DEPARTMENT OF HEALTH SERVICES
COUNTY OF LOS ANGELES

SUBJECT: **EXTRACORPOREAL CARDIOPULMONARY RESUSCITATION (ECPR) RECEIVING CENTER STANDARDS** REFERENCE NO. 321

PURPOSE: To establish minimum standards for the designation of an Extracorporeal Cardiopulmonary Resuscitation (ECPR) Receiving Center to ensure that select patients transported by the 9-1-1 system in Los Angeles County with out-of-hospital cardiac arrest (OHCA) refractory to conventional therapies and who meet ECPR criteria, are transported to a hospital appropriate to their needs.

AUTHORITY: California Code of Regulations (CCR), Title 22, Division 9, Chapter 6.2

DEFINITIONS:
Board Certified (BC): Successful completion of the evaluation process through one of the Member Boards of the American Board of Medical Specialists (ABMS) or American Osteopathic Association (AOA) including an examination designed to assess the knowledge, skills and experience necessary to provide quality patient care in a particular specialty.

Board Eligible (BE): Successful completion of a residency training program with progression to board certification based on the timeframe as specified by the ABMS or AOA for a specific specialty.

Extracorporeal Membrane Oxygenation (ECMO): Provision of oxygen and carbon dioxide exchange through the use of extracorporeal circuit consisting minimally of a blood pump, artificial lung, and vascular access cannula, using blood flows sufficient to support oxygenation and concomitantly enhance carbon dioxide removal. Also known as extracorporeal life support (ECLS).

ECMO Candidate: A patient with out-of-hospital cardiac arrest that meets LA County EMS criteria for consideration of extracorporeal membrane oxygenation; this includes patients with initial shockable rhythm refractory to conventional cardiopulmonary resuscitation or with recurrent arrest, and select other patients with potential reversible etiologies.

ECMO Coordinator: A registered nurse (RN), respiratory therapist (RT), or perfusionist who specializes in the management and operation of the ECMO machine.

ECMO Specialist: A technical specialist trained to manage the ECMO machine and the needs of the patient on ECMO.

ECPR Medical Director: A qualified physician specialist privileged by the hospital to perform cannulation and active in performing ECMO who is responsible for the ECMO program.

ECPR Program Manager: A physician, advanced practitioner, registered nurse (RN), respiratory therapist (RT), or perfusionist appointed by the hospital to monitor, coordinate, and evaluate the ECPR Program and responsible for the supervision and training of the staff, maintenance of equipment, and collection of patient data.

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Director, EMS Agency

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Extracorporeal Cardiopulmonary Resuscitation (ECPR) Receiving Center: A licensed general acute care facility that is designated by the Los Angeles County EMS Agency as a STEMI Receiving Center, meets all the requirements listed in this policy and has been designated by the LA County EMS Agency as an ECPR receiving center.

Out-of-Hospital Non-traumatic Cardiac Arrest (OHCA): Sudden, sometimes temporary cessation of function of the heart not due to a traumatic cause.

Perfusionist: An individual who has specialized training and certification in managing the heart-lung machine in the operating room and/or ECMO at the bedside.

Promptly Available: Able to be physically present in the emergency department (ED) within a period of time that is medically prudent and appropriate to the patient's clinical condition; and further, should not have a measurable harmful effect on the course of the patient management or outcome.

Qualified Specialist: A physician licensed in the State of California who has become BC or BE in the corresponding specialty by American Board of Medical Specialties (ABMS) or American Osteopathic Association (AOA).

Return of Spontaneous Circulation (ROSC): Following cardiopulmonary arrest, ROSC is the restoration of a spontaneous perfusing rhythm. Signs include: palpable pulse, breathing (more than an occasional gasp), a measurable blood pressure and/or a sudden rise in capnography to a normal/high reading.

STEMI Receiving Center (SRC): A licensed general acute care facility that meets the minimum hospital STEMI care requirements pursuant to CCR Section 100270.124 and is able to perform percutaneous coronary intervention (PCI), manage cardiac arrest and post-resuscitation care, and is designated as a SRC by the Los Angeles County EMS Agency.

POLICY:

I. ECPR Designation / Re-Designation

A. ECPR initial designation and re-designation is granted for up to three years based on maintenance of these standards and after a satisfactory review and approval by the EMS Agency.

B. The EMS Agency reserves the right to perform a scheduled on-site survey or request additional data at any time.

C. Prior to designation, the hospital shall be currently designated as a STEMI Receiving Center (SRC) for a minimum of five years and meet the SRC performance metrics, listed in Ref. No. 320.3, including first-medical contact to balloon time and door to balloon time, for a minimum of 12 months.

D. The ECPR Receiving Center must have an existing veno-arterial (V-A) ECMO program for a minimum of 12 months with quality improvement processes and managed a minimum of 6 patients on V-A circuit.

E. The ECPR Receiving Center must currently operate as an LA County designated Paramedic Base Hospital.

F. To be considered for ECPR designation, the hospital must provide workflow on receiving potential ECPR candidates to include but not limited to: procedures for receiving prenotification from EMS; team activation; ED workflow; location and procedures for cannulation; assessment for initiation and withdrawal of ECPR; multi-disciplinary team care while on ECPR and post-cannulation; and quality improvement program.

G. The ECPR Receiving Center shall immediately provide written notice to the Medical Director of the EMS Agency if unable to adhere to any of the provisions set forth in these ECPR Standards.

H. The ECPR Receiving Center shall provide a 90-day, written notice to the EMS Agency Medical Director of intent to withdraw from the ECPR program.

I. The ECPR Receiving Center shall notify the EMS Agency, in writing, of any change in status of the ECPR Medical Director, ECPR Program Manager, or data entry personnel by submitting Reference No. 621.2, Notification of Personnel Change Form.

II. General Hospital Requirements

A. Appoint an ECPR Medical Director and ECPR Program Manager who shall be responsible for meeting the ECPR Program requirements and allocate non-clinical time such that they can meet the requirements of the ECPR standards.

B. Have a fully executed Specialty Care Center ECPR Designation Agreement with the EMS Agency.

III. ECPR Leadership Requirements

A. ECPR Medical Director

1. Qualifications:

a. A qualified specialist in emergency medicine, cardiology, pulmonology, critical care, or surgery (thoracic, cardiovascular, or trauma), or other qualified specialist with specific training and experience in ECMO support and credentialed to perform ECMO cannulation.

b. This person typically serves as the ECMO Director, providing oversight for the ECMO program including the ECPR program.

2. Responsibilities:

a. Provide medical oversight for the ongoing performance of the ECPR program

b. Ensure the credentialing of clinicians who care for ECMO patients and/or who will manage the ECMO circuit

c. Collaborate with the ECPR Program Manager to ensure adherence to these standards

d. Participate in the relevant hospital committees associated with ECMO, cardiac arrest, and post-resuscitation care.

e. Liaison with hospital administration, ECPR Program Manager, medical and clinical staff across the patient's continuums of care

f. Ensure continuing education and competency evaluation in ECMO

g. Attend 100% of the EMS Agency's SRC and ECPR QI Meetings onsite or via video conference. Fifty percent (50%) of meetings may be attended by an alternate ECPR qualified specialist from the same ECPR Receiving Center.

h. Confirm proper and valid data submission to the EMS Agency

B. ECPR Program Manager

1. Qualifications:

a. A physician, advanced practitioner (physician assistant, nurse practitioner), registered nurse, or respiratory therapist licensed in the State of California, or a certified clinical perfusionist, with a minimum of 1-year ICU experience.

b. Knowledgeable in the care of the ECMO and post-cardiac arrest patient.

c. Experience with program management and quality improvement.

d. This person typically serves as the hospital's ECMO Coordinator.

2. Responsibilities:

a. Collaborate with the ECPR Medical Director to ensure adherence to these Standards

b. Confirm hospital policies are consistent with these Standards

c. Implement, maintain, and monitor ECPR QI programs

d. Ensure continuing education and competency evaluation in ECMO

e. Ensure that program availability is consistent with EMS policies and processes are in place to maximize the 24/7 team availability

f. Collaborate with the ED Medical and Clinical Directors on the management of patients with OHCA who meet criteria for ECMO

g. Liaison with hospital administration, ECPR Medical Director, medical and clinical staff across the ECMO patient continuums of care

h. Participate in the relevant hospital committees associated with ECMO, cardiac arrest, and post-resuscitation care

i. Serve as a contact person for the EMS Agency and be available upon request to respond to County business

j. Attend 100% of the EMS Agency's SRC and ECPR QI Meetings onsite or via video conference. For both, fifty percent (50%) of meetings may be attended by an alternate clinician from the ECPR team.

k. Ensure processes are in place to identify and track patients transported to the ECPR center by EMS

l. Provide oversight of complete, accurate and timely data collection and submission

IV. ECPR Program Personnel Requirements

A. Sufficient qualified ECMO cannulators to maintain program availability 24 hours per day/7 days per week/365 days per year

B. ECMO specialists (clinicians trained to operate the ECMO circuit)

C. An ECPR team available 24/7/365 to evaluate and care for the ECMO candidate upon the patient's arrival to the ED or within 5 minutes thereof, which includes at a minimum:
   a. One ECMO-trained physician dedicated to the ECPR team and on call at only one facility at a time
   b. One ECMO specialist dedicated to the ECPR team

D. Other qualified specialist available to manage the other aspects of the patient's care including the resuscitation

E. Cardiothoracic and/or vascular surgery available on call 24/7/365

F. All physicians performing emergent ECMO cannulation must maintain current board certification, or be board eligible, in their specialty of practice

V. Training and Continuing Education

A. ECPR Program Manager and Medical Director shall ensure staff are sufficiently trained and maintain competency in ECMO. Regular team-based simulation are highly encouraged.

B. Training opportunities shall include, but not limited to:

1. Didactic lectures

2. Hands-on training with ECMO equipment

3. Bedside training

4. Simulations

C. For facilities performing V-A ECMO <24 cases per year (average < 2/month) and/or if ECMO personnel are not involved in ECPR patient management for more than two (2) months consecutively, team-based ECPR patient simulations shall occur to ensure at least one ECPR patient experience quarterly. Simulations should include all aspects of the process from patient arrival with EMS, to cannulation with ongoing resuscitation and through ICU management, and should involve the relevant clinicians.

D. ECPR Receiving Centers should provide periodic ECPR Base Hospital education with collaboration between the ECPR Program Manager/Medical Director, Prehospital Care Coordinator/Base Hospital Medical Director and EMS provider agencies.

VII. ECPR Program Plan

The hospital shall develop and maintain an ECPR Program Plan pertaining to the care of the ECPR patient. The plan shall be reviewed by the ECPR Program Manager annually and approved by the appropriate committee(s) minimally every three years. The ECPR Program Plan should include, at minimum, the following:

A. Job descriptions and organization structure clarifying the relationship between the ECPR Medical Director, ECPR Program Manager and the ECPR team

B. ECPR team activation guidelines with the ability to track activations and cancelations

C. A process for immediate notification of the emergency physician and ECPR team upon EMS notification of an ECMO candidate transport

D. A single call activation system to directly activate the ECPR team

E. Policy and procedures outlining the following:

1. ECPR team activation

2. ED workflow for the potential ECPR patient

3. Indications and contraindications for ECPR

4. Clinical management of the ECPR patient including but not limited to:

    a. Process for transfer from prehospital to hospital equipment while minimizing interrupting chest compressions
    b. Coordination between ECPR team and the clinical care team (e.g., emergency department clinicians and/or cath lab staff)
    c. Transition of the patient through phases of care (ED, cath lab, ICU)

5. ECMO circuit management

6. Maintenance of equipment

7. Policy for termination of ECPR therapy in patients who fail to recover and cannot be weaned, including involvement of a multi-disciplinary team, and availability of long-term cardiac support either on site or through transfer agreements

8. Follow-up of the ECPR patient short and long-term outcomes

9. Process for the triage and treatment of simultaneously arriving ECPR patients

F. Plan to ensure 100% of ECPR patients receive immediate evaluation for reversible causes of OHCA.

1. Immediate coronary angiography for patients without an obvious alternate noncardiac cause
2. Imaging and/or thrombolysis/thrombectomy for suspected massive pulmonary embolus

G. Post resuscitation care policies, including initiation of TTM

H. Involvement of a multidisciplinary team to include but not limited to emergency medicine, cardiology, neurology and/or intensive care medicine with experience in prognostication, respiratory therapy and palliative care.

I. A process for feedback to the transporting paramedics on the patient's presumed diagnosis and ED disposition

J. A process to collaborate with EMS provider agencies to integrate electronic prehospital patient care (ePCR) records into the hospital electronic medical record

VIII. Equipment and Supplies

A. ECMO supplies shall be easily accessible, readily available, and in close proximity to the ED and/or cath lab depending on the designated location(s) for cannulation.

B. Required ECMO equipment and supplies include:

1. ECMO system that consists of a suitable blood pump, a system for servo-regulation, blood heat exchanger and warming unit

2. Appropriate disposable materials including membrane oxygenator tubing packs and connectors

3. Primed circuit or appropriate solution (crystalloid or blood) available to prime the circuit

4. Device for monitoring the level of anticoagulation including its appropriate supplies

5. Backup components for the ECMO system and supplies for all circuit components

6. Adequate lighting to support surgical interventions

7. Supplies for revision of cannulation and for exploration of bleeding complications

8. Access to blood bank, pharmaceuticals and radiology as needed

C. A mechanical compression device must be available in emergency department for transition on patient arrival and use during cannulation

IX. Data Collection and Submission Requirements

A. Participate in the data collection process established by the EMS Agency.

B. Ensure adequate data entry personnel to meet data entry requirements. Back-up data entry personnel should be identified and trained in the event primary data personnel is unable to meet the data entry requirements.

C. Collaborate with ED and Base Hospital personnel to ensure capture and entry of patients meeting inclusion criteria into the Los Angeles County EMS Agency STEMI Receiving Center (SRC) database ECPR tab on an ongoing basis.

D. Maintain an Emergency Department (ED) Log to capture patients who are transported to the ED due to ECPR designation.

E. Submit data to the EMS Agency, within 45 days of patient's discharge, which shall include all patients who meet data inclusion criteria and all applicable data elements listed in Ref. No. 648, STEMI Receiving Center Data Dictionary

F. Maintain a minimum 90% compliance for:

1. Capture of patients meeting the data inclusion criteria

2. Data field completion

3. Data field accuracy

4. Timely data entry

G. Maintain active membership in the Extracorporeal Life Support Organization (ELSO). Submission of relevant data to ELSO for all ECMO and ECPR patients is highly encouraged but not required.

X. Quality Improvement

A. ECPR Program must include a comprehensive-multidisciplinary QI Meeting. This committee can be in conjunction with the SRC committee currently established.

1. Meeting participation should include the ECPR Medical Director, ECPR Program Manager, EMS clinicians and educators, emergency physicians, interventional cardiologists, ED and cath lab personnel, critical care

personnel, neurology, as well as other healthcare specialties involved in the care of ECPR patients such as vascular surgery, and thoracic surgery.

2. Meeting to be held quarterly, at a minimum.

3. Meeting minutes and roster must be maintained for each meeting and available for review.

B. Pertinent aspects of care such as treatment and management of the ECPR patients, should be tracked and trended with the identification of areas requiring improvement and the action(s) necessary to improve care.

C. The ECPR QI program shall:

1. Review the care and outcome on all (100%) ECPR patients and track and trend the following, at a minimum:

a. All ECPR related deaths

b. Major complications such as: limb ischemia, thromboembolism, hemorrhage requiring blood transfusion, ischemic stroke, infection, and organ injury

c. Any delays in care

2. Address other issues, processes, or personnel trends identified from hospital specific data (i.e., increase in fallouts over time).

3. ECPR center shall have a mechanism to provide feedback to EMS Providers (i.e., encrypted/secure e-mail). The feedback shall be provided within one (1) week of patient arrival at the ECPR center. Feedback shall include, but be not limited to, the following:

a. Date of service, sequence number, provider unit, patient age and gender, whether the patient received ECMO, survived to admission (and discharge if known) and positive feedback when a job was well done

b. Any quality-of-care concerns

CROSS REFERENCE

Prehospital Care Manual

Ref. No. 320, **ST-Elevation Myocardial Infarction (STEMI) Receiving Center (SRC) Standards**
Ref. No. 320.1, **Target Temperature Management Guidelines**
Ref. No. 320,3, **SRC Performance Measures**
Ref. No. 502, **Patient Destination**
Ref. No. 503, **Guidelines for Hospitals Requesting Diversion of ALS Patients**
Ref. No. 513, **S-T Elevation Myocardial Infarction (STEMI) Patient Destination**
Ref. No. 516, **Cardiac Arrest Patient Destination**
Ref. No. 621.2, **Notification of Personnel Change Form**
Ref. No. 648, **STEMI Receiving Center Data Dictionary**

Ref. No. 1308, **Medical Control Guideline: Cardiac Monitoring / 12-Lead ECG**

Current American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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