Anatolian Journal of Emergency Medicine 2020;3(2); 54-57

CASE REPORT / OLGU SUNUMU

Secondary Transport of the Patient with Extracorporeal Life Support: Case Report

Ekstrakorporal Yaşam Desteği Sağlanan Hastanın Sekonder Transport Organizasyonu: Olgu Sunumu

Burak Bekgöz[1], İshak Şan[2], Mehmet Ergin[3], Burhan Albay[4]

ABSTRACT

Aim: In this case, it is aimed to share experiences in the preparation and application stages of the transport of the patients receiving Extracorporeal Life Support (ECLS).

Case: A 36-year-old patient, who was receiving ECLS, who had a Glasgow Coma Scale (GCS) score of 15 and had heart transplantation due to end-stage congestive heart failure, was transferred from Yuksek İhtisas Training and Research Hospital to newly-opened Ankara City Hospital by Emergency Medical Services (EMS) ambulances.

The team was decided to consist of 2 Paramedics, 1 Cardiovascular Surgery Specialist, 1 Anesthesia and Reanimation Specialist and 1 Extracorporeal Membran Oxygenation (ECMO) device technician. The appropriate route between these two hospitals was determined. Prior to transport, ambulance equipment was adapted and simulated; Elevators, hospital doors to be used during transport were determined.

The total transport time was 25 minutes; The time spent on the road was 14 minutes. During the transport, the patient's vital parameters were stable, no complications, or device problems occurred. In many countries, the ECMO transport system has been created, including expert professionals from different disciplines, and the organization of this system is carried out by the EMS Administration. There are no professional ECMO transport teams in our Turkey, and EMS professionals are not trained on transporting patients with ECMO.

Conclusion: It is recommended that the transport of the patients with ECLS be added to the training programs of EMS professionals and design of ambulances specific to the transport of these patients.

Keywords: Critical patients transport, ECMO, extracorporeal life support

ÖZ

Amaç: Bu olguda Ekstrakorporeal Yaşam Desteği alan hasta naklinin hazırlık aşaması ve gerçekleştirilmesi esnasındaki tecrübelerin paylaşılması amaçlanmaktadır.

Olgu : Türkiye Yüksek İhtisas Hastanesinin, Ankara Şehir Hastanesine taşınması nedeniyle Ekstrakorporeal Yaşam Desteği (ECLS) almakta olan 39 Yaşında Glaskow Koma Skalası Skoru 15 olan, son dönem konjestif kalp yetmezliğine bağlı kalp transplantasyonunu bekleyen hasta, Ankara Şehir Hastanesine acil yardım ambulansları ile nakledilmiştir. Ekipte 2 adet Paramedik, Kalp ve Damar Cerrahisi Uzmanı, Anestezi ve Reanimasyon Uzmanı ve Ekstrakorporeal Membran Oksijenizasyonu (ECMO) cihazı teknisyeninden oluşturulması kararlaştırıldı. İki hastane arasındaki uygun rota belirlendi. Nakil öncesi ambulans donanımı uygun hale getirilerek simülasyon yapıldı, kullanılacak hasta taşıma asansör, kapılar belirlendi. Hastanın toplan nakil süresi 25 dakika, yolda geçirdiği süre 14 dakika saptandı. Nakil esnasında hastanın vital parametreleri stabil seyretti, komplikasyon veya cihazlarda bir problem yaşanmadı. Birçok ülkede farklı disiplinlerden konusunda uzman personelin yer aldığı ECMO transport sistemi oluşturulmuştur ve organizasyonu hastane öncesi sağlık sistemi tarafından gerçekleştirilmektedir. Ülkemizde profesyonel ECMO nakil ekipleri yoktur ve ECMO'lu hasta nakli konusunda hastane öncesi sağlık personellerine eğitimler verilmemektedir.

Sonuç : ECLS alan hasta nakli konusunun hastane öncesi personelin eğitim programlarına eklenmesi ve sadece ECLS alan hastaların nakli için standardize edilmiş ambulansların tasarlanması önerilmektedir.

Anahtar Kelimeler: Kritik hasta transportu, ECMO, ekstrakorporeal yaşam desteği

Received: April 03, 2019 Accepted: June 6, 2020

[1] Ankara City Hospital, Department of Emergency Medicine, Ankara/TURKEY.

[2] University of Health Sciences, Ankara Numune Education and Research Hospital, Department of Emergency Medicine, Ankara/TURKEY

[3] Yıldırım Beyazıt Üniversitesi, Faculty of Medicine, Department of Emergency Medicine, Ankara/TURKEY

[4] Ankara Emergency Medical Services, Ankara/TURKEY

Corresponding Author: Burhan Albay. Prm **Address:** Mehmet Akit Ersoy Mah. Bağdat Cad. No:62 YENİMAHALLE- ANKARA. **Phone:** +90 532 0587410 **e-mail:** albayburhan06@gmail.com

Atıf için/Cited as: Bekgoz B, San I, Ergin M, Albay B. Secondary Transport of the Patient with Extracorporeal Life Support. Anatolian J Emerg Med 2020;3(2); 54-57.

Introduction

Extracorporeal Life Support (ECLS), has emerged as an option to recover the patients with severe hemodynamic or respiratory failure who are unresponsive to treatment, and it is a method of providing support with an external artificial mechanical circulatory device when critical patients cannot maintain their vital functions. The Extracorporeal Membrane Oxygenation (ECMO) device, which provides ECLS, removes carbon dioxide (CO2) from the systemic venous blood coming from the patient with the oxygenator device acting as an artificial lung and sends the blood back to the body by loading oxygen (O2) with the pump which serves as an artificial heart (1,2).

ECLS is a widely used method for patients with different indications, and Extra Corporeal Life Support Organization (ELSO) has published guidelines to standardize ECLS management. Transfer of the patient to the ECMO center, after the cannulation was provided at the scene or at the health facility, is called primary transport; If the ECLS is already provided at the referring center, and the patient is referred to another center for various reasons, this is called secondary transport (3).

The transport of patients receiving ECLS is quite difficult, and secondary transport of these patients must be performed by professional teams. According to the literature, this type of patient transport is less. In this study, it is aimed to share experiences in the preparation and application stages of the transport of the patients receiving ECLS.

Case

City Hospital was opened recently in Ankara city; with the opening of this hospital, several hospitals of Ankara were closed and all patients were transferred to the City Hospital. 210 patients of the Yüksek İhtisas Training And Research Hospital, one of these closed hospitals, were transferred to the City Hospital by fully-equipped land ambulances of Ankara Emergency Medical Services (EMS). One of these patients was transported with ECLS and is the subject of our case report. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

The patient was male, 39 years old (174 cm and 62 kg) and his Glasgow Coma Scale (GCS) score was 15; He was awaiting heart transplantation due to terminal-term congestive heart failure; He had been under treatment for 45 days in the Cardiovascular Surgery Intensive Care Unit of Yüksek Ihtisas Training and Research Hospital; He was being monitored by contact isolation with ECMO (Table 1) and ventricular support. He was receiving oxygen (3 L/min), dopamine (3 mcg/kg/min), Milrinone (0,375 mcg/kg/min), Noradrenaline (0.05 mcg / kg / min).

Preparations were started 4 days before the day of transport.

ECMO Mode	VA, Right femoral artery/vein
O_2 Flow Rate (L / min)	4
Fraction of Inspired O_2 ECMO	%40
Centrifugal Pump Drive (rpm)	5000
Blood Flow(L/min)	2
Number of days patient	45
connected to ECMO device	
Number of days of intensive care	45

Table 1. ECMO parameters

3 days before the day of transport, we interviewed the responsible cardiovascular surgery physician of the Yüksek İhtisas Training and Research Hospital; It was decided that the patient had to be transported with 1 ECMO device, 1 Ventricular Assist Device (VAD) monitor and 3 injector pumps, 12-lead ECG monitoring and intensive care ventilator for possible complications. The transport team was decided to consist of 2 experienced Paramedics (at least 5 years of work expeience, Advanced Life Support, Trauma, and Resuscitation, ECG and Arrhythmia Management Certificates), 1 Cardiovascular Surgery Specialist, 1 Anesthesia and Reanimation Specialist, and 1 ECMO device technician (Figure 1-2).

Figure 1. Loading of the patient into the ambulance

Figure 2. Transport of the patient

A route was planned from the Yüksek İhtisas Hospital to Ankara City Hospital, and the distance was measured as 16.7 kilometers (km). The route information was shared with the traffic control unit of the Provincial Police Department to make the transport process safer and faster. On the transport route, the traffic cops closed the road to traffic, and they escorted the ambulance.

Technical Support and Logistics Unit of the Ankara EMS was contacted to take the measures discussed for this patient's transport. According to the ECMO transport guide of the Extracorporeal Life Support Organization (ELSO), the ambulance to be used for the transport of the patient with ECLS should have some additional features.

These features are as follows:

- Large internal space is required as the team is crowded and additional equipment is used.
- High ceiling is required for the patient to be safely loaded into the ambulance.
- In accordance with the increasing weight of all equipment, a high-load stretcher is required.
- An independent supply of oxygen is required.
- An ambulance power supply is required to provide the necessary voltage, current and power to ensure that all equipment runs smoothly during transport (ECMO transport team members must have sufficient knowledge of the power requirements of the equipment.)
- A stretcher with a motorized lifting mechanism is required to carry an increased weight (> 450 kg).
- The height of the stretcher and ambulance should be adjustable so that the patient can be safely loaded into the ambulance (There should be adjustable air suspensions on the rear axle of the ambulance).

The Intensive Care Ambulance (Volkswagen Crafter ®, 2013, Germany), which provides all these features, was selected for transport. In order to simulate the transport with ECLS, the team visited the clinic where the patient was treated 3 days before the transport. All equipment was placed in the ambulance and the elevators and doors of the hospital to be used during transport were determined. During the simulation, a healthcare professional similar to the patient in terms of height and weight was transported; The transport route and total transport time were measured. After the route was determined, the Provincial Police Department was informed about the route and the date of the transport.

During the simulation, when the ECMO was connected to the 220V output of the ambulance, there was a problem with the ambulance's electrical system, and the ECMO device could not receive power. During this failure, the ECMO device was connected to the backup batteries to operate at the highest capacity and the simulation continued until the target hospital. The backup batteries were sufficient during the transport. There were no problems except the power supply problem. In line with the recommendation of the technical staff, it was decided to use the intensive care ambulance instead of the existing ambulance, because its electrical system was newer. The simulation was repeated with the intensive care ambulance, and no problems occurred.

The injector pump was fixed on the stretcher so that the infusion was not interrupted between the intensive care unit and the ambulance. The modification of the stretcher for fixing the injector pump was provided by the technical support unit. Thus, the continuous infusion was provided with 3 injector pumps fixed to the stretcher.

A daily ambulance check was carried out at 09:00 am on 10.02.2019 and there was no deficiency in the ambulance. The team went to the intensive care unit where the patient was hospitalized with the predetermined ambulance and equipment. The patient was transferred to the ambulance stretcher without any problem; The devices were checked. The ECMO device was disconnected from the power supply after making sure that all devices were working properly. The patient was lowered from the second floor of the hospital to the ground floor by an elevator. In this process, the ECMO device was operated with battery; The patient was loaded into the ambulance without any problems. The ECMO device was connected directly to the power supply in the ambulance. During the transport, the ambulance was escorted by a traffic police vehicle along the transport route (16.7 km). Along the entire transport route, the road was closed to vehicle traffic, so that rapid and safe transport of the patient was enabled. The total transport time was 25 minutes; The time spent on the road was 14 minutes. During the transport, the patient's vital parameters were stable, no complications, or device problems occurred (Table 2).

	Pre-Transport	**During Transport**	**Post-Transport**
O_2 Saturation (%)	99	98	100
Mean Arterial Blood Pressure	100/75	95/70	90/60
Heart rate	100	96	90
pH Blood Gas	7.47	N/A	7.51
Blood lactate level	0.6	N/A	1.03

Table 2. Hemodynamic parameters of the patient

Discussion

Today, the number of patients receiving ECLS support by connecting to the ECMO device is increasing. In patients who develop cardiac arrest in the pre-hospital period, ECMO is provided by cannulation at the scene, and patients are primarily transported to ECMO centers (4). Currently, primary or secondary patient transports with ECMO devices are carried out among cities, even among countries. Two NATO soldiers receiving ECLS, were transported from Afghanistan to Germany intercontinentally (5). Increased transport of patients receiving ECLS also affects EMS, which is part of the organization, and increases awareness.

According to the Guidelines for ECMO Transport published by ELSO, it is recommended to use a land ambulance at distances ≤ 250 miles (400 km); So that we also chose to use the land ambulance at this distance (3).

In many countries, the ECMO transport system has been created, including expert professionals from different disciplines, and the organization of this system is carried out by the EMS Administration. Establishing and operating such a system even in developed countries causes high costs (6,7). There are no professional ECMO transport teams in our Turkey, and EMS professionals are not trained on transporting patients with ECMO. In these developed countries, some experienced centers have only ambulances allocated to ECMO service (1), while there are not yet such ambulances in Turkey. This is why we used the standard intensive care ambulance during the transport, after modifying it.

Since the Ankara EMS Administration had never transported an ECLS-supported patient, we did not have any algorithms related to the subject, so that we prepared by taking into consideration the expert recommendations and scanning the scientific studies. The fact that electrical power supply was experienced during the simulation showed the importance of transport simulation and pre-transport preparations.

Conclusion

Although ECLS is a difficult and costly method, the value of a healthy life is priceless. Primary or secondary transport of the ECLS patient is difficult; therefore, specially trained personnel, special equipment and ambulances should be allocated for the transport of these patients. It is recommended that the transport of patients with ECLS be added to the training programs of EMS professionals and design of ambulances specific to the transport of these patients.

Conflict of Interest: The authors declare no any conflict of interest regarding this article.

Financial Disclosure: The authors declared that this case received no financial support.

Authors' Contribution: Burak Bekgöz conceived the case report. İshak Şan contributed reagents, materials, analysis tools or data. Burak Bekgöz and Burhan Albay drafted the manuscript and all authors contributed substantially to its revision. Burak Bekgöz takes the responsibility for the paper as a whole.

Informed Consent Statement: Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review in this journal.

References

1- Merkle J, Djorjevic I, Sabashnikov A, et al. Mobile ECMO - A divine technology or bridge to nowhere? Expert Rev Med Devices. 2017; 14(10):821-831.
2- Haydin S, Ündar A. Yasam destek sistemlerinin Dünya'daki gelismeleri ve Türkiye'deki son durum. Anadolu Kardiyoloji Dergisi. 2013: 13(6), 580.
3- Dirnberger D, Fiser RT, Harvey C, et al. "Extracorporeal Life Support Organization (ELSO)."Web site. Available at: https://www.elso.org/Portals/0/Files/ELSO%20GUIDELINES%20FOR%20ECMO%20TRANSPORT_May2015.pdf Accessed July 10,2020.
4- Hutin A, Abu-Habsa M, Burns B, et al. Early ECPR for out-of-hospital cardiac arrest: Best practice in 2018. Resuscitation. 2018; 130:44-48.
5- Zonies D, Bein T, Phillip A, et al. VV-ECMO initiation and transport of NATO combat casualties from a war zone. Presented at the 1st Euro-ELSO Congress; May 11-13, 2012, Rome, Italy.
6- Broman, LM. Inter-hospital transports on extracorporeal membrane oxygenation in different health-care systems. J Thorac Dis. 2017; 9(9):3425-3429.
7- Bryner B, Cooley E, Copenhaver W, et al. Two decades' experience with interfacility transport on extracorporeal membrane oxygenation. Ann Thorac Surg. 2014; 98(4):1363-70.