

## Venoarterial Extracorporeal Membrane Oxygenation Postcardiotomy in Adult Patients

**Youssef Ettaoumi<sup>1\*</sup> and Elmrabet Rida<sup>2</sup>**

<sup>1</sup>Professor, Cardiovascular Surgery Department, Ibn Rochd University Hospital of Casablanca, Morocco

<sup>2</sup>Cardiovascular Surgeon Department, Ibn Rochd University Hospital of Casablanca, Morocco

**\*Corresponding Author:** Youssef Ettaoumi, Professor, Cardiovascular Surgery Department, Ibn Rochd University Hospital of Casablanca, Morocco.

**Received:** October 09, 2020; **Published:** December 31, 2020

### Abstract

Extra-corporeal membrane oxygenation remains the last resort in keeping patients alive in those with profound cardiogenic shock following open surgery on the heart for adult patients. No guidelines exist on the management of patients on such a device despite a high mortality. We attempt to highlight some universal principles that would be relevant to the current practice of those exposed to this challenging field.

**Keywords:** Extra-Corporeal Membrane Oxygenation; Postcardiotomy; Cardiac Surgery

### Introduction

Cardiogenic shock after cardiac surgery may occur because of preoperative depressed ventricular function, intraoperative myocardial injury, incomplete coronary revascularization, myocardial stunning or hibernation, and technical factors [1,2].

High-dose inotropic support is the main treatment strategy for postcardiotomy cardiogenic shock. When postcardiotomy cardiogenic shock is unresponsive to pharmacologic treatment, intraaortic balloon pump (IABP) is considered a valid adjunctive tool to improve cardiac performance by reducing cardiac afterload and improving coronary artery flow.

However, IABP does not replace the cardiopulmonary function and short term mechanical circulatory support using a ventricular assist device or venoarterial extracorporeal membrane oxygenation (VA-ECMO) is the only salvage therapy for patients with severe postoperative cardiac failure [1,3,4]. However, in this setting VA-ECMO seems to be the treatment of choice because it provides both circulatory and pulmonary support and is less expensive than ventricular assist devices [5]. The aim of this study was to pool the available data on VA-ECMO after adult cardiac surgery, to evaluate the early and intermediate outcome and identify any risk factor contraindicating its use in these critically ill patients.

### Epidemiology

The incidence of postcardiotomy myocardial dysfunction is as high as 3% to 5% among patients receiving routine cardiac surgical procedures. The majority of those patients can be weaned from cardiopulmonary bypass using inotropic drugs or intraaortic balloon counter pulsation. However approximately 1% require prolonged postoperative circulatory support owing to refractory cardiac and or pulmonary dysfunction [6].

Doll N., *et al.* in their series of 219 patients, ECMO was used for 119 patients after isolated coronary artery bypass grafting, 21 after coronary artery bypass grafting and aortic valve replacement, 24 after isolated aortic valve replacement, 11 after coronary artery bypass grafting and mitral valve surgery and 44 included patients undergoing mitral valve operation (9), pulmonary embolectomy (6), repair of acute aortic dissection (5), aortic aneurysm repair (7), double valve replacement (6), heart transplantation (4), postinfarction ventricular septal defect closure (3), tricuspid valve repair and pulmonary valve replacement (2), pericardiectomy (1), and coronary artery bypass grafting with endoventricular resection of left ventricular aneurysm (1) [6].

Isolated coronary artery bypass grafting	(119)
Coronary artery bypass grafting and aortic valve replacement	(21)
Isolated aortic valve replacement	(24)
Coronary artery bypass grafting and mitral valve surgery	(11)
Mitral valve operation	(9)
Pulmonary embolectomy	(6)
Repair of acute aortic dissection	(5)
Aortic aneurysm repair	(7)
Double valve replacement	(6)
Heart transplantation	(4)
Postinfarction ventricular septal defect closure	(3)
Tricuspid valve repair and pulmonary valve replacement	(2)
Pericardiectomy	(1)
Coronary artery bypass grafting with endoventricular resection of left ventricular aneurysm	(1)

**Table:** The different cardiac surgery required temporary postoperative ECMO support [6].

## Results

F Biancari, *et al.* identified in a meta-analysis thirty-one studies reported on 2986 patients (mean age, 58.1 years) who required post-cardiotomy VA-ECMO. The weaning rate from VA-ECMO was 59.5% and hospital survival was 36.1%.

The pooled rate of reoperation for bleeding was 42.9%, major neurological event 11.3%, lower limb ischemia 10.8%, deep sternal wound infection/mediastinitis 14.7% and renal replacement therapy 47.1%. The mean stay in the intensive care unit was 13.3 days. Survivors were significantly younger (mean, 55.7 vs. 63.6 years). One-year survival rate was 30.9% [7].

N Doll identified in a study including 219 patients, the mean duration of ECMO support was 2.8 - 2.2 days. One hundred thirty-four patients (60%) were successfully weaned from ECMO. Of these, 52 patients (24%) were discharged from the hospital after 29.9 - 24 days. The main cause of death was myocardial failure. Five-year follow-up is 96% complete; 37 patients (74%) were alive with reasonable exercise capacity [6].

Hesham A., *et al.* in a series of 40,116 patients, 233(0.58%) adult cardiac surgery patients required postoperative venoarterial ECMO, and among these, 149 (64%) died in the hospital. In an unadjusted analysis, older age, higher preoperative albumin, diabetes history, coronary artery bypass graft surgery, and longer total cardiopulmonary bypass (CPB) time were associated with increased hospital mortality, and a history of cardiogenic shock was associated with decreased mortality [8].

### Factors influencing outcome

Ardawan JR concluded preoperative risk factors significantly influenced hospital outcome, only age older than 70 years (OR, 1.90; P = .022), diabetes (OR, 2.61; P = .001), and isolated coronary artery disease (OR, 0.56; P = .025) were significant in multivariate analysis.

Despite failure to reach statistical significance, there was a strong trend toward worse outcome among patients with additional tricuspid regurgitation greater than 2+, acute type A dissection, and combined aortic and mitral valve disease, whereas preoperative emergency status, preoperative acute myocardial infarction, and active mechanical resuscitation before ECMO implantation were not significant predictors for in-hospital death [9].

### Conclusion

Many studies were performed to analyze the outcome of temporary ECMO support for the indication of postcardiotomy shock. In this series, overall hospital survival was approximately 1/3 of patients.

Patients with isolated coronary artery bypass grafting had the best outcome, whereas high extracardiac morbidity and profound and ECMO-resistant postcardiotomy shock were significant risk factors for in-hospital mortality.

Because prognosis of patients undergoing ECMO for postcardiotomy shock depends significantly on the depth of postcardiotomy shock at implantation, it is wise not to wait too long when ECMO is a reasonable option. Long-term outcome of hospital survivors was relatively good. Because of the high morbidity, however, ECMO has to be considered on the basis of individual risk profile and underlying cardiac disease.

Because of the high device-related morbidity, further efforts have to be made to develop less traumatic devices, allowing fast and easy application for temporary circulatory support.

### Bibliography

1. Fukuhara S., *et al.* "Contemporary mechanical circulatory support therapy for postcardiotomy shock". *The General Thoracic and Cardiovascular Surgery* 64 (2016): 183-191.
2. Pieri M., *et al.* "Outcome of cardiac surgery in patients with low preoperative ejection fraction". *BMC Anesthesiology* 16 (2016): 97.
3. McCarthy FH., *et al.* "Trends in U.S. Extracorporeal membrane oxygenation use and outcomes: 2002-2012". *Seminars in Thoracic and Cardiovascular Surgery* 27 (2015): 81-88.
4. Ariyaratnam P., *et al.* "Extra-corporeal membrane oxygenation for the postcardiotomy patient". *Heart Failure Reviews* 19 (2014): 717-725.
5. Borisenko O., *et al.* "The cost impact of short-term ventricular assist devices and extracorporeal life support systems therapies on the National Health Service in the UK". *Interactive Cardiovascular and Thoracic Surgery* 19 (2014): 41-48.
6. Doll N., *et al.* "Five-year results of 219 consecutive patients treated with extracorporeal membrane oxygenation for refractory post-operative cardiogenic shock". *The Annals of Thoracic Surgery* 77 (2004): 151-157.
7. Fausto Biancari., *et al.* "Debra Brascia Meta-analysis of the outcome after postcardiotomy venoarterial extracorporeal membrane oxygenation in adult patients". *Journal of Cardiothoracic and Vascular Anesthesia* 32.3 (2018): 1175-1182.

8. Hesham A Elsharkawy., *et al.* "Outcome in Patients Who Require Venoarterial Extracorporeal Membrane Oxygenation Support After Cardiac". *Surgery Journal of Cardiothoracic and Vascular Anesthesia* 24.6 (2010): 946-951.
9. Ardawan Julian Rastan., *et al.* "Early and late outcomes of 517 consecutive adult patients treated with extracorporeal membrane oxygenation for refractory postcardiotomy cardiogenic shock". *The Journal of Thoracic and Cardiovascular Surgery* 139 (2010): 302-311.

**Volume 8 Issue 1 January 2021**

**All rights reserved by Youssef Ettaoumi and Elmrabet Rida.**