PERSISTENT COMPROMISED HEMODYNAMIC FUNCTION, DUE TO SINGLE VENTRICULAR EPICARDIAL PACING, AFTER AORTIC VALVE REPLACEMENT SURGERY: A CASE REPORT

Konstantinos Giakoumidakis[*,1] **and Christos Charitos**[**]

[*]Cardiac Surgery Intensive Care Unit, "Evangelismos" General Hospital of Athens, 45-47 Ipsilantou Street, 10646, Athens, Greece., [**]Cardiothoracic Surgery Department, "Evangelismos" General Hospital of Athens, 45-47 Ipsilantou Street, 10646, Athens, Greece.

ABSTRACT

We report the case of a 69-year-old woman, who was admitted to the cardiac surgery intensive care unit (ICU) of a tertiary hospital, after surgical aortic valve replacement, due to severe aortic stenosis. During the early postoperative period, the patient was hemodynamically stable, and temporary epicardial ventricular pacing supported her cardiac rhythm. One hour after her ICU admission, the woman presented compromised hemodynamics, characterized by severe hypotension with poor response to aggressive inotropic, vasopressor and fluid therapy. After 15 minutes of her significant clinical worsening, the change of the pacing mode from single ventricular to single atrial effected immediate hemodynamic stabilization, improved arterial blood pressure and optimum patient cardiovascular function. This could be explained by the significantly reduced cardiac output in the absence of atrial contraction to assist ventricular preloading, which characterized some patients with impaired ventricular function, as those with severe aortic stenosis.

KEYWORDS Aortic valve replacement, Aortic valve stenosis, Atrial pacing, Epicardial pacing, Postoperative care.

Introduction

Epicardial pacing is very common after open-heart procedures through atrial and/or ventricular pacing wires placement. [1,2] Although, historically, epicardial pacing wire electrodes were placed only in the right ventricle, [2] during the last decades, the placement of two temporary right atrial and two right ventricular epicardial wires consists the usual practice among cardiac surgical patients. [1] The temporary epicardial pacing of patients undergoing cardiac surgery has both diagnostic and therapeutic indication and value. [1] Through atrial pacing wires, clinicians can record atrial activity in unipolar and bipolar modes. [1] On the other hand, the therapeutic value of temporary epicardial pacing lies on the hemodynamic function optimization, the termination of reentrant rhythms by rapid pacing and the effective treatment of common electrophysiological abnormalities, which are often presented, intra and postoperatively, among open-heart surgical patients, such as prolonged atrioventricular (AV) delay, AV block, disfasicular block, AV junctional tachycardia, reentrant ventricular tachycardia, atrial flutter and sinus bradycardia. [1,2] Additionally, the temporary epicardial pacing could prevent the onset of atrial fibrillation postoperatively, which is a common complication after cardiac surgery. [1,2] Thus, clinicians should individualize their care, applying single atrial, single ventricular or AV temporary pacing, based on specific criteria and clinical indications. [3,4]

DOI:10.5455/ijsm.aortic-valve-replacement-surgery
First Received: August 03, 2016
Accepted: August 18, 2016
Manuscript Associate Editor: George Baytchev (BG)
Editor-in Chief: Ivan Inkov (BG)
Reviewers: Yoshihisa Morimoro (JP)
[1]Konstantinos Giakoumidakis, Cardiac Surgery Intensive Care Unit, "Evangelismos" General Hospital of Athens, 45-47 Ipsilantou Street, 10646, Athens, Greece, Email: kongiakoumidakis@gmail.com

Case report

A 69-year-old woman was admitted to the cardiac surgery intensive care unit (ICU) of one tertiary, general hospital of Athens-Greece, after open-heart aortic valve replacement due to symptomatic severe aortic stenosis. During the early postoperative period, the patient was mechanically ventilated and under sedation with a propofol infusion (25μg/kg/min). Her cardiovascular function was supported with an inotropic (dobutamine, 4μg/kg/min) and a vasopressor (norepinephrine, 1.1 μg/kg/min) agent, according to the protocol of our center. Additionally, although two temporary right atrial and two right ventricular epicardial wires had been placed, the patient's cardiac rhythm was supported through single ventricular temporary pacing.

During the first postoperative hour the patient remained hemodynamically stable, with optimum cardiovascular function and the following signs: arterial blood pressure (active / mean) of 120/68/85 mmHg, central venous pressure (CVP) of 7 mmHg, paced heart rhythm of 90 beats/min and body temperature of 36.1 oC. Additionally, a twelve-lead electrocardiogram (ECG) was performed, without pacing supporting, which had the appearance of sinus bradycardia (50 beats/min).

Suddenly, the patient developed clinical worsening and compromised hemodynamic status with severe hypotension (Systolic/diastolic arterial blood pressure of 75/45 mmHg) with poor response to aggressive treatment, including both the significant increase of inotropic and vasopressor support and the infusion of intravenous fluids. There were no signs of mediastinal bleeding and her CVP remained unchangeable (7 mmHg). After 15 minutes, with poor response to the above interventions, we decided to change the pacing mode from single ventricular to single atrial. Immediately, a significant improvement it was observed on patient hemodynamics, without the need of increasing inotropic and vasopressor infusion. Specifically, the woman regained normal arterial blood pressure of 125/75 mmHg, and her CVP occurred a small decrease (6 mmHg). A twelve-lead ECG was recording, without pacing support, indicating sinus bradycardia (50 beats/min). The intervention mentioned above led to the immediate optimization of the patient cardiovascular status and her hemodynamic stabilization.

Discussion

Temporary epicardial pacing is a common practice after the completion of open-heart surgery aiming to achieve the optimum cardiovascular management of cardiac surgery patients through the immediate treatment of many electrophysiological abnormalities, some of them could even lead to life-threatening conditions. [2] Our patient developed hemodynamic instability and persistent compromised cardiovascular function with poor response to our pharmaceutical interventions. The change of the temporary epicardial pacing mode, from single ventricular to single atrial, achieved an immediate improvement on patient hemodynamics, with no need for more aggressive inotropic, vasoactive and fluid therapy. Some patients, mainly those with impaired ventricular function, reduced ventricular compliance and low ejection fraction, as occurs in patients with severe aortic stenosis, have a significantly reduced cardiac output in the absence of atrial contraction to assist ventricular preloading. [2, 5-7] Additionally since AV delay is often prolonged after open-heart surgery, shortening it artificially using AV pacing can improve patient hemodynamics. [1] The literature review reveals that cardiac surgery patients have superior hemodynamics and cardiac output with atrial or AV pacing compared to single ventricular pacing. [1] Other recent studies have examined the potential benefit of bi-ventricular pacing among patients with reduced ventricular function and concluded to hopeful findings, including improved hemodynamics due to this pacing mode. [8-10]

Conclusion

Single ventricular temporary epicardial pacing could be harmful to many patients after the completion of a cardiac surgery procedure causing, rarely, compromised patient hemodynamics, with poor response to pharmaceutical measures. Patients with impaired ventricular function are needed single atrial or AV temporary epicardial pacing to achieve improved cardiac output and superior cardiovascular function. The effective atrium contraction, as the result of the atrium or AV pacing, assists the ventricular preloading and finally ensures the optimum ventricular function. The knowledge of this rare condition by the cardiothoracic nurses is paramount and could lead to the early recognition of this abnormality, eliminating life-threatening conditions. Moreover, nurses can perform measures for complications associated with the inappropriate patient pacing mode and the rapid improvement of the cardiac surgery patient clinical condition. The selection of the optimum temporary pacing mode is a simple, safe, non-pharmaceutical and cost-effective independent nursing intervention, which contributes to the evidence-based postoperative management of the cardiac surgical patient.

Disclosure Statement

There were no financial support or relationships between the authors and any organization or professional bodies that could pose any conflict of interests.

Competing Interests

Written informed consent obtained from the patient for publication of this case report and any accompanying images.

References

1. Bojar BM. Manual of perioperative care in adult cardiac surgery. 5th edn. Wiley – Blackwell, 2011.

2. Reade MC. Temporary epicardial pacing after cardiac surgery: a practical review: part 1: general considerations in the management of epicardial pacing. Anaesthesia 2007; 62:264-271.

3. Hurlé A, Gómez-Plana J, Sánchez J, Martínez JG, Meseguer J, Llamas P. Optimal location for temporary epicardial pacing leads following open heart surgery. Pacing Clin Electrophysiol 2002; 25:1049-1052.

4. Reade MC. Temporary epicardial pacing after cardiac surgery: a practical review. Part 2: Selection of epicardial pacing modes and troubleshooting. Anaesthesia 2007; 62:364-373.

5. Curtis JJ, Maloney JD, Barnhorst DA, Pluth JR, Hartzler GO, Wallace RB. A critical look at temporary ventricular pacing following cardiac surgery. Surgery 1977; 82:888-893.

6. Curtis J, Walls J, Boley T, Reid J, Flaker G, Madigan N, et al. Influence of atrioventricular synchrony on hemodynamics in patients with normal and low ejection fractions following open heart surgery. Am Surg 1986; 52:93-96.

7. Broka SM, Ducart AR, Collard EL, Eucher PM, Jamart J, Delire VR, et al. Hemodynamic benefit of optimizing atrioventricular delay after cardiopulmonary bypass. J Cardiothorac Vasc Anesth 1997; 11:723-728.

8. Dzemali O, Bakhtiary F, Israel CW, Ackermann H, Moritz A, Kleine P. Impact of different pacing modes on left ventricular function following cardiopulmonary bypass. Thorac Cardiovasc Surg 2008; 56:87-92.

9. Muehlschlegel JD, Peng YG, Lobato EB, Hess PJ Jr, Martin TD, Klodell CT Jr. Temporary biventricular pacing post-cardiopulmonary bypass in patients with reduced ejection fraction. J Card Surg 2008; 23:324-330.

10. Vaughan P, Bhatti F, Hunter S, Dunning J. Does biventricular pacing provide a superior cardiac output compared to univentricular pacing wires after cardiac surgery? Interact Cardiovasc Thorac Surg 2009; 8:673-678.