A CASE OF UNDERSIZED IABP BALLOON IN A CARDIAC ARREST PATIENT AFTER PERCUTANEOUS CORONARY INTERVENTION: A CASE REPORT

Siburian R[1], Mansjoer A[2], Kurnia A[3], Wilson Tanod J[3], and Donald Aposan Silalahi T[4].
[1]Research Unit, Jakarta Heart Center, Jakarta 13140, DKI Jakarta, Indonesia
[2]Division of Cardiac Intensive Care, Jakarta Heart Center, Jakarta 13140, DKI Jakarta, Indonesia
[3]Cardiac Anesthesia, Jakarta Heart Center, Jakarta 13140, DKI Jakarta, Indonesia
[4]Division of Cardiovascular, Jakarta Heart Center, Jakarta 13140, DKI Jakarta, Indonesia

Correspondence:
Reynold Siburian,
Research Unit,
Jakarta Heart Center,
Jakarta 13140, DKI Jakarta,
Indonesia
Email: reynold.timotius@gmail.com

Abstract

Cardiac arrest during percutaneous coronary intervention is a rare but serious complication. Intra-aortic balloon pump (IABP) is often utilized to support hemodynamics after a return of spontaneous circulation (ROSC) due to cardiac problem. However, supply chain issues that arise limit the availability of the optimal balloon size. A 70-year-old-man with angina pectoris, despite optimal medical therapy (OMT), underwent an elective percutaneous coronary intervention (PCI). He developed cardiac arrest and achieved ROSC, but had low blood pressure despite inotropes and vasopressor. IABP support was necessary but ideal balloon size was unavailable due to supply chain problems. An undersized balloon (25 cc) was utilized instead. He was monitored in the ICU and began to improved and was finally discharged. An undersized balloon may still provide some benefit in increasing coronary blood flow and reducing cardiac workload in certain patients who need IABP support, especially when supply chain issues or lack of other circulatory devices limit such options. However, careful individualized assessment is required.

Keywords: Cardiac Arrest, ROSC, Cardiovascular Critical Care, Intra-aortic Balloon Pump

Introduction

In-hospital cardiac arrest is one of the feared complications of percutaneous coronary intervention (1–3). After achieving return of spontaneous circulation (ROSC), placement of patient on temporary mechanical support such as intra-aortic balloon pump (IABP) may be required to improve patient outcome. IABP should have a good placement and appropriate balloon size to confer full benefits. However, the disruption of supply chain due to war on Ukraine caused a shortage of imported balloon size; therefore, an undersized balloon was utilized instead (4). This case report presented the successful use of undersized IABP in a cardiac arrest patient during percutaneous coronary intervention who survived with favorable outcomes and highlighted the potential benefits of its use in limited settings.

Case Presentation

A 70-year-old man was admitted to our hospital with an angina pectoris despite optimal medical therapy. The patient's medical history was otherwise unremarkable except for a history of hypertension, the sole risk factor for his coronary artery disease. Physical examination did not reveal any abnormalities of pulses, murmurs, and rales. ECG revealed no ST-T changes. The patient was scheduled for elective percutaneous coronary intervention (PCI).

On the day of the procedure, the coronary angiography revealed stenosis in multiple arteries, including mid-left anterior descending artery (LAD), distal left circumflex artery, obtuse marginal artery, and ostial right coronary artery. The culprit lesion was a critical narrowing in LAD; thus, the decision to place the stent was made. The first stent was placed uneventfully. However, during the placement of the second stent, the patient developed cardiogenic shock and cardiac arrest, presenting with ventricular tachycardia as the initial rhythm. Defibrillation was done; however, rhythm shortly developed to pulseless electrical activity (PEA). Manual resuscitation was subsequently performed, and the patient was immediately intubated. At that time, arterial blood gas analysis revealed metabolic acidosis due to low perfusion with high lactate.

Manual resuscitation lasted for 30 minutes before the patient achieved a return of spontaneous circulation

(ROSC), with ECG showing sinus rhythm. Furthermore, initial treatment consisted of dopamine, adrenaline, and noradrenaline infusion was undertaken. At the same time, a cardiac echo ruled out cardiac tamponade. Due to the hypotension (50/20 mmHg), despite the administration of inotropic, IABP was placed, and ECG-triggered pulsatile life support was performed with maximal augmentation (Figure 1).

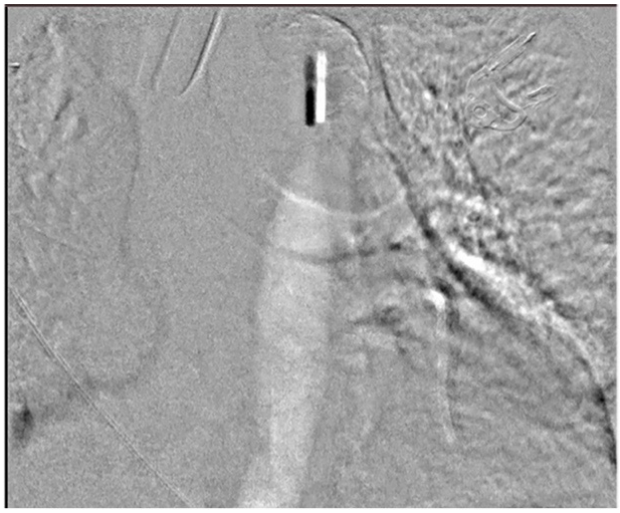

Figure 1: Successful IABP insertion (balloon inflated)

Ideally, a 40 cc intra-aortic balloon volume should be utilized for optimal hemodynamic support for our patient based on his height (165 cm). However, adequate IABP size was unavailable; thus, an undersized 25 cc balloon volume was placed instead. IABP waveform during ICU admission to removal was shown in Figure 2.

After the procedure, the patient was transferred to the cardiovascular intensive care unit (CICU). We performed serial echoes throughout treatment in the CICU to evaluate cardiac functions. Cardiac echo was 40-45%. Presepsin was found to be elevated (502 pg/ml) and initial SOFA score was 9, indicating sepsis thus cardiogenic-septic shock. Antibiotics were administered immediately. Culture yielded no potential causative agent. Other laboratory tests showed an unremarkable result.

Gradually, the patient began to show improvements in all aspects. On day three, he was extubated, and on day four, the IABP was removed. On day 5, he was transferred to step down unit and discharged from the hospital on day 8. The patient provided consent for this case report.

Discussion

Patients requiring cardiopulmonary resuscitation with multiple vasopressors and inotropes have low survival rate (5). In this case, the concomitant cardiogenic-septic shock

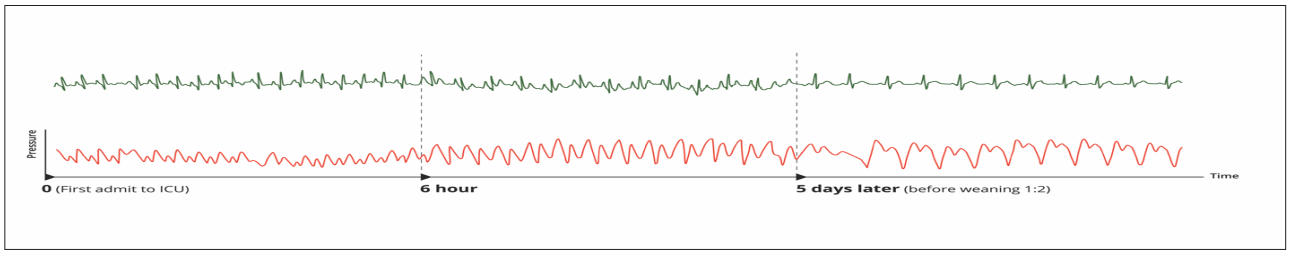

Figure 2: IABP waveform during first admission to ICU until rate weaning

with sustained hypotension necessitates IABP placement. IABP is widely utilized to support hemodynamic status in the event of cardiogenic shock during or after PCI. However, its use in septic shock requires to be better established (6, 7). It is postulated that IABP assists the heart indirectly by decreasing afterload and augmenting diastolic pressure resulting in improved coronary blood flow. The mechanism behind IABP is rapid inflation during diastole that occurs synchronously with aortic valve closure and after the appearance of dicrotic notch rapid deflation prior to the onset of systole. Inflation of the balloon results in increased diastolic pressure and coronary perfusion. Conversely, a deflation of the balloon would reduce afterload by decreasing systolic aortic pressure, thereby reducing myocardial oxygen demand (8). Due to unavailability of an appropriately-sized balloons, we considered utilizing an undersized balloon. While an undersized balloon may not provide the same level of counter-pulsation as a larger balloon, it could still offer benefits in terms of improving coronary blood flow and reducing the afterload on the heart, and the impact of device placement would still be better than no pump (8, 9). This was our rationale for placing the undersized balloon to increase coronary perfusion. This would decrease cardiomyocyte oxygen demand and allowed recovery of myocardial function to improve survival probability. To minimize further metabolic needs, we further optimized sedative therapy and analgesia.

In our case, the patient was evaluated for the possibility of organ injury, and the result was unremarkable. This is partly supported by the combination of high-quality CPR with immediate placement of IABP; thus, significant ischemia could be prevented. To our knowledge, there has not been a case report on the use of undersized IABP balloon on patient hemodynamic. Immediate high-quality resuscitation followed by combined pharmacotherapy and mechanical circulatory support (MCS) could potentially

be life-saving. Even with less-than-optimal MCS device being available, any additional support could be utilized to improve patient's hemodynamic.

Conclusion

In summary, the use of IABP in a patient with cardiac arrest, as presented in this case report, albeit undersized, may be used to improve patient's hemodynamic. Although in the ideal setting, balloon volume size should be matched according to patient height, the disruption of global supply affects the availability of balloon volume. An undersized IABP may still be considered in a hemodynamically unstable patient with concomitant cardiogenic-septic shock.

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Competing interests

The authors declare that they have no competing interests.

Ethical Clearance

Ethical approval is not required for this study in accordance with local or national guidelines. Written informed consent for the publication of this case report was obtained from the patient.

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