward if there are no contraindications for fibrinolytic. If there are no signs of severe pneumonia, it is recommended to perform primary percutaneous coronary intervention (IKPP) in an isolated catheterization laboratory room if the consideration of the benefits of IKPP outweighs the risks. There was also no significant difference in the drugs used to treat STEMI in cases of STEMI with suspected COVID-19, namely by administering statins, double antiplatelet therapy (DAPT), angiotensin-converting enzyme inhibitors (ACE-i)/ ARBs, laxatives, and diazepam. In addition to medical treatment, long-term care also includes education on nutrition and diet, risk factors and a healthy lifestyle.[12,13]

In accordance with current guidelines, reperfusion therapy is still indicated in patients with ischemic symptoms of <12 hours duration and persistent ST-segment elevation on at least two adjacent ECG lead. At the same time, the safety of health workers must be ensured. Therefore testing for SARS-COV2 should be carried out as soon as possible after the first medical contact for patients with suspected COVID-19, regardless of the treatment strategy, to enable medical personnel to implement adequate protective measures and management pathways. Personal protective equipment (PPE) used in the catheterization laboratory is the level 3 PPE, which consists of a catheterization work gown, hat, surgical mask, face shield or goggles, sterile operating gown, sterile apron and closed shoes. By paying attention to the use of a well and correct PPE, catheterization services and advanced STEMI treatment can still be carried out safely while reducing the incidence of COVID-19 transmission between patients and medical personnel.[12]

CPR actions can increase the risk of transmitting COVID-19 to medical personnel. Various CPR procedures such as chest compressions, insertion of a breathing apparatus and positive pressure ventilation can generate aerosols. Virus particles can be suspended in the air within 1 hour, which can then be inhaled by people around the location. Several principal changes in the CPR algorithm have been adapted to the conditions of the COVID-19 pandemic, especially to maintain the safety of rescuers. These efforts include the use of complete PPE to avoid droplets, as well as oxygenation and ventilation carried out with the principle of minimal aerosolization.[14–16]

Rescuers must protect themselves and their co-workers from exposure to the SARS-CoV-2 virus during CPR. Some strategies that can be done are using PPE that has been adapted to the standard of airborne and droplet before performing CPR, limiting the number of health workers present during CPR, and using mechanical CPR for chest compressions for adult patients, if such facilities are available, ensure the patient's COVID-19 infection status and provide the information clearly to rescuers before arriving at the location. When performing CPR, the resuscitation team must wear level 3 PPE consisting of an N95 mask or another type that guarantees a higher level of protection, eye protection such as goggles and full face shields, gloves, and an apron. This complete set of PPE should always be available in the resuscitation trolley. The use of full PPE can be done alternately between members of the resuscitation team. If possible, close the door to prevent contamination of adjacent rooms.[14–18]

Before performing manual or mechanical ventilation, a high-efficiency particulate air filter) if available, is connected to the passage through which the exhaled air passes. Prior to intubation, use a bag-mask device (or T-piece for neonates) with a HEPA filter and an airtight seal if available. Consider the use of passive oxygenation with a non-rebreathing mask covered with a surgical mask (face mask) in adult patients. Furthermore, intubation procedures should only be performed by trained and experienced medical personnel and performed using methods that have a high chance of success on the first attempt at intubation. During the intubation procedure, stop chest compressions.[14,16,18]

Safe intubation procedures can be performed after defibrillation. It is suggested to use an endotracheal tube cuff which is connected to a ventilator with a HEPA filter system and an in-line suction catheter to produce a closed circuit. After successful closed circuit installation, minimize device disconnection immediately to reduce aerosolization. Consider manual ventilation with a supraglottic airway or bag-mask device equipped with a HEPA filter, if available,

if the intubation procedure fails or has to be postponed. If the patient's spontaneous circulation returns (ROSC), adjust the ventilator according to the patient's clinical setting.[14,15,18–20]

Patients with suspected or confirmed COVID-19 who achieve ROSC should be reported to the relevant infection control department. Post-cardiac arrest management procedures for COVID-19 patients are no different from those for patients without COVID-19. Post-resuscitation plans generally require intensive care unit critical care, where the transfer of the patient requires coordination with the infection control department. ROSC is characterized by a palpable pulse, detectable blood pressure, spontaneous breathing, end-tidal carbon dioxide ($PETCO_2$) suddenly increasing to 40 mmHg), and arterial pressure waves seen on intra-arterial monitoring. What needs to be considered during the post-cardiac arrest management procedure is to maintain the safety of the rescuer with the use of complete PPE.[16,17,21]

Post-cardiac arrest patients generally go into a coma after ROSC. It is important to do a 12-lead ECG after ROSC. The ECG can provide diagnostic data for the cause of cardiac arrest. The clinician must be able to recognize ST-segment elevation (STEMI) or other acute ischemic features requiring emergency reperfusion. Laboratory examination abnormalities that are often found are electrolyte and acid-base disorders. Arterial blood gas analysis (AGD) should be performed every 6 hours during induction of hypothermia and rewarming to assess the acid-base status and guide ventilator management. Serum electrolytes were also checked every 6 hours during induction of hypothermia and rewarming. Leukocytosis (10,000 - 20,000/µl) is common after cardiac arrest due to the inflammatory response. The specific toxicological examination is indicated when toxicosis is suspected. Troponins are checked every 8-12 hours to detect myocardial infarction.[22,23]

The principles of post-cardiac arrest management include ABCD (Airway, Breathing, Circulation, and Disability). The first is control of oxygenation, where hypoxemia and hypercarbia can cause recurrent cardiac arrest and secondary brain injury. Hyperoxia can also be adversely affected by oxidative stress. The American Heart Association (AHA) recommends that post-cardiac arrest patients should be given the highest concentration of oxygen until arterial oxygen partial pressure (PaO2) or arterial oxygen saturation (SaO2) can be evaluated. Hyperoxia within 24 hours after ROSC is associated with a poorer outcome than hypoxemia or normoxia within 24 hours.[22,23]

Second is ventilation control with endotracheal intubation, sedation, and controlled ventilation considered in unconscious post-cardiac arrest patients. Avoid hyperventilation. Start with 10 breaths/min and titrate until it reaches the target end-tidal CO2 (ETCO2) 35-40 mmHg. A protective mechanical ventilation strategy is recommended with a tidal 6-8 mL/kg ideal body weight and a positive end-expiratory pressure (PEEP) of 4-8 cmH2O.[23,24]

The third is hemodynamic stabilization. The main goal of hemodynamic management is to prevent and treat hypotension. The AHA recommends a target systolic blood pressure of 90 mmHg or a mean arterial pressure (MAP) of 65 mmHg. Monitoring of blood pressure, heart rate, urine output, plasma lactate clearance, and oxygen saturation is required to guide the treatment. Serial echocardiography is required, especially in hemodynamically unstable patients, to detect myocardial dysfunction. Administration of intravenous fluids and vasoactive drugs is required to treat hypotension. 0.9% NaCl liquid; or Ringer's Lactate may be given as a 1-2 liter intravenous bolus. The last is optimizing neurological recovery by controlling temperature, controlling seizures, controlling glucose, sedation and other drug therapy.[22–24]

CONCLUSION

Studies have shown a higher mortality rate in STEMI patients with COVID-19 compared to STEMI patients without COVID-19, associated with a much lower success rate in CPR. By improving the knowledge and skills in the management of cardiac arrest in COVID-19 patients and post-ROSC management in STEMI patients with COVID-19, as well as paying attention to and maintaining the safety of rescuers, it is hoped that this will reduce the mortality of the patients.

ETHICAL CONSIDERATIONS

The patient has given consent to participate and publish the data.

CONFLICT OF INTEREST

There was no conflict of interest in writing this study report.

FUNDING

The author was responsible for funding this study without involving other parties.

AUTHOR'S CONTRIBUTION

The author contributed to writing this study report, from the first step of proposal preparation, data collection and analysis until the preparation of the report in the form of publication.

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