

WHAT'S NEW IN INTENSIVE CARE



Ten things that nurses should know about ECMO

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Introduction

Venovenous extracorporeal membrane oxygenation (VVECMO) is a potent salvage therapy for ARDS patients who remain severely hypoxemic despite the use of more conventional treatments. In a study done in the UK, VVECMO improved the outcome of severe ARDS patients [1]. Critically ill patients require a high degree of acute care resources and nurses who have specialized knowledge and skills. Education and preparation beyond their basic nursing degree is therefore mandatory in order to provide an optimal level of care. In this short review, we describe ten important tips for nurses caring for patients receiving ECMO.

Care differences in VVECMO vs venoarterial ECMO (VAECMO)

The nursing care differences in VVECMO vs VAECMO are primarily related to mobility restrictions and the institution of cardiopulmonary resuscitation (CPR). Mobility may be restricted in VAECMO as a result of central cannulation (cannulas inserted in the right atrium and the aorta) and hemodynamic instability of the patient. With respect to cardiac arrest situations, external chest compressions are unnecessary in patients receiving VAECMO as both cardiac and pulmonary systems are supported thus maintaining systemic circulation [2]. In contrast, chest compressions are required if a cardiac arrest occurs during VVECMO as solely lung function is maintained and hemodynamics may only be indirectly supported secondary to improvement in oxygenation [2].

Blood transfusion requirements

Patients requiring ECMO are at risk of bleeding because they receive anticoagulation therapy to prevent thromboembolic complications and oxygenator thrombosis [3]. Moreover, ECMO patients have variable transfusion needs dependent on patient diagnosis, comorbidities, type of surgical intervention, ease and type of cannulation, and the presence of active bleeding [2]. The setting of target hemoglobin, coagulation, and platelet values plays an important role in the evaluation of blood product transfusion requirement. These target values allow the nurse to independently monitor the patient and consult the physician as appropriate. Practice is highly variable with adherence to restrictive transfusion thresholds and consideration for the risks of transfusion-related complications [2].

Prone position can be done safely in ECMO patients

Prone position improves the outcome of ARDS patients [4]. However, the use of prone positioning in ECMO patients was supposed to be dangerous because of the risk of accidentally decannulating the patient. It was recently shown that prone position can be done safely in ECMO patients [5]. Six caregivers are needed to switch the patient. One nurse is specifically in charge of tubing and ECMO during the switch. Prone position can certainly be done safely by trained teams.

Continuous renal replacement therapy (CRRT) can be done using ECMO circuit

CRRT is usually done via a dedicated venous access. A CRRT device can be inserted into the ECMO circuit if venous access is limited. If a centrifugal ECMO pump is used, it is necessary to place the CRRT machine after the pump because of the risk of air entrapment. Reconnection to return blood from the CRRT device is required before the oxygenator to trap air or clots before return to the patients [6] (Fig. 1).

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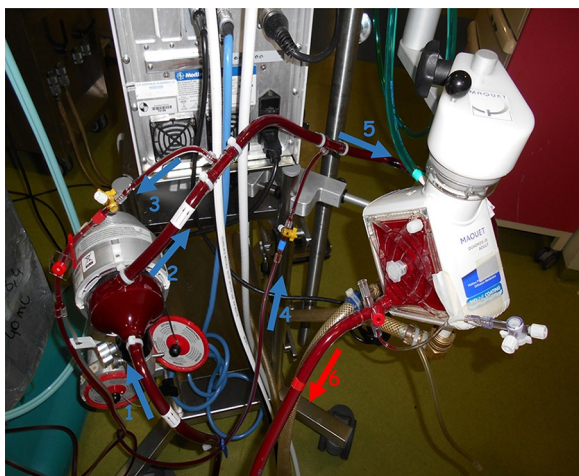


Fig. 1 Continuous renal replacement treatment (CRRT) under ECMO. 1 From the patient to the centrifugal pump. 2 From the centrifugal pump to the oxygenator. 3 From the ECMO circuit to the CRRT device. 4 From the CRRT device to the ECMO circuit. 5 From the centrifugal pump to the oxygenator after CRRT circuit return connection. 6 From the oxygenator to the patient

Early mobility

The effect of critical illness has an impact on functional ability which is related to ICU-acquired weakness [7–9]. It is essential to assess ECMO patients for readiness to mobilize at the first opportunity for hemodynamic stability, location and integrity of cannulation sites, lower limb strength, and balance [10]. A thorough exercise program should be developed inclusive of using an exercise bike in the bed and chair as well as a treadmill until the patient has regained sufficient strength and balance. Once the patient is able to mobilize they are assisted by an ECMO trained physiotherapist, nurse, and perfusionist.

ECMO support for extended periods

ECMO support for extended periods has been associated with bridging to lung transplant therapy and recovery post-transplantation. Longer-term support is now more common in the treatment of ARDS patients. In some instances patients may be weaned from mechanical ventilation and extubated while remaining on ECMO until lung injury resolves [2]. Nursing care of long-term ECMO patients is not solely focused on physiological patient condition. Consideration must be given to both psychological and social factors that impact the patient and family [11].

Why ECMO should be done in referral centers

Complications are not rare and are related to the technique itself or its consequences. Ventilator settings are very different from usual care. Determining the right

time to remove ECMO requires a lot of clinical experience. ECMO should be done by trained nurses and doctors in dedicated ECMO centers according to regional organization. When the annual ECMO case volume is at least 30, an improvement in mortality is observed as compared with centers with less ECMO activity [12].

Mobile ECMO team for non-ECMO centers

These ECMO referral centers should have a mobile ECMO team available 24/7 able to place ECMO in any patient hospitalized in an ICU in a large area around the referral center and to transfer this patient to the referral center. Mobile ECMO units should have dedicated personnel trained to insert cannulas, to prime and set up the ECMO system, and to transport these critically ill patients.

An extensive role for ICU nurses in charge of ECMO patients

The ICU nurse in an ECMO center should be able to inspect the circuit for integrity, clot formation, air accumulation, or leaks and to preserve patient safety in major patient position changes. ARDS patients under ECMO more frequently need bedside procedures such as chest tube insertion, catheter insertion, certain surgical procedures, or a bronchoscopy. Patients receive huge amounts of sedatives, paralytic agents, fluids (including blood products), and vasopressors. Anticoagulation requires repeated laboratory exams. Renal replacement therapy is frequently needed. Because of the severity of the situation, patients' family members need a lot of attention from nurses.

Nurse staffing for ECMO patients

Consideration for staffing ratios for patients receiving ECMO should include hemodynamic stability, whether the patients require invasive mechanical ventilation support, level of consciousness, and the need for continuous renal replacement therapy (CRRT). A recent position paper [13] suggested a nurse-to-ECMO patient ratio of 1:2–1:1. However, a nurse-to-patient ratio as high as two nurses for one ECMO patient has been reported [14]. There is some utility for cohorting patients as this enables a 3:2 nurse patient ratio which would assist in supporting a high volume of ECMO patients at any given time. All nursing staff should receive specific ECMO training and have to demonstrate ongoing competencies through continuing education, e-learning, and in-service [13]. Better evaluation of the adequate human resources according to a precise evaluation of nursing workload is urgently needed.

In conclusion, recent technological advances have improved the safety of ECMO. ECMO must be

considered on a case-by-case basis and should be delivered in referral centers with well-trained doctors and nurses. An area for investigation is the impact on patient outcomes of the presence of advanced practice nurses in critical care with ECMO competencies.

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Compliance with ethical standards

Conflicts of interest None.

Received: 15 February 2016 Accepted: 24 February 2016

Published online: 8 March 2016

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