Proposal for bail-out procedures - Arrhythmia

Rescue peri-operative management of the patient with giant electrical storm and severe left ventricular dysfunction: support by levosimendan and intraaortic balloon counterpulsation

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Abstract

We present a case of a 62-year-old male patient (coronary heart disease, and stenosis of aortic valve) with severe left ventricular dysfunction (left ventricular ejection fraction 20%, left ventricular end-diastolic diameter 80 mm, end-diastolic volume 329 ml) who developed giant electrical storm (on the whole 115 episodes of pulseless ventricular tachycardia treated by antiarrhythmics and electrical discharges) with low-elevation of cardiac biomarkers. The patient was referred to emergent cardiac surgery (double coronary bypass grafting, aortic valve replacement, and implantation of left ventricular epicardial electrode). Levosimendan and intraaortic balloon counterpulsation were used for successful weaning from the cardiopulmonary bypass; no other arrhythmia appeared in the post-bypass period. Postoperatively no arrhythmic events were detected, and repeated echocardiographic examinations of the patient in good general condition showed gradual improvement of left ventricular ejection fraction (30–35%), likewise in other parameters (left ventricular end-diastolic diameter 72 mm, end-diastolic volume 285 ml).

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Keywords: Electrical storm; Open-heart surgery; Impaired ventricular function; Levosimendan; Intraaortic balloon pump

1. Introduction

Electrical storm is defined as the occurrence of three or more separate episodes of ventricular tachycardia (VT) or fibrillation within a 24 h period [1]. Repeated episodes of VT with low-level elevation in cardiac biomarkers are reported in patients with coronary artery disease in the situation, when myocardial metabolic demands exceed its actual supply [2]. Especially patients with severe left ventricular dysfunction have an increased mortality risk due to these arrhythmic disorders [3].

2. Case description

Our patient, a 62-year-old male, had an old history of myocardial infarction (unknown localization) 18 years ago; from that time he was without any angina symptoms. Presently, during exhausting home work he collapsed (presumably cardio-respiratory arrest) and was successfully resuscitated by his wife according to the instructions of the emergency service phone operator. After that he was admitted to our cardiological department in good general condition and in full consciousness. On examination, echocardiography showed poor left ventricular ejection fraction (20% with diffuse hypokinesis and dilatation of the chamber – left ventricular end-diastolic diameter 80 mm, end-diastolic volume 329 ml) (Video 1) and calcified aortic valve with stenosis (aortic valve area 0.9 cm², maximal gradient 27 mmHg, mean gradient 19 mmHg). Coronarography showed focal stenosis (70%) of the left anterior descending coronary artery, 80% stenosis on the diagonal ramus and chronic occlusion in the proximal part of the right coronary artery and of the circumflex artery (Fig. 1). Ventriculography was in agreement with echocardiography conclusions. The haemodynamically stable patient with sinus rhythm and no myocardial enzyme elevations (troponin I <0.2 μg/l) started to be prepared for cardiac surgery (infectious focus examination before planned valve replacement).

On the 7th day of in-department stay, arrhythmic instability occurred with 15 episodes of sustained pulseless VT treated by electric shocks, and amiodarone continuous infusion. The patient was intubated and sedation with artificial lung ventilation was established. Myocardial enzyme levels were hereafter low (troponin I =0.42 μg/l) and echocardiography finding remained unchanged. During the night, arrhythmic instability faded into the giant elec-
Mechanical valve problems were unexpectedly prolonged by surgical technique (dial electrode diography). Solution of left coronary artery, vena cava – marginal artery bypass grafting lasting 360 min, cardiopulmonary bypass time 205 min, aortic clamp time 146 min was as follows: double coronary artery bypass grafting (left internal thoracic artery – left anterior descending coronary artery, vena – marginal ramus), aortic valve replacement (Sorin Biomedica 23 mm mechanical valve), and implantation of permanent epicardial electrode (Biotronik) to the left ventricle. Procedure times were unexpectedly prolonged by surgical technique problems (repeated paravalvular leak verified by echocardiography). A repeated dose of cold crystalloid cardioplegic solution (St. Thomas) was used during the cardiac arrest. The weaning from the cardiopulmonary bypass was ideally facilitated with the support of an intraaortic balloon pump. Sinus rhythm was restored spontaneously and no arrhythmia appeared in the post-bypass period. The patient required only minimal vasopressor treatment by continuous nor-epinephrin (0.05 μg/kg/min) to maintain adequate blood pressure.

The postoperative course was uncomplicated as well. The patient was extubated on postoperative day (POD) 1; intraaortic balloon pump support was terminated on POD 3. Continuous infusion of levosimendan was stopped 15 h after the end of surgery, and the next day the administration of a small continuous dose of metoprolol was started. No other arrhythmic events were detected, and repeated echocardiographic examinations showed gradual improvement of left ventricular ejection fraction (30–35%), likewise in other parameters (left ventricular end-diastolic diameter 72 mm, end-diastolic volume 285 ml).

The patient was discharged from the intensive care unit on POD 6, and on POD 9 he was transferred back to the cardiological department for the completion of postoperative rehabilitation and the implantation of biventricular pacing cardioverter.

3. Discussion

Due to the time pressure in the situation of severe rhythmic instability, precise electrophysiological examination was not realized but we assumed that the main trigger of VT was myocardial ischaemia in combination with pressure overloaded dysfunctional left ventricle due to severe coronary heart disease and aortic stenosis, even though cardiac biomarkers remained on low-levels. The peri-operative course of the patient proved us right.

For fear of pro-arrhythmogenic potential of other inotropic agents we decided to use a relatively new calcium-sensitizer levosimendan and intraaortic balloon counterpulsation as the only inotropic support for the patient with severe left ventricular dysfunction [4, 5]. For the same reason, a Swan-Ganz catheter was not introduced and the haemodynamics were managed by fairly frequent echocardiography.

We suppose that the inotropic and vasodilatory actions of levosimendan (without or with a minimum increase in myocardial oxygen demand) and its plausible improvement of stunned myocardium were beneficial to the patient with a seriously impaired ventricular function in a life-threatening condition caused by severe electrical instability. The persisting active long-acting metabolite of levosimendan helped the patient break through the critical days of the early postoperative period [6]. To the best of our knowledge, there are no data in the available literature referring to the use of levosimendan in the event of an electrical storm. In conclusion, we present the combination of levosimendan and intraaortic balloon counterpulsation as a feasible bail-out approach.

References


