



ORIGINAL

Infections occurring in adult patients receiving mechanical circulatory support: The two-year experience of an Italian National Referral Tertiary Care Center*

M. Pieri^a, N. Agracheva^a, L. Fumagalli^b, T. Greco^a, M. De Bonis^c, M.C. Calabrese^c,
A. Rossodivita^c, A. Zangrillo^a, F. Pappalardo^{a,*}

^a Department of Cardiothoracic and Vascular Anesthesia and Intensive Care, Istituto Scientifico San Raffaele, Milan, Italy

^b Department of Infectious Diseases, Istituto Scientifico San Raffaele Turro, Milan, Italy

^c Department of Cardiac Surgery, Istituto Scientifico San Raffaele, Milan, Italy

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KEYWORDS

Extracorporeal membrane oxygenation;
Infection;
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Abstract

Objective: Infection during mechanical circulatory support is a frequent adverse complication. We analyzed infections occurring in this population in a national tertiary care center, and assessed the differences existing between the setting of extracorporeal membrane oxygenation (ECMO) and ventricular assist devices (VADs).

Design, setting, and participants: An observational study was made of patients treated with ECMO or VAD in the San Raffaele Scientific Institute (Italy) between 2009 and 2011.

Interventions: None.

Results: Thirty-nine percent of the 46 patients with ECMO and 69% of the 15 patients with VAD developed infection. We observed a mortality rate of 36.1% during mechanical circulatory support and of 55.7% during the global hospitalization period. Although Gram-negative infections were predominant overall, patients with ECMO were more prone to develop *Candida* infection (29%), and patients with VAD tended to suffer *Staphylococcus* infection (18%). Patients with infection had longer ECMO support ($p=0.03$), VAD support ($p=0.01$), stay in the intensive care unit ($p=0.002$), and hospital admission ($p=0.03$) than patients without infection.

Infection (regression coefficient=3.99, 95% CI 0.93–7.05, $p=0.02$), body mass index (regression coefficient=0.46, 95% CI 0.09–0.83, $p=0.02$), fungal infection (regression coefficient=4.96, 95% CI 1.42–8.44, $p=0.009$) and obesity (regression coefficient=10.47, 95% CI 1.77–19.17, $p=0.02$) were predictors of the duration of ECMO support. Stepwise logistic regression analysis showed the SOFA score at the time of implant (OR=12.33, 95% CI 1.15–132.36, $p=0.04$) and VAD (OR=1.27, 95% CI 1.04–1.56, $p=0.02$) to be associated with infection.

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* Corresponding author.

E-mail address: pappalardo.federico@hsr.it (F. Pappalardo).

PALABRAS CLAVE

Oxigenación con membrana extracorpórea; Infección; Dispositivos de asistencia ventricular

Conclusions: Infection is a major challenge during ECMO and VAD support. Each mechanical circulatory support configuration is associated with specific pathogens; fungal infections play a major role.

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Infecciones en pacientes adultos tratados con soporte circulatorio mecánico: la experiencia a dos años de remisión de un centro de atención terciaria italiano

Resumen

Objetivos: La infección es una complicación asociada habitualmente al soporte circulatorio mecánico. Analizamos las infecciones manifestadas en esta población en un centro de atención terciaria italiano y evaluamos las diferencias existentes entre la oxigenación con membrana extracorpórea (ECMO) y los dispositivos de asistencia ventricular (VAD).

Diseño, ámbito y participantes: Se llevó a cabo un estudio observacional de pacientes tratados con ECMO o VAD en el Instituto Científico de San Raffaele (Italia) entre 2009 y 2011.

Intervenciones: Ninguna.

Resultados: El 39% de los 46 pacientes tratados con ECMO y el 69% de los 15 pacientes tratados con VAD manifestaron una infección. Observamos una tasa de mortalidad del 36,1% durante el soporte circulatorio mecánico y del 55,7% durante el periodo de hospitalización global. Si bien en general las infecciones gramnegativas eran las predominantes, los pacientes con ECMO fueron más propensos a desarrollar infección por *Candida* (29%), mientras que los pacientes tratados con VAD tendieron a sufrir infección por *Staphylococcus* (18%). Los pacientes con infección recibieron más soporte con ECMO ($p=0,03$), más soporte con VAD ($p=0,01$), permanecieron durante más tiempo en la unidad de cuidados intensivos ($p=0,002$), y presentaron una tasa de ingreso hospitalario más elevada ($p=0,03$) que los pacientes que no sufrieron una infección.

Las infecciones (coeficiente de regresión = 3,99, IC del 95% 0,93-7,05, $p=0,02$), el índice de masa corporal (coeficiente de regresión = 0,46, IC del 95% 0,09-0,83, $p=0,02$), las infecciones micóticas (coeficiente de regresión = 4,96, IC del 95% 1,42-8,44, $p=0,009$) y la obesidad (coeficiente de regresión = 10,47, IC del 95% 1,77-19,17, $p=0,02$) fueron factores predictivos de la duración del soporte con ECMO. Un análisis de la regresión logística escalonada mostró que la puntuación SOFA en el momento del implante (OR = 12,33, IC del 95% 1,15-132,36, $p=0,04$) y de la terapia con VAD (OR = 1,27, IC del 95% 1,04-1,56, $p=0,02$) se asociaban a infecciones.

Conclusiones: La infección representa un reto importante durante el soporte con ECMO y VAD. Cada configuración del soporte circulatorio mecánico se asocia a patógenos específicos; las infecciones micóticas desempeñan un papel importante.

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Introduction

The development of extracorporeal support devices has been fueled by the need to treat critically ill patients failing all conventional therapeutic options. In the last years, evidence regarding their safety and feasibility has grown, and their impact on the improvement of survival has also been demonstrated.^{1,2}

In the setting of the intensive care unit, the most common types of extracorporeal support include extracorporeal membrane oxygenation (ECMO), and ventricular assist devices (VAD).

ECMO support is frequently percutaneous and not requiring surgery, but is associated with the need of bed riding, a larger exposure of blood to foreign surfaces, and, as it is used as a rescue therapy, with multiple organ damage. On the opposite, left VAD (LVAD) requires extensive surgery, and the tunneling of cannulas and drivelines through the chest of the patient. Furthermore, VAD is indicated in patients with preserved lung function, as the circuit does not include the

oxygenator. Intracorporeal VAD is indicated in patients who are candidates to receive heart transplant or as destination therapy. On the contrary, paracorporeal VAD is employed for patients who could experience myocardial recovery.

Since the first experiences with prolonged extracorporeal support, infection has been unanimously pointed out as one of the most frequent and adverse complications.³⁻⁵

Indeed, infections occurring on extracorporeal support are often difficult to treat, especially if they involve the foreign device. Moreover, few data are available on the distribution and the penetration of antibiotics on their surfaces.

As both ECMO and VAD are increasingly used as a bridge to further therapeutic options, including heart and lung transplants, the presence of infection, however, jeopardizes patient's eligibility to receive these therapies, with consequent poor prognostic implications.

Despite the heavy burden of infection, paradoxically, few definite criteria and guidelines have been developed for the prevention and management of this complication during

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