SURVIVAL AGAINST THE ODDS – ECMO IN POSTCARDIOTOMY CARDIOGENIC SHOCK

PREŽIVLJAVANJE UPRKOS SVEMU – EKMO U POSTKARDIOTOMIJSKOM KARDIOGENOM ŠOKU

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Case report
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Abstract

Introduction. Postcardiotomy cardiogenic shock is a severe complication of cardiac surgery, often requiring mechanical circulatory support and associated with high mortality. We present a case illustrating the complex management of biventricular failure, atrial fibrillation, and ischemic cardiomyopathy from emergency admission to surgical recovery. **Case Report**. A 67-year-old man presented with dyspnoea, hypotension, and facial and peripheral oedema. Echocardiography revealed severe biventricular dysfunction with a left ventricular ejection fraction of 15%, right ventricular failure, and severe tricuspid regurgitation. On admission, he developed atrial fibrillation, managed with inotropes, diuretics, and cautious rate control. Diagnostic work-up revealed multivessel coronary and significant carotid artery disease. The patient underwent urgent triple coronary artery bypass grafting, tricuspid annuloplasty, left carotid endarterectomy, box pulmonary vein isolation, and left atrial appendage occlusion. Intraoperatively, refractory cardiogenic shock necessitated veno-arterial extracorporeal membrane oxygenation with left ventricular venting. Mechanical circulatory support was successfully weaned after three days as cardiac function improved. Postoperative recovery was complicated by *Clostridioides difficile* enterocolitis and fungal pneumonia. He was discharged on postoperative day 36, and at six months remained clinically stable with improved functional capacity. **Conclusion**. This case underscores the importance of a multidisciplinary approach in managing complex cardiac patients. Early hemodynamic assessment, individualized therapy, and timely initiation of extracorporeal membrane oxygenation were critical to survival. In this setting, extracorporeal membrane oxygenation proved to be an effective bridge to recovery, emphasizing its value in select high-risk cases of postcardiotomy cardiogenic shock.

Key words: Shock, Cardiogenic; Thoracic Surgery; Cardiac Surgical Procedures; Extracorporeal Membrane Oxygenation; Extracorporeal Circulation; Risk Factors; Treatment Outcome

Sažetak

Uvod. Postkardiotomijski kardiogeni šok je ozbiljna komplikacija nakon kardiohirurških intervencija, koja često zahteva mehaničku cirkulatornu podršku i povezana je sa visokom smrtnošću. Ovaj prikaz slučaja ilustruje složeno lečenje biventrikularne slabosti, atrijalne fibrilacije i ishemijske kardiomiopatije od hitnog prijema do oporavka nakon operacije. **Prikaz slučaja.** Muškarac star 67 godina primljen je u urgentni centar sa dispnejom, hipotenzijom, otokom lica i ekstremiteta. Ehokardiografijom je utvrđena teška biventrikularna disfunkcija, sa ejekcionom frakcijom leve komore od 15%, insuficijencijom desne komore i teškom trikuspidalnom regurgitacijom. Pri prijemu je razvijena atrijalna fibrilacija, koja je lečena inotropima, diureticima i pažljivom kontrolom frekvencije. Dijagnostika je pokazala višesudovnu koronarnu bolest i značajnu stenozu karotida. Pacijent je hitno operisan: urađena je trostruka aortokoronarna bajpas operacija, anuloplastika trikuspidalne valvule, endarterektomija leve karotidne arterije, izolacija plućnih vena i okluzija apendiksa leve pretkomore. Tokom operacije razvio se refraktarni kardiogeni šok koji je zahtevao veno-arterijsku ekstrakorporalnu membransku oksigenaciju sa ventingom leve komore. Mehanička cirkulatorna podrška je uklonjena nakon tri dana, kada je došlo do poboljšanja srčane funkcije. Postoperativni tok bio je komplikovan enterokolitisom izazvanim *Clostridioides difficile* i gljivičnom pneumonijom. Pacijent je otpušten iz bolnice 36. postoperativnog dana i šest meseci kasnije je bio stabilan, sa poboljšanom funkcionalnom sposobnošću. **Zaključak.** Ovaj prikaz slučaja ističe značaj multidisciplinarnog pristupa u lečenju kompleksnih kardioloških pacijenata. Rano hemodinamičko procenjivanje, individualizovana terapija i pravovremena primena ekstrakorporalne membranske oksigenacije bile su ključne za preživljavanje. Ekstrakorporalna membranska oksigenacija se pokazala kao efikasan most ka oporavku u slučajevima postkardiotomijskog kardiogenog šoka, što naglašava njegov značaj u selektovanim visokorizičnim slučajevima.

Ključne reči: kardiogeni šok; grudna hirurgija; kardiološke hirurške procedure; ekstrakorporalna oksigenacija; ekstrakorporalna cirkulacija; faktori rizika; ishod lečenja

Introduction

Cardiogenic shock is defined by the International Society for Heart and Lung Transplantation/Heart

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Abbreviations

SCAI	– Society for Cardiovascular Angiography and Interventions
POCUS	– point of care ultrasonography
LV	– left ventricular
LVEF	– left ventricular ejection fraction
VTI	– velocity time interval
ECMO	– extracorporeal membrane oxygenation
RSPV	– right superior pulmonary vein
MCS	– mechanical circulatory support

Failure Society of America guideline on acute mechanical circulatory support as a state of tissue hypoperfusion and end-organ dysfunction caused by a primary cardiac disorder with reduced cardiac output. It may present in different stages, as categorized by the Society for Cardiovascular Angiography and Interventions (SCAI) [1,2]. Despite advances in therapy, cardiogenic shock remains a highly fatal and morbid syndrome arising from various cardiovascular conditions. With the growing burden of cardiovascular disease in an aging population, the prevalence of both low cardiac output syndrome and its most severe manifestation – cardiogenic shock – is expected to rise [3]. Physicians across emergency medicine, cardiology, intensive care, and cardiac surgery are therefore increasingly confronted with such patients.

The management aims to restore perfusion and stabilize oxygen delivery to prevent multi-organ dysfunction. This typically involves a stepwise and coordinated approach with volume optimization, diuretics, inotropes, vasopressors and vasodilators [3]. The benefit of levosimendan in this setting remains controversial [4–6]. When medical and surgical interventions fail to achieve hemodynamic stability, mechanical circulatory support (MCS) becomes necessary [7].

We report the case of an adult male with cardiogenic shock, initially managed in the emergency department, subsequently treated in a cardiac surgery unit, and ultimately discharged home following recovery.

Case Report

Patient History and Presentation

A 67-year-old male with a history of hyperlipidaemia and right-sided femoropopliteal bypass presented with bilateral leg oedema, ascites, tachypnoea, and dyspnoea. The dyspnoea occurred both in the supine position and on exertion, accompanied by a sensation of choking, but improved when seated. He also reported several months of progressive decline, a dry cough, and recent dizziness.

On admission, he was relatively hypotensive (100/68 mmHg), tachycardic, and tachy-dyspnoeic. Clinical examination revealed bilateral heart failure, including facial and tongue oedema, dilated jugular veins, and bilateral inspiratory crackles and expiratory wheezing. Breath sounds were absent over the right lower lung field. His abdomen was distended but non-tender, and both lower extremities were swollen below the knees. The patient was obese with a body mass index of 36.6.

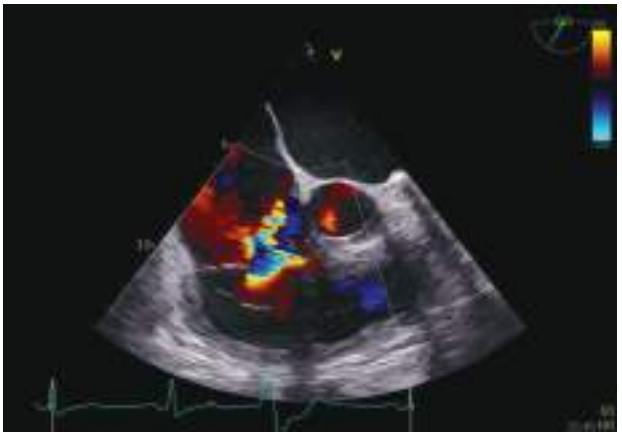

Figure 1. Ultrasound showing severe tricuspid regurgitation

Diagnosis and Intervention

Electrocardiography showed sinus tachycardia at 114 bpm with Q waves in precordial leads V1-3 and low-amplitude T waves in aVL.

Point-of-care ultrasonography (POCUS) in the emergency department revealed a reduced left ventricular ejection fraction of 15%, degenerative changes in the aortic valve, and diminished function of the right ventricle with severe tricuspid regurgitation, later confirmed on transoesophageal echocardiography **(Figure 1).** Fluid status showed dilated inferior vena cava with minimal respiratory modulation, and right-sided pleural effusion **(Figure 2)** with B-profile in multiple lung zones including both-sided anterior

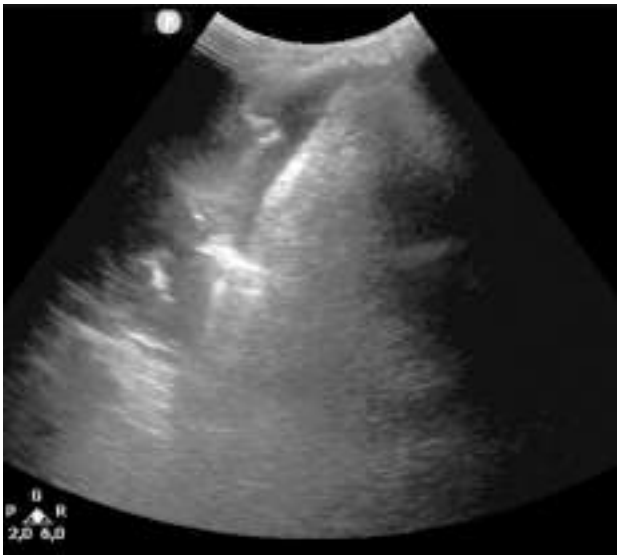

Figure 2. Echo of right pleural effusion on admission

Figure 4. Computed tomography scan revealing significant bilateral carotid stenoses

axillary line and free fluid in the abdomen. The X-ray confirmed a right pleural effusion. Laboratory analyses revealed an elevated serum N-terminal pro b-type natriuretic peptide level of 3863 ng/L.

The patient was started on continuous intravenous furosemide followed by dobutamine. Transient non-invasive positive pressure ventilation was used for respiratory support. During treatment, he developed atrial fibrillation with a rapid ventricular response of 188 bpm, for which amiodarone and therapeutic-dose low molecular weight heparin were initiated.

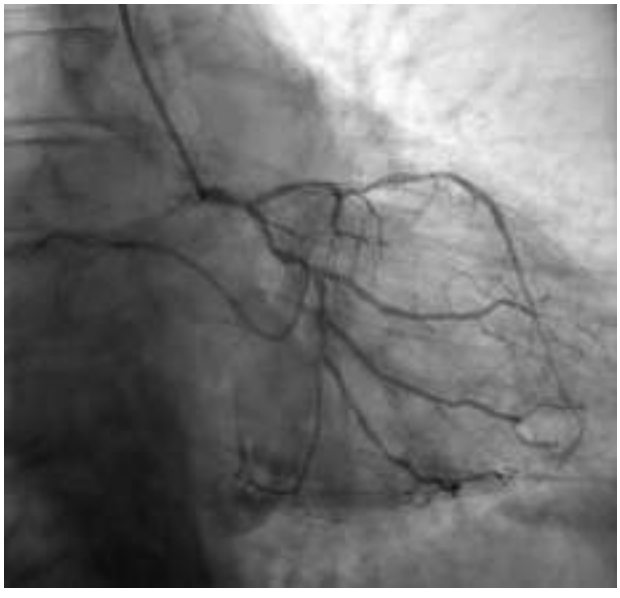

Figure 3. Coronary artery angiogram showing significant left main stenosis, subtotal LAD, and several circumflex stenoses

Coronary angiography demonstrated severe obstructive three-vessel coronary disease, with >50% left main stenosis and an occluded right coronary artery **(Figure 3).** Myocardial perfusion scintigraphy showed non-viable apex and lower half of the septum. Computed tomography angiography identified a subtotal stenosis of the left internal carotid with an 80% stenosis of the right internal carotid artery **(Figure 4).**

After stabilization and diagnostics, the patient underwent triple coronary artery bypass grafting, left carotid endarterectomy, tricuspid annuloplasty, radiofrequency ablation, and left atrial appendage occlusion. Weaning from cardiopulmonary bypass was complicated by refractory cardiogenic shock (LVEF 5%, (velocity time interval (VTI) 8 cm), requiring initiation of extracorporeal membrane oxygenation (ECMO) with left ventricular (LV) venting via the right superior pulmonary vein (RSPV). He required high-dose continuous inotropic support (epinephrine, milrinone, dobutamine) and vasopressors (norepinephrine, vasopressin). After 70 hours, ECMO was safely removed following improved LV function (LVEF 25%, VTI 12 cm). Postoperatively, recovery was prolonged due to *Clostridioides difficile* enterocolitis and *Candida parapsilosis* pneumonia **(Figure 5).**

Outcome

The patient was discharged on postoperative day 36. At six-month follow-up, he remained clinically stable with improved functional capacity and was managed on an outpatient basis.

Conclusion

This case report underscores the multifaceted challenges encountered in the emergency and surgi-

Figure 5. Postoperative chest X-ray confirming diffuse bilateral pulmonary infiltrates

cal management of postcardiotomy cardiogenic shock, highlighting extracorporeal membrane oxygenation as a life-saving intervention [2,7,8]. The patient presented with severe biventricular failure and multi-organ dysfunction (Society for Cardiovascular Angiography and Interventions stage B (1)), necessitating a complex sequenced combination of medical, interventional, and surgical therapies.

From an emergency medicine perspective, this case emphasized the pivotal role of early echocardiographic assessment in guiding acute management, including the initiation of non-invasive positive pressure ventilation and continuous infusion diuretics [9]. The occurrence of tachycardic atrial fibrillation in a patient with ischemic cardiomyopathy illustrated a critical therapeutic dilemma – balancing rate control, hemodynamic support, and anticoagulation without exacerbating hypotension or further impairing cardiac output [10].

The surgical phase highlights the extreme risk posed by concomitant multivessel coronary artery disease and valvular pathology in the context of profound hemodynamic instability. The patient's estimated morbidity & mortality risk according to the Society of Thoracic Surgeons score was 70%, with a 60% likelihood of prolonged ventilation estimation and a 45% probability of hospital stay exceeding 14 days. The necessity of performing coronary artery bypass grafting, tricuspid valve repair, ablation, and left atrial appendage occlusion in a single procedure reflects the complexity of perioperative management at Society for Cardiovascular Angiography and Interventions stage D (1). The use of extracorporeal membrane oxygenation for refractory postcardiotomy shock demonstrates its evolving role in cardiac surgery and critical care, serving as an effective bridge to recovery while mitigating low cardiac output syndrome. Importantly, our institution has recently updated our left ventricular unloading technique from concomitant intra-aortic balloon pump [11] to right superior pulmonary vein vent placement.

Postoperative complications – including *Clostridioides difficile* enterocolitis, fungal pneumonia, and the need for prolonged rehabilitation – further illustrate the vulnerability of this patient population [12]. Nevertheless, the patient's successful discharge and six-month clinical stability underscore the value of multidisciplinary collaboration, timely mechanical circulatory support initiation, and structured long-term follow-up [13].

A recently proposed dynamic scoring tool, the Houston Severity, Hemodynamics, Onset, Causes, and Kinetics Score, integrates temporal changes in cardiogenic shock severity [14]. In our patient, the score was 2 at emergency department presentation – prompting escalation of management – and later increased to 3 perioperatively, indicating the need for urgent mechanical circulatory support. We found the Houston Severity, Hemodynamics, Onset, Causes, and Kinetics Score to be a practical, intuitive, and clinically useful framework for guiding decision-making in critically ill patients [14].

This case serves as an exemplary reference for managing high-risk cardiac surgical patients, and underscores the need for further research into optimal perioperative hemodynamic support strategies to improve survival outcomes in this complex population.

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