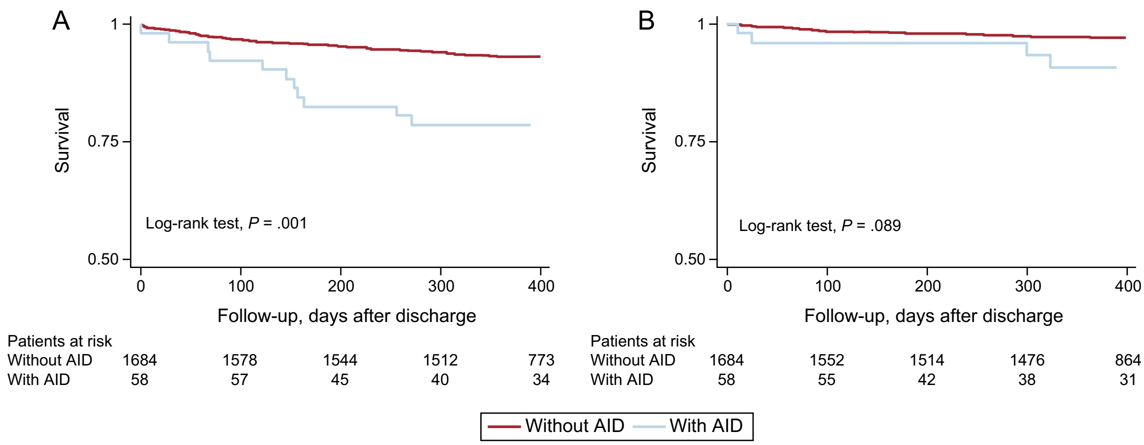

Figure. Kaplan-Meier curves. Overall mortality (A) and major bleeding (B) after discharge according to presence of autoimmune diseases (AID).

treatment and clinical presentation. These patients are also vulnerable to bleeding. Recently, it has been shown that a combination of traditional risk factors, atherosclerotic load, and extent of coronary artery disease can identify patients at long-term risk after ACS, but the predictive power is moderate.[5] The risk of long-term bleeding risk is, on the other hand, is only weakly predicted.[6] In view of our results, autoimmune disease may be considered a comorbidity that can help in general stratification of our patients after ACS.

Given the limited number of patients with autoimmune disease, we pooled them together for analysis, and therefore this population comprised a heterogenous group. Another limitation of the study is that the specific treatment was recorded on admission for ACS but not in the preceding years, which would have better reflected the temporal relationship.

Nuria Lozano Rivas,[a] Francisco J. Pastor-Pérez,[b,*] Pedro J. Flores-Blanco,[b] Carlos Marras Fernández-Cid,[a] Luis F. Linares,[a] and Sergio Manzano-Fernández[b]

[a]*Servicio de Reumatología, Hospital Clínico Universitario Virgen de la Arrixaca, El Palmar, Murcia, Spain*
[b]*Servicio de Cardiología, Hospital Clínico Universitario Virgen de la Arrixaca, El Palmar, Murcia, Spain*

* Corresponding author:
E-mail address: franpastor79@hotmail.com (F.J. Pastor-Pérez).

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Interhospital Transfer in Patients on ECMO Support. An Essential Tool for a Critical Care Network

Traslado interhospitalario en ECMO. Una herramienta imprescindible para la atención del paciente crítico en red

To the Editor,

Extracorporeal membrane oxygenation (ECMO) has proven effective for providing respiratory and circulatory support in patients with refractory cardiogenic shock or severe respiratory failure.[1] Formerly, this therapy was limited to certain tertiary hospitals performing transplants, but over the last few years, many centers have initiated ECMO programs. The development of new, more compact ECMO systems has enabled transport of critically ill patients in relative comfort, and in safer and more favorable hemodynamic conditions. The creation of mobile units with trained professionals that can provide on-site care, with stabilization and subsequent transfer to a specialized center, offers these patients a chance for survival.[2]

In October 2013, *Hospital Universitario de Salamanca* launched its ECMO program, which was extended to a mobile ECMO program starting in June 2014. We performed a retrospective analysis of patients hospitalized with ECMO support in our center. Since its implementation, 9 patients have undergone interhospital transfer with ECMO. The aim of this report was to evaluate the feasibility and safety of an interhospital transfer program using ECMO for critically ill patients. We describe the logistic problems, indications, and outcome of our series.

Our mobile ECMO program includes 2 scenarios. The first is transfer of a patient receiving ECMO from our hospital to a reference hospital for heart or lung transplant. In this case, the attending team is composed of a perfusionist, a physician, and a

Table

Demographic Characteristics, and Transport- and Outcome-related Variables in Included Patients

Patient	Sex	Age, y	Indication	Type of support	Access, cannula, Fr	Transfer	Distance, km	Time, min	Outcome	ECMO, days	Survived	Cause of death
1	M	62	Cardiogenic shock. Anterior AMI	VA-ECMO+IABC	RFV, 21; RFA, 19	Secondary	224	210	Explanted	9	No	Infection
2	M	55	Postcardiotomy shock	VA-ECMO+IABC	RFV, 21; RFA, 17	Secondary	224	200	Explanted	7	Yes	—
3	M	54	Arrhythmic storm	VA-ECMO+IABC	LFV, 21; LFA, 17	Secondary	224	190	Explanted	6	Yes	—
4	M	61	Postcardiotomy shock	VA-ECMO	RFV, 23; RFA, 17	Secondary	224	180	Explanted	9	Yes	—
5	M	55	Arrhythmic storm	VA-ECMO+IABC	RFV, 23; RFA, 17	Secondary	224	180	CTX list, urgency 0	12	No	Brain hemorrhage
6	M	61	Anterior AMI. Prolonged CRA	VA-ECMO+IABC	RFV, 23; RFA, 21	Secondary	202	140	Switch to BiVAD. CTX list, urgency 0	3	No	Brain hemorrhage
7	F	38	Cardiogenic shock. Anterior AMI	VA-ECMO	LFV, 21; LFA, 17	Secondary	202	130	Switch to BiVAD	4	Yes	—
8	F	27	ARDS due to influenza A in pregnancy	VV-ECMO	RFV, 23; LFV, 19	Primary	126	150	Required new cannulation	2	No	Bleeding
9	M	52	Cardiogenic shock. Anterior AMI	VA-ECMO+IABC	RFV, 23; LFA, 17	Primary	208	175	Explanted	8	Yes	—

AMI, acute myocardial infarction; ARDS, acute respiratory distress syndrome; BiVAD, biventricular assist device; CRA, cardiorespiratory arrest; CTX, cardiac transplant; F, female; IABC, intra-aortic balloon counterpulsation; LFA, left femoral artery; LFV, left femoral vein; M, male; RFA, right femoral artery; RFV, right femoral vein; VA-ECMO, venoarterial extracorporeal membrane oxygenation; VV-ECMO, venovenous extracorporeal membrane oxygenation.

nurse with extensive experience of ECMO. The second possibility is to transport a team to a center without an ECMO program, provide the care needed, and then transfer the patient to our center. In this scenario, the team additionally includes a physician experienced in cannulation, who could be a cardiologist or surgeon, depending on the type of support required. The response time in our program is $<$ 90 minutes from the decision to mobilize the team to its departure, and the service is permanently available, 365 days a year.

The vehicle used is an advanced life support ambulance, equipped with a CARDIOHELP system (MAQUET, Cardiopulmonary AG, Germany). Peripheral cannulation through femoral access is performed according to the Seldinger technique, using 17 to 21 Fr arterial cannulas and 21 to 29 Fr venous cannulas. Cannulation of the superficial femoral artery for distal limb perfusion is carried out using a 6 to 7 Fr catheter under Doppler ultrasound guidance. Implantation is controlled by transesophageal echocardiography. During transfer, patients are under sedation and pain medication and are connected to mechanical ventilation.

From October 2013 to August 2016, 9 critically ill patients (7 men and 2 women, mean age 51.7 $\pm$ 11.7 [range 27-62] years) required transfer on ECMO. In 2 cases, the team went to other centers for ECMO implantation and in the remaining cases, the patients were transferred from our hospital to centers performing cardiac transplantation. The patients' demographic characteristics and the reasons why circulatory/respiratory support was needed are summarized in Table. The most frequent indication was cardiogenic shock due to myocardial infarction in 4 patients (44.4%). Eight patients required venoarterial ECMO support and 6 of them additionally needed intra-aortic balloon counterpulsation therapy. In 1 patient, venovenous ECMO was implanted for acute respiratory distress syndrome. Percutaneous cannulation was performed in 7 patients, and surgical placement in 2 patients with postcardiotomy shock. The mean distance travelled was 206.4 $\pm$ 31.7 km and the mean transport time was 172.8 $\pm$ 27.3 minutes. The patients had no complications, transport-related morbidity or mortality, or device-related logistic/technical complications. The mean time on support was 6.7 (2-12) days. In-hospital survival was 55.6%, and all surviving patients were alive at the time of writing. The causes of death were bleeding complications (75.0%) and infections (25.0%). Weaning from ECMO was achieved in 55.6% of patients, although 1 died 2 weeks later due to sepsis secondary to pneumonia. Two patients (cases 6 and 7) who required a longer time on support were switched to a long-term biventricular system; only patient 7 survived. Two of the 4 patients who died were on the cardiac transplant waiting list (urgency 0); their deaths were due to bleeding complications.

A percentage of critically ill patients do not respond to conventional treatment and must be transported to centers offering more advanced specialized care. Often, these patients are hemodynamically unstable, and their transfer implies a high risk.[3] In these cases, ECMO provides respiratory and circulatory support that facilitates transfer and improves prognosis. Several articles have reported data on interhospital transfer of patients on ECMO,[2,3] but there is little information in this line from Spain. Groups that manage large numbers of patients have indicated that there are few complications during transport, and mortality rates are low, around 0.5%.[3] No complications occurred in our series during transfer.

There is no standard definition of an "ECMO center", but various publications have cited a minimum of 20 cases per year to complete an adequate learning curve and achieve a decrease in mortality after 30 patients per year.[4]

Our increasing experience in the use of ECMO has been extended to include applications in other less common indications, as previously reported in *Revista Española de Cardiología*.[5] The present report describes our experience with interhospital transfer of patients under ECMO support. Our results show that it is a safe and effective option for transporting unstable patients. Widespread use of this resource could facilitate the creation of health care networks for the treatment of cardiogenic shock in Spain, with the aim of centralizing experience of this option and improving patient prognosis.

Aitor Uribarri,[a,*] Ignacio Cruz-González,[a] María José Dalmau,[b] María Concepción Rubia-Martín,[b] Miriam Ochoa,[c] and Pedro L. Sánchez[a]

[a]*Servicio de Cardiología, Complejo Asistencial Universitario de Salamanca, Universidad de Salamanca-IBSAL, Salamanca, Spain*
[b]*Servicio de Cirugía Cardiaca, Complejo Asistencial Universitario de Salamanca, Universidad de Salamanca-IBSAL, Salamanca, Spain*
[c]*Unidad de Cuidados Intensivos, Complejo Asistencial Universitario de Salamanca, Universidad de Salamanca-IBSAL, Salamanca, Spain*

* Corresponding author:
E-mail address: auribarrig@gmail.com (A. Uribarri).

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Cardiogenic Shock and Cardiac Tamponade in the Context of Influenza A Myopericarditis

Shock *cardiogénico y taponamiento cardiaco en el contexto de la miopericarditis por influenza A*

To the Editor,

The cardiac manifestations of influenza A virus infection are currently not well defined. Infection with influenza A virus is estimated to cause myocardial injury in 10% of patients, and the reported manifestations are diverse, from asymptomatic through to acute myocarditis,[1] tako-tsubo syndrome, and cardiac tamponade.[2]

A 54-year-old woman with a history of diverticulitis and primary biliary cirrhosis attended the emergency department with generalized weakness and muscle pain. The patient reported having had cold symptoms and fever (39 °C) during the previous week. The physical examination and hemodynamic profile on admission were normal. An initial electrocardiogram revealed sinus tachycardia without repolarization abnormalities (Figure 1). A chest X-ray revealed cardiomegaly with signs of fluid overload (Figure 2A), and blood analysis revealed mild leukocytosis. Peak high-sensitivity troponin T was 312 ng/L, C-reactive protein was elevated (15 mg/L), and procalcitonin was normal.

The patient's clinical course while in the emergency department was poor, with onset of respiratory failure and lactic acidosis (lactic acid, 4.2 mmol/L) associated with abdominal pain. Suspected sepsis was investigated with a chest and abdomen computed tomography scan, which revealed signs of congestive heart failure and a small pericardial effusion (maximum diameter, 12 mm) (Figure 2B). Transthoracic echocardiography identified moderate left ventricular dysfunction (ejection fraction 37% by the Simpson method) and a

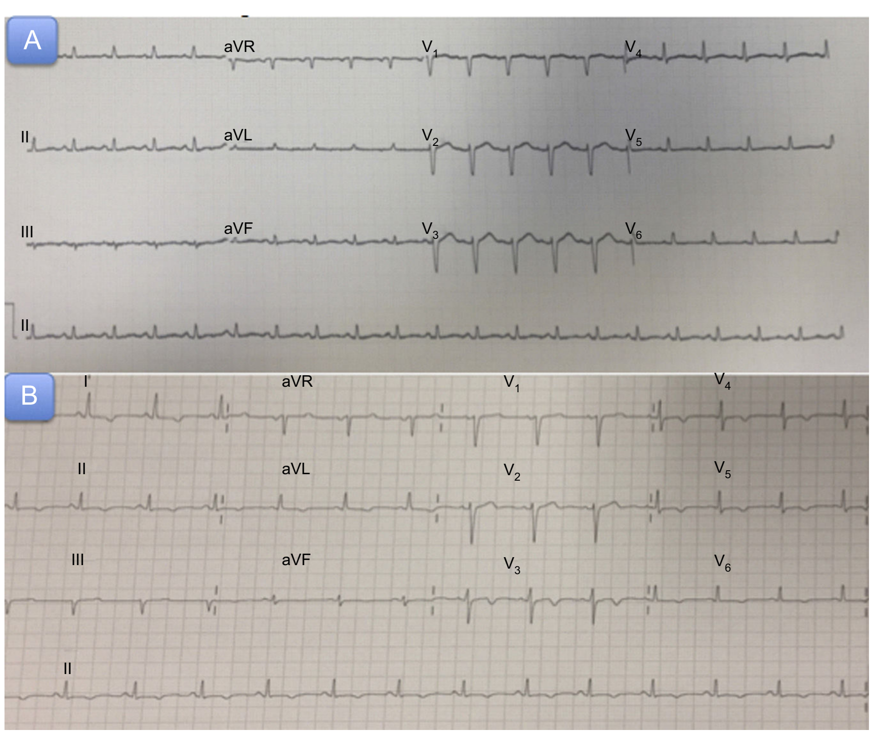

Figure 1. A: Admission electrocardiogram. B: Electrogram 72 hours after acute symptom onset.