

Cardiovascular critical care nursing procedures in patients on venoarterial extracorporeal membrane oxygenation

Venoarteriyel ekstrakorporeal membran oksijenasyonu uygulanan hastalarda kardiyovasküler yoğun bakım hemşirelik uygulamaları

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ABSTRACT

Objectives: This study aims to evaluate nursing care procedures and outcomes in patients with post-cardiotomy cardiogenic shock (PCCS) requiring venoarterial extracorporeal membrane oxygenation (VA-ECMO).

Patients and methods: Between June 2016 and June 2017, a total of five patients (1 male, 4 females; mean age 67.2 years; range, 55 to 81 years) who received VA-ECMO for PCCS in our clinic were retrospectively analyzed. The ECMO device was implanted in the operating room or in the cardiovascular intensive care unit CICU by an experienced cardiovascular surgeon. Air and thrombus formation and blood flow were monitored by the perfusionists. Daily nursing care included monitorization, control of bleeding, sedation management, pain control, nutrition, control of skin integrity and infection, sponge bath, changing the position of endotracheal tube, dressing replacement, decubitus control, changing sheets, and back hygiene.

Results: Two patients who were successfully weaned off VA-ECMO survived to hospital discharge. The median duration of daily nursing care was 62 (range, 45 to 65) min. The longest steps in daily nursing were sponge bath and elevation of the patient. None of the patients suffered from decannulation or displacement of the VA-ECMO cannulas during nursing.

Conclusion: We conclude that nurses are fundamental in the care of VA-ECMO patients for the early diagnosis and intervention of procedure-related complications.

Keywords: Cardiovascular critical care unit, care, extracorporeal membrane oxygenation, nursing.

ÖZ

Amaç: Bu çalışmada venoarteriyel ekstrakorporeal membran oksijenasyonu (VA-EKMO) gerekli olan postkardiyotomi kardiyojenik şok (PCCS) hastalarında hemşirelik bakım uygulamaları ve sonuçları değerlendirildi.

Hastalar ve Yöntemler: Haziran 2016 - Haziran 2017 tarihleri arasında kliniğimizde PCCS nedeniyle VA-EKMO uygulanan toplam beş hasta (1 erkek, 4 kadın; ort. yaş 67.2 yıl; dağılım, 55-81 yıl) retrospektif olarak incelendi. Ekstrakorporeal membran oksijenasyon cihazı deneyimli bir kalp damar cerrahı tarafından ameliyathanede veya kardiyovasküler yoğun bakım ünitesinde (KYBÜ) yerleştirildi. Hava ve pıhtı oluşumu ve kan akımı takipleri perfüzyonistler tarafından yapıldı. Günlük hemşirelik bakımı monitorizasyon, kanama kontrolü, sedasyon yönetimi, ağrı kontrolü, beslenme, cilt bütünlüğü ve enfeksiyon kontrolü, yatakta sünger ile temizlik, endotrakeal tüp pozisyonunun değiştirilmesi, pansumanların değiştirilmesi, dekübit kontrolü, çarşafaların değiştirilmesi ve sırt bakımını içermekteydi.

Bulgular: Başarılı bir şekilde VA-EKMO'dan ayrılan iki hasta taburculuğa kadar sağ kaldı. Günlük hemşirelik bakım süresi medyan 62 (dağılım, 45-65) dk. idi. Hemşirelik bakımında en uzun süren uygulamalar, hastanın yatakta sünger ile temizliği ve elevasyonu idi. Bakım sırasında hiçbir hastada EKMO kanüllerinde yer değiştirme veya yerinden çıkma görülmedi.

Sonuç: Yoğun bakım hemşirelerinin VA-EKMO'ya bağlı hastaların bakımında erken tanı ve işleme bağlı komplikasyonlara erken müdahale açısından büyük önem taşıdığı kanaatindeyiz.

Anahtar sözcükler: Kardiyovasküler yoğun bakım ünitesi, bakım, ekstrakorporeal membran oksijenasyonu, hemşirelik.

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Post-cardiotomy cardiogenic shock (PCCS) is a clinical condition following cardiac surgery characterized by cardiogenic shock which does not improve despite inotropic and intra-aortic balloon support. Its incidence ranges from 3 to 5%.^[1] The main etiology of PCCS is suggested to be ischemia-reperfusion injury, resulting in myocardial stunning.^[2] Post-cardiotomy cardiogenic shock is fatal, if mechanical circulatory support is not ensured timely. In recent years, venoarterial (VA) extracorporeal membrane oxygenation (ECMO) is the preferred and life-saving choice of treatment in PCCS patients.^[3] The VA-ECMO patients are suggested to be cared particularly in cardiovascular intensive care units (CICUs).^[4] The heart team concept is not new in cardiac surgical procedures and also for cardiovascular surgeons. Similarly, the ECMO team concept has been recently introduced in this era and these teams have increased the survival to discharge rates of the hospitals after cardiac surgery.^[4] The ECMO team mainly consists of cardiac surgeons, cardiac anesthesiologists, ICU nursing staff, and perfusionists. Nursing care in these high-risk and critically ill patients is essential and consists of monitorization, control of the ECMO circuits for thrombosis, control of bleeding, care of pain and sedation, control of ventilatory support, endotracheal tube aspiration, prevention of iatrogenic infections, care of patient hygiene and patient comfort, care of oral mucosal and skin integrity, and management and care of nutrition.^[5]

In the present study, we aimed to evaluate nursing care procedures and outcomes in patients with PCCS requiring VA-ECMO.

PATIENTS AND METHODS

Between June 2016 and June 2017, medical data a total of five patients (1 male, 4 females; mean age 67.2 years; range, 55 to 81 years) who received VA-ECMO for PCCS in our clinic were retrospectively analyzed. In case of acute cardiac failure despite inotropic and intra-aortic balloon support, VA-ECMO was indicated. The ECMO device was implanted in the operating room or in the CICU by an experienced cardiovascular surgeon. All patients were connected to a Medos MDC Consule, (Medos AG, Germany) consisting of a polymethylpentene oxygenator, a centrifugal pump, and a heater unit. Both femoral artery (15-18F) and femoral vein (25-29F) were cannulated through a minimal incision, and a 7F catheter was inserted distally into the femoral artery to prevent severe leg ischemia.^[6]

The pump speed was adjusted to obtain a blood flow of 4 to 5 L/min. The distal pulse pressures in the lower extremity were controlled via a hand-held Doppler ultrasound every hour. The control of ECMO, air and thrombus in the ECMO cannulas, and blood flow was performed by perfusionists. Daily nursing care included monitorization, control of bleeding, sedation management, pain control, nutrition, control of skin integrity and infection, sponge bath, changing the position of endotracheal tube, dressing replacement, decubitus control, changing sheets, and back hygiene.

The patients were monitored in the CICU and heart rate, systolic, diastolic, and mean arterial pressures, arterial oxygen saturation, central venous pressure, bispectral index values, hourly urine output, temperature, and arterial blood gas analysis were recorded. As bleeding is a common problem in patients with ECMO due to anticoagulation and thrombocytopenia, the patients were controlled for bleeding from the cannulation sites, cardiac tamponade, intracranial hemorrhage, or gastrointestinal bleeding.

All patients were sedated based on their bispectral index values and pain control was performed based on the behavioral and physiological responses of these sedated patients. Control of skin integrity was performed by changing the positions of the patients and taking care of pressure sores. Prevention of oral mucosal integrity was performed every day with chlorhexidine 0.2% mouthwash. Enteral or parenteral nutrition of the patients were started by the nutrition committee and controlled by the nursing staff. Sponge bath consisted of a complete bed bath with disposable pre-soaped sponges. Back hygiene and sheets replacement were performed by gentle mobilization of the patients to their sides. All cannula dressings were changed at least every seven days or earlier in case of bleeding. The study protocol was approved by the Ankara Numune Training and Research Hospital Ethics Committee. A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

All statistics were performed using the PASW for Windows version 17.0 software (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean \pm standard deviation and were compared by unpaired Student's t-test.

RESULTS

The patients' characteristics are summarized in Table 1. Two patients who were successfully weaned off ECMO survived to hospital discharge. The first patient was weaned off ECMO on the postoperative Day 10 and the second patient on the postoperative Day 17. In the latter patient, the use of renal replacement therapy was required; however, the patient was not on routine dialysis program during follow-up. Three patients died during the ICU stay due to multiple organ failure within 24 to 48 h following ECMO implantation.

None of the patients suffered from leg ischemia, surgical wound infections, intracranial bleeding, cardiac tamponade, sepsis, air embolism, mechanical ventilation associated pneumonia, gastrointestinal bleeding or decubitus ulcers.

The median duration of daily nursing care was 62 (range, 45 to 65) min. The longest steps in daily nursing were sponge bath and elevation of the patient. Hypertension and tachycardia were the most common complications, particularly during the sponge bath. These complications were managed with extra boluses of sedation. None of the patients suffered from decannulation or displacement of the ECMO cannulas during nursing care. In addition, no complications such as desaturation and altered blood flows were observed.

DISCUSSION

Extracorporeal membrane oxygenation has been widely used in patients with PCCS.^[4] It is also widely used as a rescue therapy for critically ill patients with severe respiratory or cardiac failure.^[7] In our study, the ECMO support was successful in two patients. Previous studies have suggested that the overall survival of patients receiving VA-ECMO support ranges from 33 to 63%.^[8,9] It has been also reported that high-volume centers have lower mortality rates.^[4] Recently, a team-based approach has been implemented in ECMO care, particularly in high-volume centers, indicating that this approach can reduce the complication rates and improve the outcomes of patients with the operator satisfaction.^[4,10]

Nursing staff in the CICU are one of the most important components of the ECMO team. Nursing care is essential in all patients care, but very important in these critically ill patients receiving

VA-ECMO. Nursing procedures improve patient comfort, reduce the incidence of infections, and it is critical to evaluate bleeding and vascular access and to assess skin integrity, particularly in the back. Nursing care is more difficult than normal patient care in ECMO patients, as these patients are critically ill and mobilization of them should be made carefully. Therefore, nursing should be performed by experienced staff in these patients.

All of our nurses were senior in the present study; however, they did not have an ECMO certificate. Daily nursing procedures were performed in all five patients. Hypertension and tachycardia were the most common complications managed with additional sedation. In all nursing procedure sessions, a junior cardiovascular surgeon was available in the CICU to manage possible adverse events and complications. None of the patients suffered from decannulation or displacement of the ECMO cannulas during nursing care. In addition, no complications such as desaturation and altered blood flow were observed. Two of our patients were weaned off ECMO and they are still alive.

In a study by Redaelli et al.,^[11] sponge bath was mostly associated with hypertension and tachycardia, probably due to an inadequate level of sedation. Our study also showed similar results with the aforementioned study that our patients became hypertensive and tachycardic during sponge bath. The authors also reported that the ECMO blood flow was reduced during elevation with the scooping stretcher for sheets replacement and back hygiene. None of our patients showed a reduction in the blood flow during this nursing procedure. We believe that gentle mobilization of the patient to the side rather than elevation with scooping stretcher is the main reason of these results.

In conclusion, nurses are fundamental in the care of extracorporeal membrane oxygenation patients for the early diagnosis and intervention for complications of extracorporeal membrane oxygenation. Nursing care may have a significant impact on physiological parameters of these critically ill patients. We believe that all nurses taking care of extracorporeal membrane oxygenation patients should have an extracorporeal membrane oxygenation certificate and a cardiovascular surgeon should be available during nursing procedures to manage any possible complications.

Declaration of conflicting interests

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