SBAR: ECMO GUIDELINES FOR ADULT PATIENTS WITH COVID-19

Pulse Heart Institute

Situation:

The world is amid a global pandemic, involving a novel coronavirus. For a small percentage of the population this virus is associated with a cytokine storm and severe adult respiratory distress. A small percentage of those patients who experience continued cardiopulmonary decline will benefit from temporary advanced mechanical support. This temporary mechanical support is provided through extracorporeal membrane oxygenation (ECMO: veno-venous and/or veno-arterial circuits). There is emerging observational data that rescue ECMO therapy for COVID 19 patients refractory to mechanical support and optimal medical therapy provides a survival benefit. This "rescue" ECMO therapy is considered an important adjunct to the standard of care for these higher acuity patients in established programs. Tacoma General Hospital of MultiCare has had an established mechanical support program since 2009. It provides life-saving therapy in the Puget Sound Region and beyond (1 program out of a total of 4 in the state).

Background:

The Pulse Heart Institute launched a mechanical support program in 2009 and formalized a certified ECMO program in 2015. The program has responded to prior pandemics with the need for temporary mechanical support, including the H1N1 pandemic. The program was launched with multidisciplinary support, and a set of system policies went into effect. These policies are reviewed and updated annually. Despite a patient population with a very high associated morbidity and mortality, we have demonstrated excellent survival outcomes. Overall, the ECMO program has seen > 50% of patients survive to discharge.

The ECMO team provides the highest level of training and education to the CVICU nursing team and support staff at Tacoma General Hospital. The Ventricular Assist Device Coordinators and Cardiac Perfusionists have worked closely with the nursing and medical staff for the past five years to develop a robust ECMO program. We know that the elements are in place to provide this life-saving therapy to appropriately selected COVID 19 patients in Washington State. The selection has been developed by a multidisciplinary group of medical providers and will be similarly implemented.

Assessment:

The current situation in our community, requires us to reflect on our mission to provide the highest quality of care to this patient population, while also considering the allocation of limited resources. We anticipate a percentage of young to middle-aged COVID-19 patients will require advanced support with ECMO. The WHO recently announced in their guidelines that ECMO is a

treatment mechanism for severe ARDS secondary to COVID-19. The Pulse Heart Institute has the resources to provide continuous ECMO support for up to 6 patients simultaneously.

Please see mission scope policy for Adult ECMO concerning time of support, criteria, withdrawal of care, as well as program structure. The program consistently reviews outcome data and implements quality improvement initiatives. In response to the emerging crisis, the ECMO team has developed a focused patient selection document specifically designed for the COVID-19 pandemic (please see attached references 1-current ECMO policy and 2-COVID 19 selection checklist).

The World Health Organization weighed in with recommendations of ECMO on its *Clinical Management of Severe Acute Respiratory Infection when Covid-19 Suspected*. (https://www.who.int/docs/default-source/coronaviruse/clinical-management-of-novel-cov.pdf) It concluded that temporary mechanical support through ECMO can reduce mortality in this patient population.

Recommendations:

It is the recommendation of the Pulse Heart Institute ECMO Team and this working group (critical care medicine, pulmonary medicine, anesthesia, CT surgery, heart failure cardiology, perfusionists, VAD coordinators) that we provide this life-sustaining support during this crisis. We have established criteria that we will use as guidance prior to placing someone on support. We are also attaching an assessment tool that we will use to assist in the interdisciplinary decision-making process (please see reference 2). Any ECMO support will occur in the setting of appropriate medical and mechanical ventilator therapies. The Pulse Heart Institute has the resources and program in place to be able to support this essential need during this critical time. Criteria below, are from system policy.

Inclusion Criteria Considerations:

1. Adult ECMO selection criteria apply to patients greater than 18 years of age
2. Patient should meet inclusion criteria and not have contraindications to ECMO before offering ECMO support.
3. Patients with acute respiratory failure with any one of the following will be considered an ECMO candidate:
   a) Severe respiratory failure as defined by a shunt > 30% on a FiO2 > 0.6 despite maximal medical management.
   b) Severe respiratory failure as defined by a static lung compliance <0.5cc/cmH2O/kg despite maximal medical management.
   c) Severe and life-threatening hypoxemia independent of time course.
   d) Lack of recruitment defined as an inadequate SpO2/PaO2 response to increasing PEEP from 5 to 15cmH20.
   e) Hypercarbic respiratory failure defined as uncorrectable hypercarbia when pH is < 7.0 and/or PIP > 40.
   f) 50% mortality risk, consider ECLS: PaO2/FiO2 < 150 on FiO2 >90% and/or Murray score 3-4.

g) 80% mortality risk, definite ECLS: PaO2/FiO2 <80 on FiO2 > 90% and Murray score 3-4.
h) CO2 retention (asthma, permissive hypercapnia) PaCO2 > 80 or inability to achieve safe inflation pressures (Pplat less than or equal to 30cm H2O).
i) Severe air leak syndromes

Exclusion Criteria Considerations:

a) Contraindication to systemic anti-coagulation
b) Terminal disease state with a short life expectancy
c) Underlying moderate to severe Chronic lung disease
d) Evidence of malignancy or incurable disease state
e) Multiple organ dysfunction syndrome defined as >2 organ system failure
f) PaO2/FiO2 ratio <100 for 5 or more days
g) Mechanical ventilation > 7 days
h) Uncontrolled metabolic acidosis
i) Central nervous system injury or malfunction
j) Chronic myocardial dysfunction
k) Chronic organ dysfunction
l) Prolonged CPR without adequate tissue perfusion
m) Massive PE or tamponade
n) Moderate to severe aortic insufficiency

Relative Contraindications:

a) Severe pulmonary hypertension (MPAP >45 or 75% systemic)
b) Cardiac arrest
c) GI bleeding
d) Acute, potentially irreversible myocardial dysfunction
e) Immunosuppression (absolute neutrophil count < 400/ml
f) Profound septic shock
g) More than 6 days of mechanical ventilation (FiO2 > .9, Pplat > 30)
h) Failure to wean from cardiopulmonary bypass
i) Age: No specific age considerations but consider increasing risk with increasing age, special consideration if patient is > 65 years of age
j) If patient weight is >125Kg the Team will need to closely examine case

NOTE: If there is not full agreement on whether ECMO is an appropriate therapy for a patient, the decision will be adjudicated by the SICC Medical Branch Chief, the CMO of the Pulse Heart Institute, and an ethicist in collaboration with the Critical Care team and the lead surgeon responsible for patients receiving ECMO treatment.

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ECMO CLINICAL DISCUSSION CHECKLIST (COVID SURGE)
Date & Patient MRN

Service/Team	Representative
Pulmonary	
Cardiothoracic Surgery	
Heart Failure	
ICU Charge RN	
Perfusion	
VAD Coordinator	
Palliative	
Social Work	

CLINICAL DATA

Demographics Age & Sex Major Comorbidities (DM?)	
Respiratory/Pulmonary/Med Tx FIO2/PEEP/Plateau Pressure Days on Vent Last ABG-Oxygen Index ARDS Tx (Proning, paralytic, pulm vasodilators) Attempted Respiratory Tx Attempted Medical Tx Current Pressor/Inotrope Requirements	
Hepatic Last LFTs (including Albumin, Bilirubin) Last INR (on anticoagulation?) Cirrhosis? Last Hepatic Imaging	
Cardiovascular Last Echocardiogram (EF/AI/PFO) PAD? SVO2, Hemodynamic Data	
Renal Current Creatinine/UOP Baseline Creatinine RRT/HD	
Neurologic Status Recent CVA? Last CNS Imaging	

MultiCare
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PROGRAM	LAST REVIEWED/REVISED DATE: July, 2019	NO. OF PAGES: 8
PULSE HEART INSTITUTE ADULT ECMO PROGRAM	POINT OF CONTACT: VAD Coordinator	TELEPHONE NUMBER: 253-231-1721

I. Description of Program / Service:

A. Extracorporeal Membrane Oxygenation (ECMO) is the use of a modified cardiopulmonary bypass circuit for temporary life support for adult patients with potentially reversible cardiac and/or respiratory failure.

B. ECMO is a life support modality that provides the opportunity to receive proper treatment and/or recovery time. ECMO at this institution will be utilized as supportive care and not treatment.

C. The Adult ECMO Program at Tacoma General Hospital utilizes guidelines developed by our multidisciplinary team. These guidelines have been created from up to date information from available publications and from the published guidelines of Extracorporeal Life Support Organization (ELSO).

D. Patients of the Adult ECMO program are selected based on structured selection and exclusion criteria, created by the program team, and will be ultimately approved by the surgical director. The ECMO selection team consists of the Surgical Director, Critical Care Intensivist, ECMO Coordinator, and referral consultant if available. Social Work and Palliative Care will be consulted in the selection decision process as well. The decision as to whether ECMO cannulation will be Veno-venous or Veno-arterial will be based on the patient's clinical scenario and will be the ultimate decision of the Surgical Director and Intensivist. ECMO support may be initiated in numerous settings within the hospital, but the monitoring and care of the patient will take place in TG CVICU.

E. Any patient undergoing cardiac surgery who is deemed by CV Surgery to be high risk for requiring ECMO in order to wean from bypass will be communicated to the ECMO team including pulmonary intensivist. This patient would then ideally receive a consult with social work and palliative medicine prior to the surgery date. In the event that a post-cardiotomy patient is placed on ECMO, the ECMO coordinator will facilitate communication with the intensivist prior to the patient coming to the CVICU.

F. Any ECMO patient will be considered to be in critical condition and will have a predicted mortality of 50% to 80% without this supportive care. ECMO patients should be being treated for an underlying disease process while on support.

G. Because ECMO is considered support it may be withdrawn at the decision of the ECMO Team. Withdrawal of care would come in conjunction with careful communication with family and other medical practitioners. There will be an ECMO informed consent form in place detailing the manner in which ECMO will be withdrawn if ongoing support is found to be non-progressing or futile.

II. Structure of Program:

A. Medical and Surgical Director

1. Maintain overall responsibility of the program
2. Assures proper credentialing and training of specialists involved
3. Assures there is accountability of staff performance
4. Directs quality improvement, leads meetings and assures there are proper data collection
5. Will have been through appropriate ECMO Training Course
6. Surgical Director determines credentialing criteria to properly place 17-25 French Cannula into Femoral Vein, or appropriate venous cannulation site with or without fluoroscopy assistance, to achieve proper cannula drainage for ECMO
7. Surgical Director determines credentialing criteria to properly place 19-22 French Cannula into Femoral artery, or appropriate ECMO inflow site, with or without fluoroscopy assistance to provide proper ECMO Flow
    a. Both surgical and medical director, or designated ECMO coordinator(s), insure that necessary team members are able to make proper “wet- to-wet” airless connections of these cannulae
    b. Responsible for providing education of these skills needed to other providers and continuing verification of these skills

B. ECMO Coordinators

1. A minimum of one perfusionist and one VAD coordinator
2. One VAD Coordinator and one perfusionist that have been trained as ECMO Specialists through the appropriate intensive training course
    a. This training course must provide full training of implementation, priming, startup, management, troubleshooting and weaning of ECMO
3. Responsible for supervision and training of technical staff
4. Works with Biomed to assure there is a maintenance plan for all clinical equipment
5. Assures proper data is properly collected
6. Works with Startup Team to build and facilitate ECMO Specialist Training Program

C. ECMO Specialists Startup Team

1. VAD Coordinator RN, Perfusionist, OR ECMO Specialist RN Trained as ECMO Specialists with further training in ECMO Implementation and startup
2. Completion of MultiCare ECMO Specialist Course

3. Demonstrates competency in wet lab training: must be able to properly setup and initiate ECMO
4. Demonstrates competency in weaning of ECMO
5. Demonstrates ability to make “wet-to-wet” connections of ECMO circuit
6. Works with Coordinators and Directors in developing program guidelines
7. Team Members unable to demonstrate skills through patient care or staff teaching within a 3 month period need to re- demonstrate skills in a wet lab setting
8. All demonstrations will be verified by an ECMO Coordinator

D. ECMO Specialists

1. Registered nurse or Perfusionist that has completed MultiCare ECMO Specialist Course and has documented competency of skills including Wet to Wet Connections of circuit
2. Must have access and training in ACT monitoring
3. Monitors and troubleshoots ECMO circuit
4. Biannual Skills verification including “wet-to-wet” connections

E. Pulmonary Intensivist

1. At least two intensivists should go through the intensive ECMO training with emphasis in medical management
2. Will receive proper ECMO medical management training from the aforementioned trained partners
3. If placing cannulae for ECMO startup must have had proper training for placement verified by surgical director of program
4. Will be trained and proficient in “wet-to-wet” connections of circuit

F. Non-Clinical Members

1. CVICU Management
    a. Assist in unit policy and guideline creation
    b. Assist in Staff Development
2. Palliative
    a. Early consult imperative
    b. Part of early team discussions so risk/benefit can clearly be communicated
3. Social Work
    a. Early consult imperative
    b. Important to establish family patient relationship early

c. Needs to be involved with all therapy decisions so they can communicate to patient and family

4. Education Services
   a. Help develop training plan for staff
5. Finance
   a. Preauthorization requirements
   b. Make team aware of insurance difficulties
   c. Workup for Bridge Therapies

III. Multidisciplinary Team Program Oversight:

A. Team Members

1. Medical Surgical Director
   a. Pulmonary Intesivist designee if Medical Director unavailable
   b. CV Surgeon designee if Surgical Director unavailable
2. Cardiology ad hoc
3. ECMO Coordinator
4. ECMO Specialists
5. CVICU Management

B. Team Meetings

1. Monthly meetings or as determined by Medical and Surgical Director
2. Debriefing on current or past ECMO runs
3. Programmatic review and updates
4. Quality review quarterly

IV. Mission:

Administer quality patient care, where quality is defined as achieving optimal outcomes for our patients through exceptional customer service and effective use of human, technological and financial resources.

V. Patient Selection:

A. General Selection Requirements

1. Adult ECMO selection criteria apply to patients greater than 18 years of age
2. Patient should meet inclusion criteria and not have contraindications to ECMO before offering ECMO support

B. **ECMO For Acute Respiratory Distress Syndrome:**

Patients with acute respiratory failure with any one of the following will be considered an ECMO candidate:

1. Severe respiratory failure as defined by a shunt > 30% on a FiO2 > 0.6 despite maximal medical management.
2. Severe respiratory failure as defined by a static lung compliance <0.5cc/cmH2O/kg despite maximal medical management.
3. Severe and life threatening hypoxemia independent of time course.
4. Lack of recruitment defined as an inadequate SpO2/PaO2 response to increasing PEEP from 5 to 15cmH20.
5. Hypercarbic respiratory failure defined as uncorrectable hypercarbia when pH is < 7.0 and/or PIP > 40.
6. 50% mortality risk, consider ECLS: PaO2/FiO2 < 150 on FiO2 >90% and/or Murray score 3-4.
7. 80% mortality risk, definite ECLS: PaO2/FiO2 <80 on FiO2 > 90% and Murray score 3-4.
8. CO2 retention (asthma, permissive hypercapnea) PaCO2 > 80 or inability to achieve safe inflation pressures (Pplat less than or equal to 30cm H2O).
9. Severe air leak syndromes

C. **ECMO For Cardiac Support or Other Veno-Arterial Support:**

Patients may be offered ECMO if they suffer an acute, life threatening, but potentially reversible, cardiovascular and/or respiratory decompensation which is amenable to ECMO support. Neurologic assessment can be challenging and a 24 hour trial time of support may be needed to assess this function, please see ECMO Withdrawal section below. Acute decompensation is defined as any one of the following:

1. Any condition which results in serious systemic hypotension unresponsive to maximal pharmacotherapy.
2. Acute hypoxemia unresponsive to maximal medical management.
3. Sepsis/septic shock
4. Aspiration syndromes
5. Trauma
6. Poisonings/overdoses
7. Cardiogenic shock (inadequate tissue perfusion manifested by hypotension and low cardiac output despite adequate intravascular volume, inotropes and/or intra-aortic balloon counterpulsation, if appropriate.
8. Diabetic Coma without signs of permanent brain damage

9. Bridge to transplant or other assistive device.

D. **EXCLUSION CRITERIA:**

An adult patient (those patients > 18 years of age) may be excluded from ECMO if any of the following conditions exist. The interpretation of absolute and relative criteria is at the discretion of the Medical or Surgical directors or their designees, the team agrees that these issues are most likely absolute contraindications:

1. Contraindication to systemic anti-coagulation
2. Terminal disease state with a short life expectancy
3. Underlying moderate to severe Chronic lung disease
4. Evidence of malignancy or incurable disease state
5. Multiple organ dysfunction syndrome defined as >2 organ system failure
6. PaO2/FiO2 ratio <100 for 5 or more days
7. Mechanical ventilation > 7 days
8. Uncontrolled metabolic acidosis
9. Central nervous system injury or malfunction
10. Chronic myocardial dysfunction
11. Chronic organ dysfunction
12. Prolonged CPR without adequate tissue perfusion
13. Massive PE or tamponade
14. Moderate to severe aortic insufficiency

Consideration of the following relative contraindications to ECMO should be made. These are not necessarily individually excluding factors but several taken together or the occurrence of one very severe condition may be used to exclude a given patient.

1. Severe pulmonary hypertension (MPAP >45 or 75% systemic)
2. Cardiac arrest
3. GI bleeding
4. Acute, potentially irreversible myocardial dysfunction
5. Immunosuppression (absolute neutrophil count < 400/ml3)
6. Profound septic shock
7. More than 6 days of mechanical ventilation (FiO2 > .9, Pplat
8. >30)
9. Failure to wean from cardiopulmonary bypass

10. Age: No specific age considerations but consider increasing risk with increasing age, special consideration if patient is > 65 years of age
11. If patient weight is >125Kg the Team will need to closely examine case

VI.PATIENT MANAGEMENT

A. Multidisciplinary team collaborative

B. Daily rounding

1. Medical and Surgical Director (or in-house designees)
    a. ECMO coordinator
    b. Bedside ECMO Specialist
    c. Active medical consultants
    d. Palliative care and Social Work as needed
    e. Consultants
    f. Social Work and Palliative Care to be consulted immediately during the decision process
    g. Necessary in aiding in communications with patients and families regarding progress of support and possible need for withdrawal
    h. Neurology to be consulted if assistance is needed in determining brain death
    i. Cardiology to be consulted for necessary interventions and rhythm management

VII.ECMO WITHDRAWAL:

The initiation of ECMO to stabilize a patient who suffers an acute, life threatening event shall not be misconstrued as making a fixed commitment to prolonged ECMO support. It is important to remember that ECMO is considered support, not therapy. If ECMO is determined to be futile, such support may be electively discontinued at a time determined by the medical and surgical director or their designees. The informed consent clearly defines this information to patients and families. ECMO for cardiac support needs can be complicated by an unknown state at the time of cannulation. A contraindication to placement is neurologic malfunction, yet in unconscious patients that need support, this can be difficult to determine. The team will allow a 24 hour time period permitting for identification of neurologic status after cannulation. If determined that the patient's neurologic status is compromised at the end of this 24 hour period, the team may elect to remove ECMO support. The decision to remove care will be discussed with the ECMO team in rounds, but the ultimate decision falls on the Medical and Surgical directors or their delegates.

VIII.AVAILABLE SERVICES

A. Comprehensive Heart Failure Management Program

1. Located within the Tacoma General Heart Hospital
2. Outpatient management of heart failure including optimization of medical management, supportive self- management instruction and support groups
3. Evaluation for destination therapy based on ACC/AHA guidelines
4. Heart Failure interdisciplinary consultative services including social work, palliative care physicians, case management, dieticians, patient and family educators, and transition navigators
5. Post implant monitoring of destination therapy device patients

B. Comprehensive Cardiovascular Intensive Care and Progressive Care Management

1. 13 bed Cardiovascular Intensive Care Unit specializing in cardiac, vascular and thoracic surgery and all cardiac medical intensive care needs
    a. Staffed 24/7 with skilled cardiac intensive care unit staff with advanced competency in ventricular assist device management
2. 29 bed Coronary Care Unit specializing in cardiac, vascular and thoracic surgery and cardiac medical progressive care from intensive care step down to discharge.
    a. Staffed 24/7 with skilled cardiac progressive care unit staff with competency in HeartMate II ventricular assist device management
    b. Staffed 24/7 with skilled staff that assist VAD program with home preparedness and physical rehabilitation (physiatrists, physical therapists, occupational therapists, speech therapists, case managers, social workers and RNs).

C. Ventricular Assist Device Destination Therapy Program Interdisciplinary Committee

1. Patients on ECMO that could potentially become LVAD patients will be quickly referred and evaluated by the VAD Program

VIEWPOINT

Preparing for the Most Critically Ill Patients With COVID-19
The Potential Role of Extracorporeal Membrane Oxygenation

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The novel coronavirus has now infected tens of thousands of people in China and has spread rapidly around the globe.[1] The World Health Organization (WHO) has declared the disease, coronavirus disease 2019 (COVID-19), a Public Health Emergency of International Concern and released interim guidelines on patient management.[2] Early reports that emerged from Wuhan, the epicenter of the outbreak, demonstrated that the clinical manifestations of infection were fever, cough, and dyspnea, with radiological evidence of viral pneumonia.[3,4] Approximately 15% to 30% of these patients developed acute respiratory distress syndrome (ARDS). The WHO interim guidelines made general recommendations for treatment of ARDS in this setting, including that consideration be given to referring patients with refractory hypoxemia to expert centers capable of providing extracorporeal membrane oxygenation (ECMO).[2]

ECMO is a form of modified cardiopulmonary bypass in which venous blood is removed from the body and pumped through an artificial membrane lung in patients who have refractory respiratory or cardiac failure.[5] Oxygen is added, carbon dioxide is removed, and blood is returned to the patient, either via another vein to provide respiratory support or a major artery to provide circulatory support. ECMO is a resource-intensive, highly specialized, and expensive form of life support with the potential for significant complications, in particular hemorrhage and nosocomial infection. Recent evidence suggests that use of ECMO in the most severe cases of ARDS is associated with reduced mortality.[6] There is some evidence that outcomes from ECMO are better in higher-volume centers.[7]

> ECMO is not a therapy to be rushed to the frontline when all resources are stretched in a pandemic.

The role of ECMO in the management of COVID-19 is unclear at this point. It has been used in some patients with COVID-19 in China but detailed information is unavailable.[3] ECMO may have a role in the management of some patients with COVID-19 who have refractory hypoxemic respiratory failure.[6] However, much about the virus is unknown, including the natural history, incidence of late complications, viral persistence, or the prognoses in different subsets of patients. This uncertainty might be compared to the emergence of influenza A(H1N1) in 2009, when it was initially unclear what the role of ECMO should be.[8] However, the degree of uncertainty surrounding COVID-19 is much greater. To address this, prompt mobilization of existing registries and clinical research groups should help facilitate the systematic collection of data. For example, the Extracorporeal Life Support Organization (ELSO) Registry is being adapted to acquire new information about COVID-19 and prospective observational studies are under way.

ECMO does not provide direct support for organs other than the lungs or heart beyond increasing systemic oxygen delivery and mitigating ventilator-induced lung injury. A substantial proportion of critically ill patients with COVID-19 appear to have developed cardiac arrhythmias or shock,[3] but it is unknown how many have or will develop refractory multiorgan failure, for which ECMO may be of more limited use. To postulate about the potential benefit of ECMO in this infection, more data on the mechanism of death and disease are required. The virus may cause death through progressive hypoxic respiratory failure, septic shock, refractory multiorgan failure, or by precipitating exacerbation of comorbid diseases such as ischemic heart disease or cardiac failure, but the relative proportions of these diseases in large cohorts of patients with COVID-19 infection are unknown.

The global spread of COVID-19, although the number of cases outside of China remains small, will likely occur via many dispersed epicenters where local transmission has become established. If these epicenters occur in sophisticated health care systems with preexisting ECMO programs, this will provide vital information about the utility of ECMO and help anticipate global demand. Should the initial experience be encouraging, it is likely that non-ECMO centers will refer early to ECMO centers in anticipation of impending clinical deterioration. This will disproportionately affect hospitals with ECMO programs, even when ECMO is not required.

Furthermore, with the apparent contagiousness of this virus and the relatively high numbers of patients who require intensive care, this may prove very resource-consumptive. Countries will need to pay specific attention to the considerable investment needed to provide ECMO during this outbreak. Judgment will be needed to decide when ECMO may be worthwhile and when it may not, understanding that the risk-to-benefit ratio of performing ECMO in these circumstances is dynamic and dependent on many factors. If the mechanism of death in COVID-19 ultimately includes a substantial number of patients with septic shock or refractory multiorgan failure, then the shift away from ECMO is likely to occur earlier because

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the most severely ill patients in this cohort would be less likely to benefit. The higher the all-cause mortality, the less relevant ECMO becomes.

Regardless, ECMO is clearly a finite resource. In a large outbreak, additional limitations to providing ECMO may include a lack of ECMO consoles or disposable equipment, suitably trained staff, or isolation rooms with the requisite infrastructure. Many materials necessary to make ECMO circuitry are manufactured in China and it is conceivable that the outbreak may disrupt supply chains.

A number of different models of ECMO service provision exist worldwide, ranging from a relative lack of regulation and centralization—with many hospitals having ECMO capability but often with very low case volumes (eg, in the US or Japan)—through to regional or national coordination of ECMO referral centers with dedicated interhospital retrieval teams (eg, New Zealand, Australia, Singapore, Qatar, the United Kingdom, or Sweden). In response to influenza A(H1N1) in 2009, some countries such as Italy adopted the latter model and it is possible that COVID-19 could be addressed similarly. The advantages of such an approach include standardization of indications, management, data collection, and containment.[5,7] The disadvantage is the potential for hospitals that provide ECMO to be overwhelmed with critically ill patients unless interhospital transfers are centrally coordinated.

With the WHO recommendation for ECMO in place and the tropism of the COVID-19 virus for severe respiratory illness, the number of cases in which ECMO is used may increase over the course of this outbreak. However, there may come a tipping point. Should the case volume in any given region increase beyond the ability to provide routine care, any earlier increase in ECMO use may give way, with utilization later decreasing in proportion to the overwhelming demands on the system as a whole.

Support with ECMO is for the most critically ill patients in regions with the extensive resources required to provide this therapy. ECMO is not a therapy to be rushed to the frontline when all resources are stretched in a pandemic. In less well-resourced countries, many more lives will be saved by ensuring oxygen and pulse oximetry are widely available. Mitigation efforts to slow the outbreak are critical so that health care systems are not overwhelmed and all patients receive the correct management, whether simply confirmation of the diagnosis and appropriate quarantine, oxygen therapy alone, mechanical ventilation or, for those most likely to benefit, ECMO.

ARTICLE INFORMATION

Published Online: February 19, 2020. doi:10.1001/jama.2020.2342

Conflict of Interest Disclosures: Dr Brodie reported receiving grants from Alung Technologies, serving on the medical advisory board for Alung Technologies, Xenios, Breethe, Baxter, and Hemovent. No other disclosures were reported.

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