ECMO

Abd Alrhman Dakak

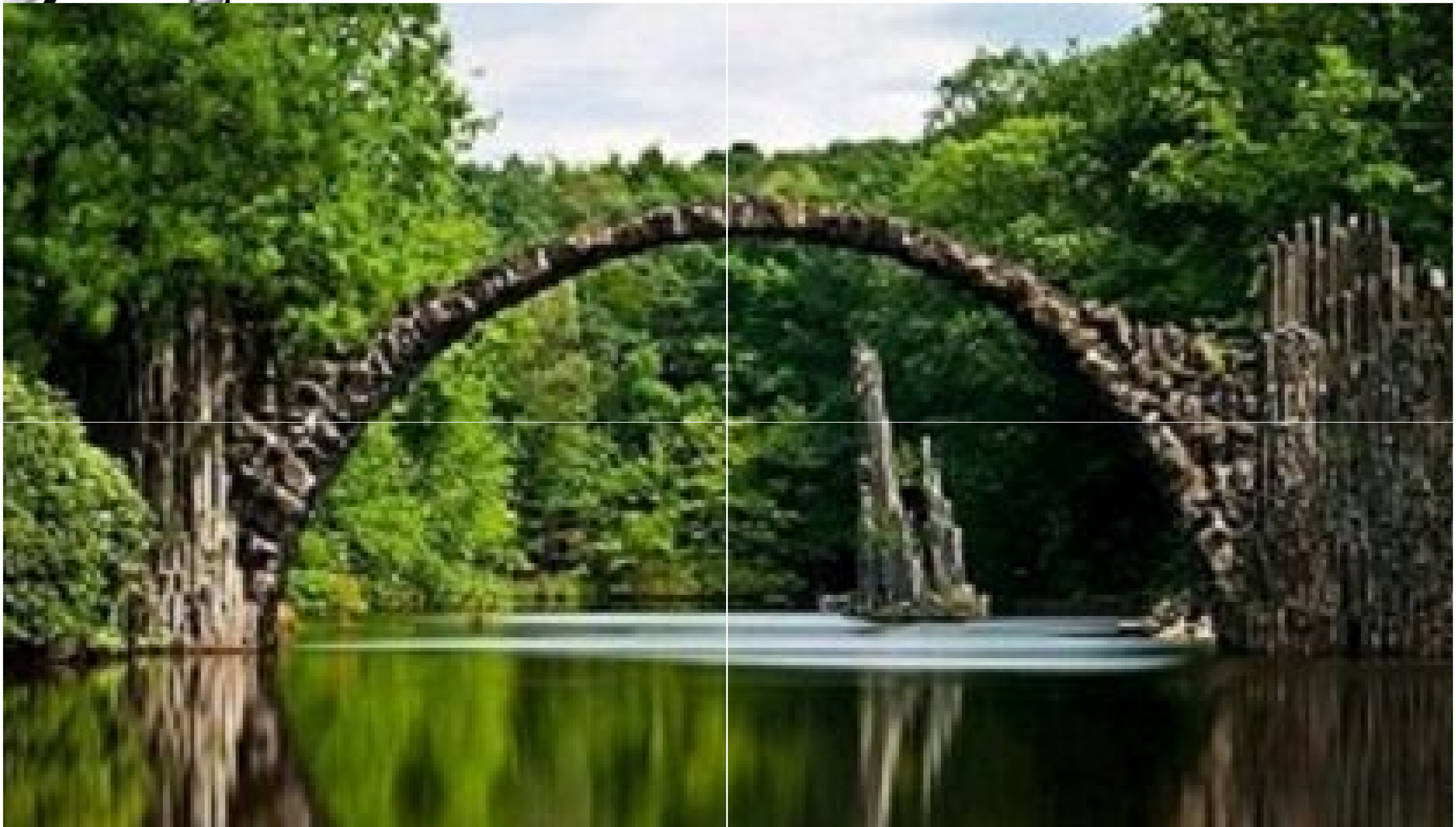
OUT LINE

- DEFINITION
- HISTORY OF ECMO
- ECMO TYPE
- INDICATION
- CONTRA INDICATION
- COMPLICATIONS
- SURVIVALS
- CONCLUSION

- What is ECMO

(ECMO) MEANS

- extracorporeal membrane oxygenation (ECMO),
- extracorporeal life support,(ECLS)
- or extracorporeal lung assist

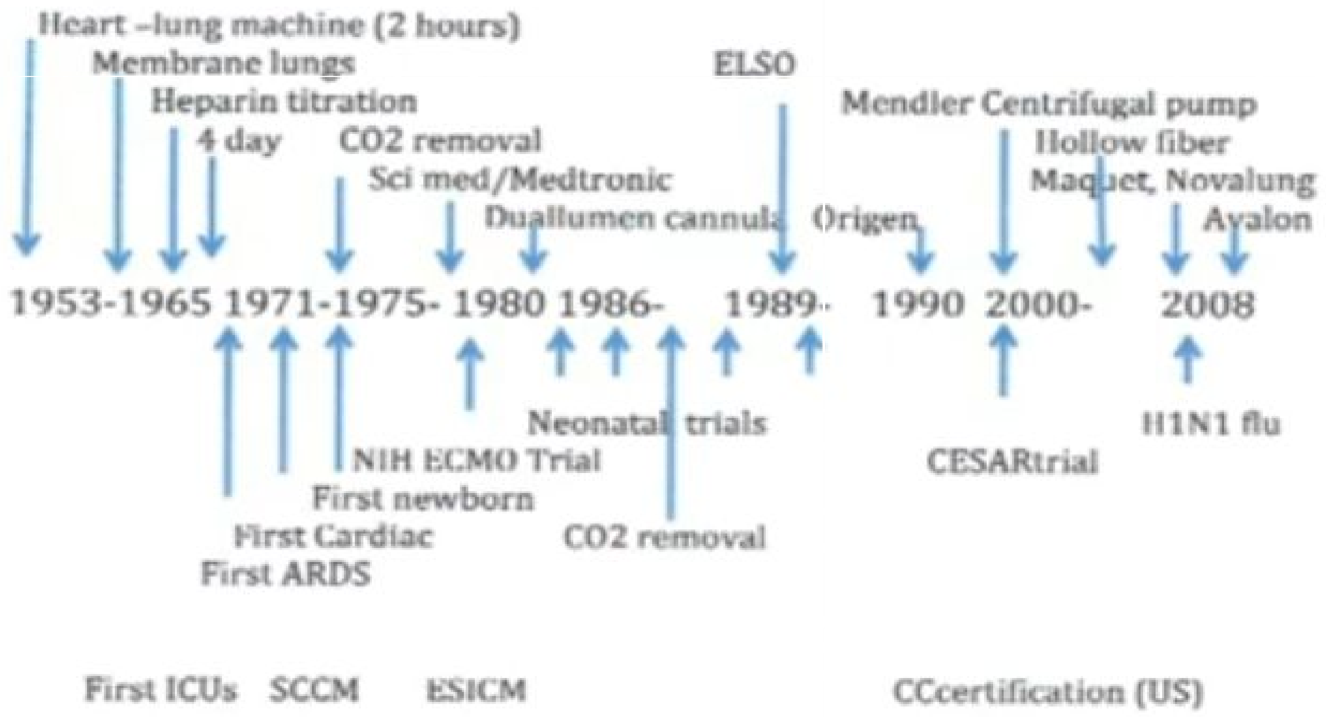


- EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO),
- BLOOD IS PUMPED OUTSIDE OF YOUR BODY TO A HEART-LUNG MACHINE THAT REMOVES CARBON DIOXIDE AND SENDS OXYGEN-FILLED BLOOD BACK TO TISSUES IN THE BODY.

- BLOOD FLOWS FROM THE RIGHT SIDE OF THE HEART TO THE MEMBRANE OXYGENATOR IN THE HEART-LUNG MACHINE, AND THEN IS REWARMED AND SENT BACK TO THE BODY

History of ECMO

A History of ECMO



History of ECMO

History of Extracorporeal Life Support

1950s	Development of membrane **oxygenator** in laboratory
1971	**First successful case**
1972	**First successful paediatric cardiac case**
1975	**First neonatal case** (Esperanza)
1975-89	Trial in **ARDS**, 10% survival
1990	**Standard practice for neonates and paediatrics** in some centres
2000	**Standard practice for adults** in some centres
2009	Publication of the **CESAR** trial which led to a significant growth in the use of ECMO for ARDS cases

ECMO Trials

Clinical Trials, 2009-2020

2009 ANZIC ECMO. H1N1	*Cohort: 70% surv*
• *2010. H1N1. (Noah)*	*Propensity 76% surv*
• *2012: EOLIA trial. (Combes)*	*RCT: 65% surv*
• *2020. Covid (Registry,Barbaro)*	*Observational 60% surv*
• *2020 Covid. (Osborn).*	*Observational. 75% surv*
• *2020 Covid. (Tatooles).*	*Observational. 75% surv*

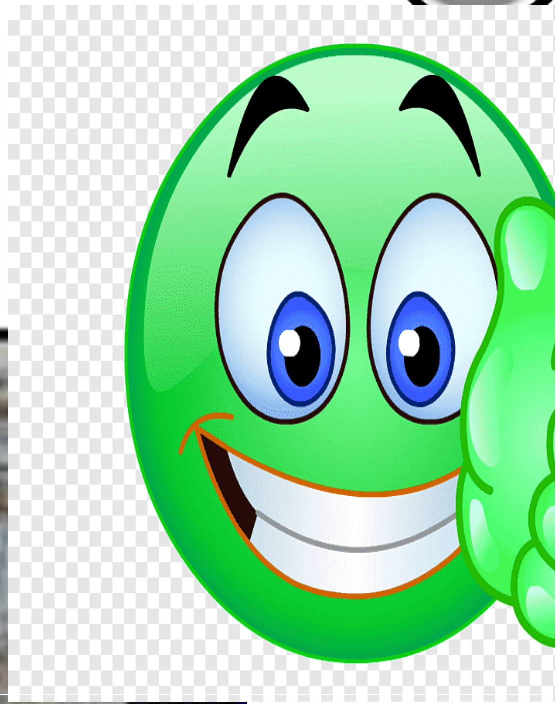
First successful ECMO patient in1971

Figure 3.4. The first successful extracorporeal life support patient, treated by J. Donald Hill using the Bramson oxygenator (foreground), Santa Barbara, 1971.

First Neonatal ECMO survivor..

Esperanza, Age 1 day 1975

Esperanza, age 21



om this...

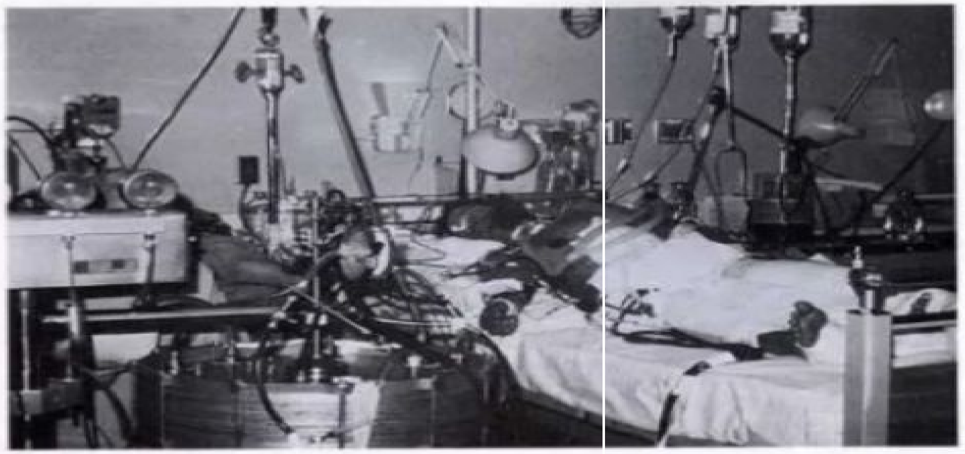


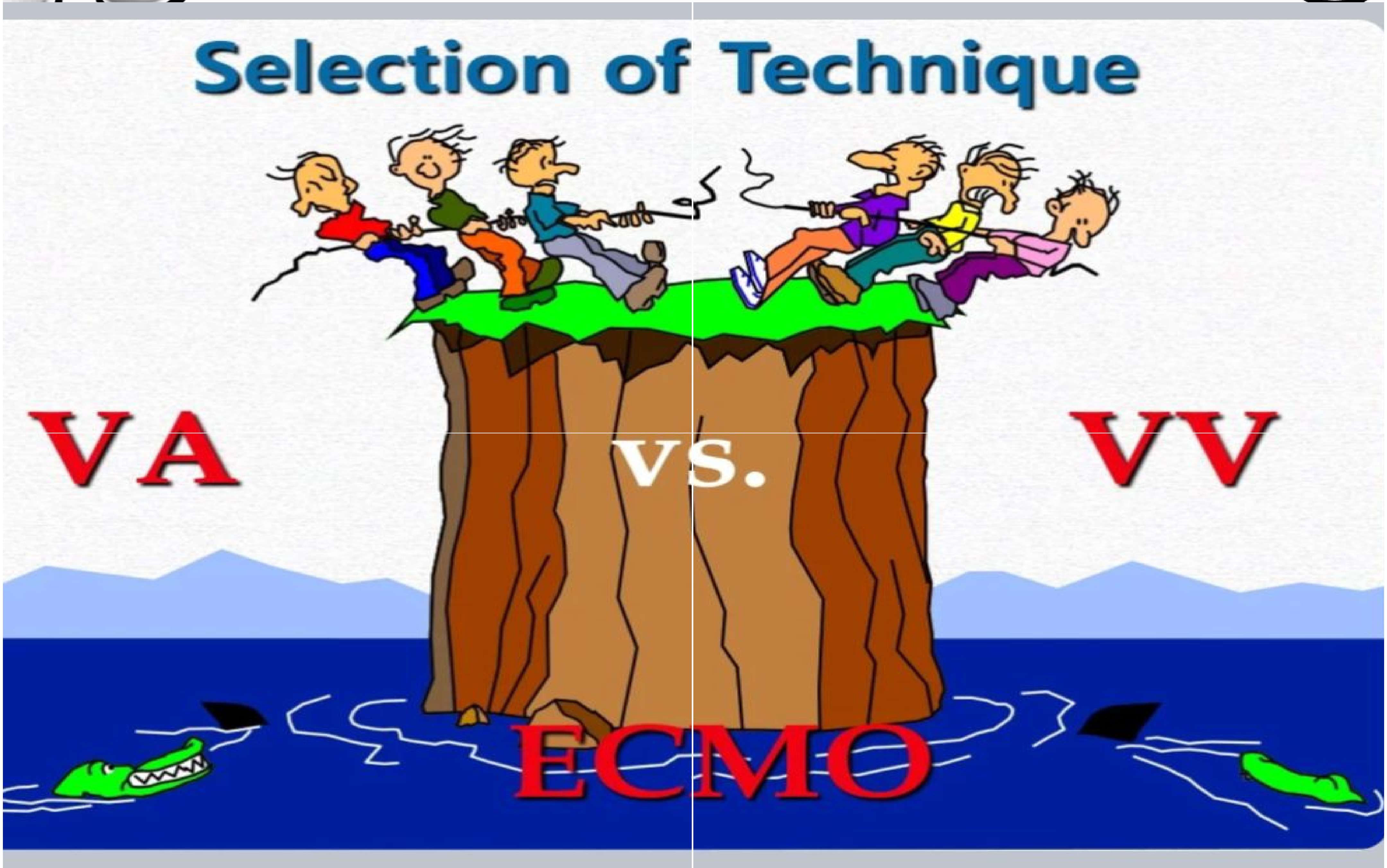
FIGURE 3.4 The first successful extracorporeal life support patient, treated by J. Donald Hill using the Bramson oxygenator (foreground), Santa Barbara, 1971.

TO THIS!!

There are two types of ECMO

venovenous (VV).

venoarterial (VA)


Selection of Technique
VA
VS.
VV
ECMO

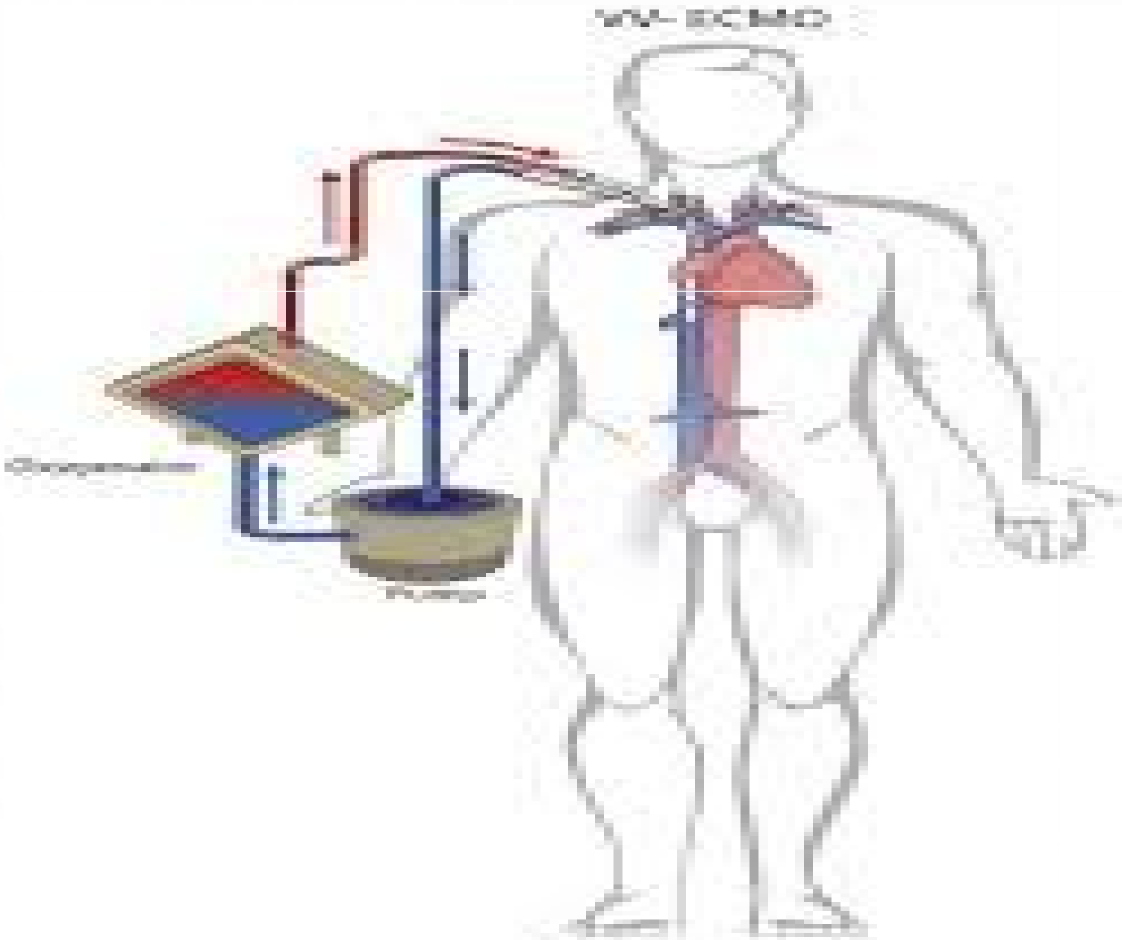
VA – VenoArterial

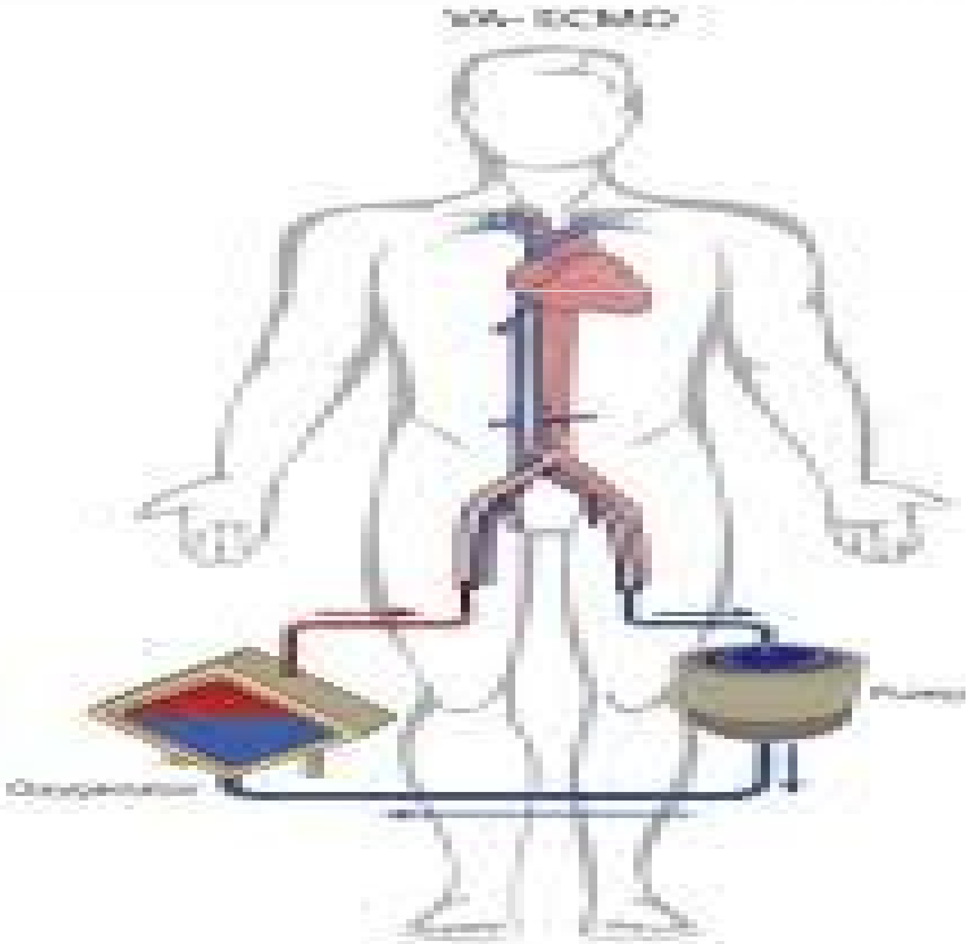
- Provides cardiac and respiratory support

VV – VenoVenous

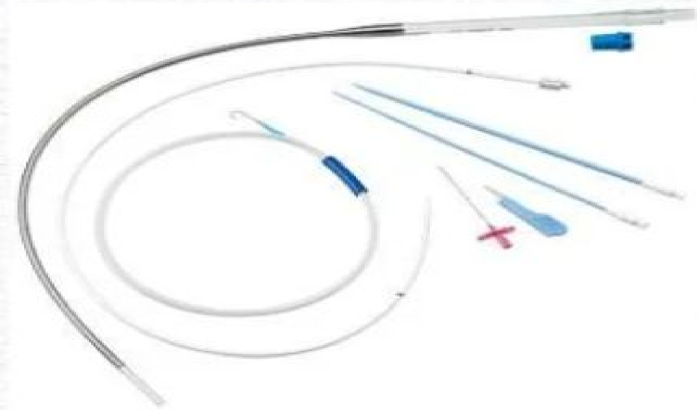
- Provides respiratory support <u>only</u>

ECMO CANNULATION





Cannulation …



Ch
Healthcare of Atlanta

INDICATION OF ECMO\ELSO GUIDELINES

ACUTE SEVERE CARDIAC FAILURE

OR

- PULMONARY FAILURE THAT IS POTENTIALLY REVERSIBLE AND UNRESPONSIVE TO CONVENTIONAL MANAGEMENT

ECLS IS CONSIDERD AT 50% MORTALITY RISK AND INDICATED AT 80% RISK

Indications for ECMO in respiratory failur

f PaO2/FiO2 < 150 on FiO2 > 90%:

:heck the following first before considering ECMO:

a. Lung protective ventilation according to ARDSnet

b. Prone Positioning if not contraindicated

c. Complete sedation RAS -3

d. Neuro Muscular Blockade

e. Lung Recruitment maneuvers

f. Diuresis

Indications for ECMO in respiratory failu

..In hypoxic respiratory failure: ECMO should be considered when:
the risk of mortality is 50% or greater and is indicated when
the risk of mortality is 80% or greater.
a.50% mortality risk is associated with a $PaO_2/FiO_2 < 150$ on $FiO_2 > 90\%$
b.80% mortality risk is associated with a $PaO_2/FiO_2 < 100$ on $FiO_2 > 90\%$
despite optimal care for 6 hours or more.

. CO_2 retention on mechanical ventilation despite high Pplat (>30 cm H_2O)

When to Initiate VV ECMO

Refractory Hypoxia

F Ratio <80 mmHg for >6-hours **OR**

F Ratio <50 mmHg for >3-hours

Refractory Hypercapnia

Hypercapnia that results in:

H <7.20 for >6-hours with PaCO2 ≥ 60mmHg

Despite optimal ventilator settings:

RR up to 35/minute and Plateau Pressure up to 32cmH20)

Some Lung (Pulmonary) Conditions in Which ECMO May Be Used Include

Acute respiratory distress syndrome (ARDS)

Blockage in a pulmonary artery in the lungs (pulmonary embolism)

Coronavirus disease 2019 (COVID-19)

Defect in the diaphragm (congenital diaphragmatic hernia)

Fetus inhales waste products in the womb (meconium aspiration)

Flu (influenza)

High blood pressure in the lungs (pulmonary hypertension)

Pneumonia

Respiratory failure

Trauma

Some heart conditions in which ECMO may be used include:

- Heart attack (acute myocardial infarction)
- Heart muscle disease (decompensated cardiomyopathy)
- Inflammation of the heart muscle (myocarditis)
- Life-threatening response to infection (sepsis)
- Low body temperature (severe hypothermia)
- Post-transplant complications
- Shock caused by the heart not pumping enough blood (cardiogenic shock

CONTRAINDICATIO

PATIENTS NOT ELIGIBL FOR ECMO :

1.Age >65

2.Chronic Organ Dysfunction, e.g., lung, liver, and or heart failure.

3.Severe Neurological Dysfunction e.g., acute, or chronic debilitating stroke, dementia, etc.

4.Malignancy with life-expectancy of less than 5-years

5.Patients who did not receive optimal medical therapy for ARDS

6.Multi-organ failure (excluding reversible pre-renal failure by only IV fluid management) (only Respiratory Failure).

7.Significant Comorbidities (except controlled DM and HTN).

- Relative contraindications

PATIENTS NOT ELIGIBL FOR ECMO :

8.Mechanically ventilated for more than 7 days.

9.CPR

10.BMI more than 40

11.Immunocompromised status

12. High dose vasopressor requirement

13.Sever peripheral vascular Disease

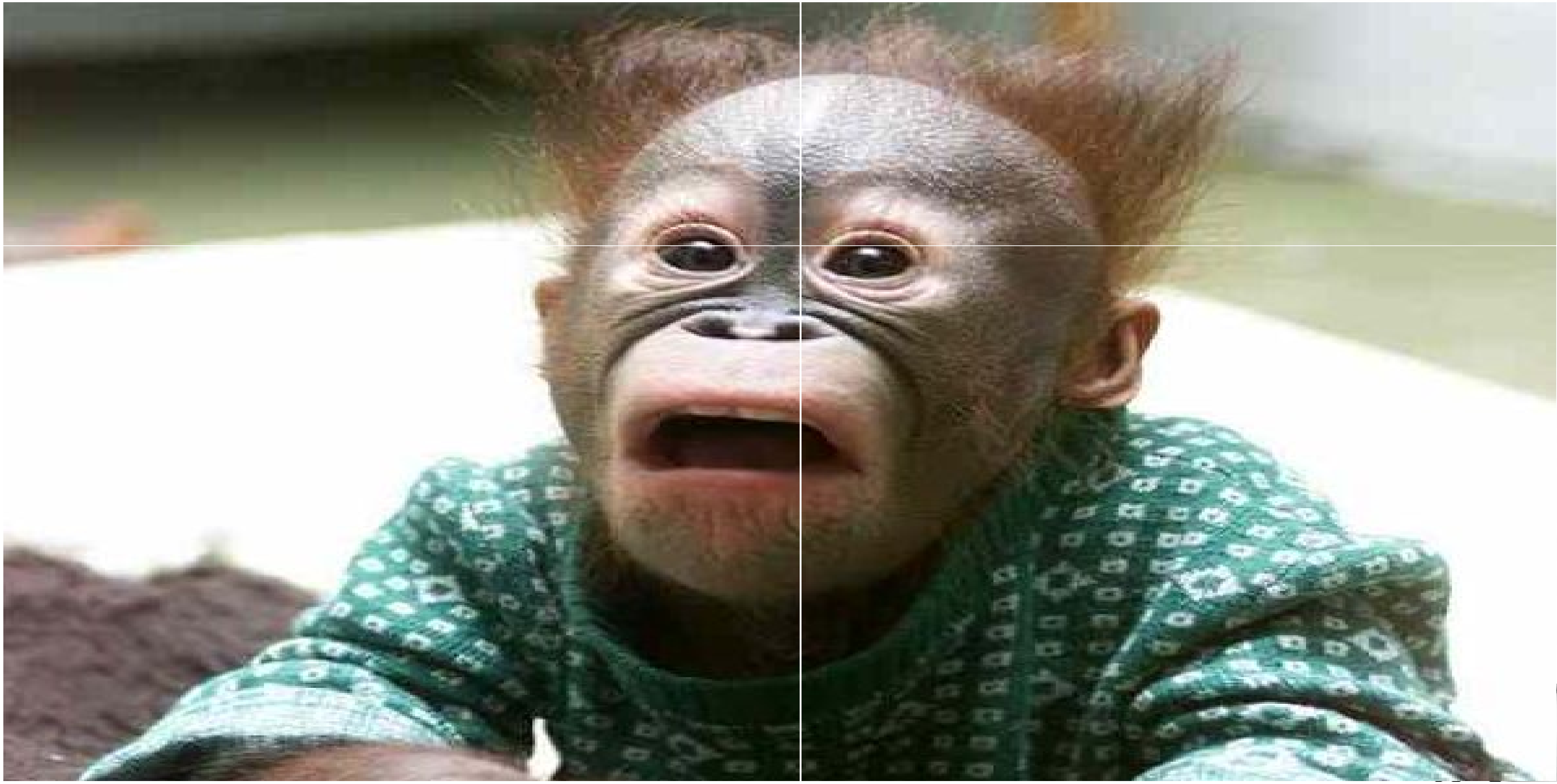
14.Contraindications to anticoagulation

- Relative contraindications ⚠️

CONTRAINDICATIONS

The only absolute contraindication to ECMO is a pre-existing condition that is incompatible with recovery (end stage malignancy……)

THE MOST COMMON RISKS THAT MAY OCCUR WITH ECMO INCLUDE:



THE MOST COMMON RISKS THAT MAY OCCUR WITH ECMO INCLUDE:

Bleeding

Blood clot (thromboembolism)

Blood clotting disorder (coagulopathy)

Infection

Loss of blood in hands, feet or legs (limb ischemia)

Seizures

e (part of the brain is damaged by loss of blood or by a blood vessel that bursts)

- SURVIVAL

(CESAR; 2009) TRIAL

trial randomly assigned 180 patients with severe acute respiratory failure

to either be referred to a single ECMO center in the(U K) or

undergo continued conventional management.

(CESAR; 2009) TRIAL

25 % of the patients referred for ECMO were **not managed** with ECMO becau

5died before transfer to the ECMO center

nd 16 recovered with the conventional ventilation protocol used by the ECMO cent

(CESAR; 2009) TRIAL

e trial defined severe acute respiratory failure as

hypercapnic respiratory acidosis with an arterial pH <7.20 or

a Murray score greater than 3.0 :

e Murray score quantitates the severity of lung disease on the basis of the ratio of erial oxygen tension to the fraction of inspired oxygen (PaO2/FiO2)

ositive end-expiratory pressure (PEEP),

ng compliance, and chest radiograph.

portant exclusion criteria included an age <18 years or >65 years, intubation greater th ven days, and contraindications to anticoagulation. However, this trial was criticized fo heterogeneous ventilation strategies in the control group and the large number of ients transferred for ECMO that never received it due to improvement with standard lo ume ventilation.

(CESAR; 2009) TRIAL

The group referred to the ECMO center had <u>significantly increased survival</u> without disability at <u>6 months</u> compared to conventional management (63 versus 47 percent).

(CESAR; 2009) TRIAL

The **conclusion** of this trial was that adults with severe acut respiratory failure should be referred to an ECMO center for evaluation for ECMO.

EOLIA TRIAL

randomly assigned **249** patients with severe ARDS:

PaO2:FiO2] <50 mmHg >3 hours or

aO2:FiO2 <80 mmHg for >6 hours)

eceive early (as soon as entry criteria are met) venovenous ECMO

onventional low-tidal volume low-pressure ventilation (which could

ude late ECMO as a rescue therapy)

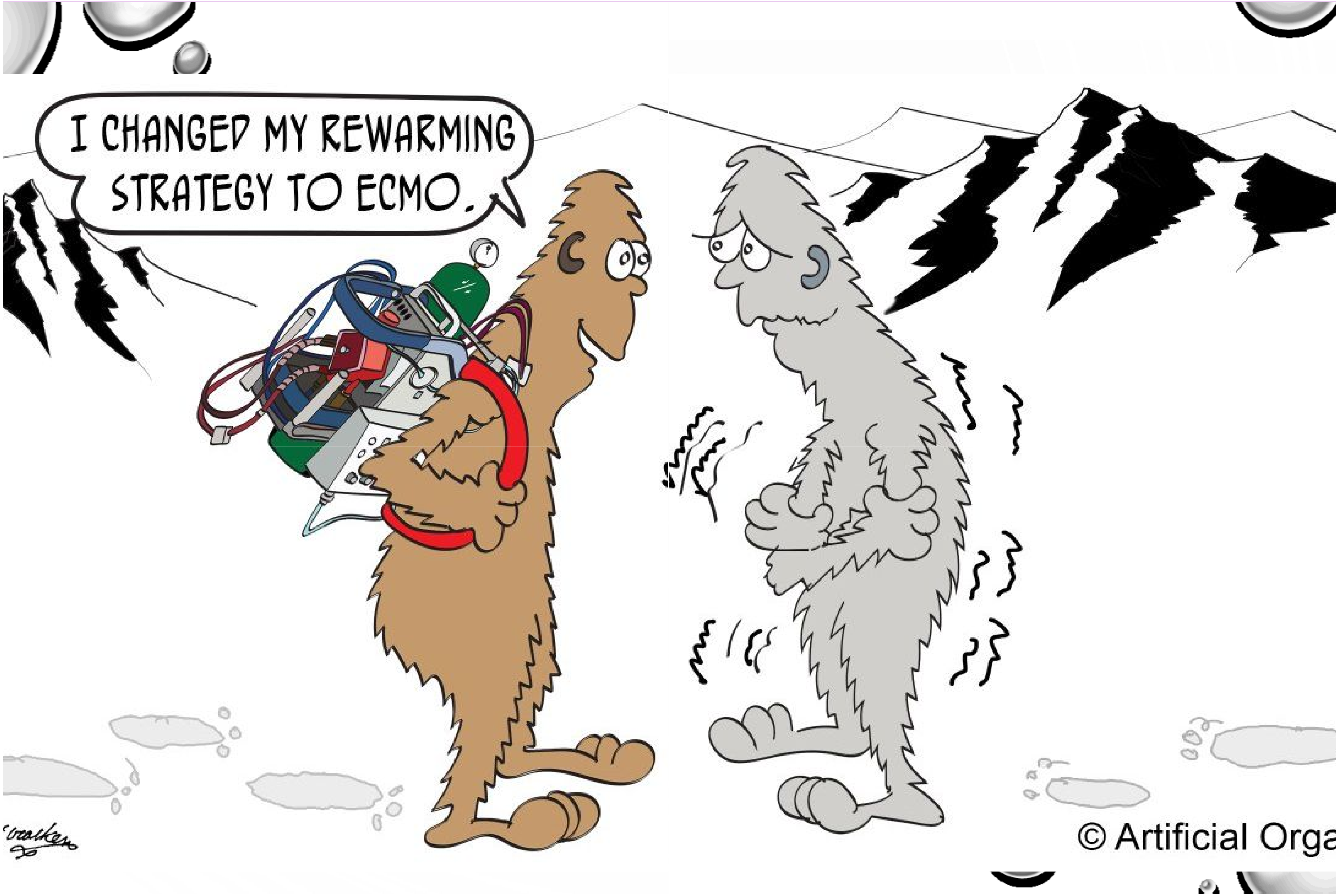
		venovenous ECMO		conventional low-tidal volume low-pressure ventilation	
roved oxygenation, e days free of renal ure		46%		21%	
ay mortality, while in favor of early IO,		46%		35%	
erse cts: bleeding uiring transfusion		46%		28%	
ere mbocytopenia		27%		16%	

'hese results may have been biased in favor of conventional care by several factors including early termination of the trial,

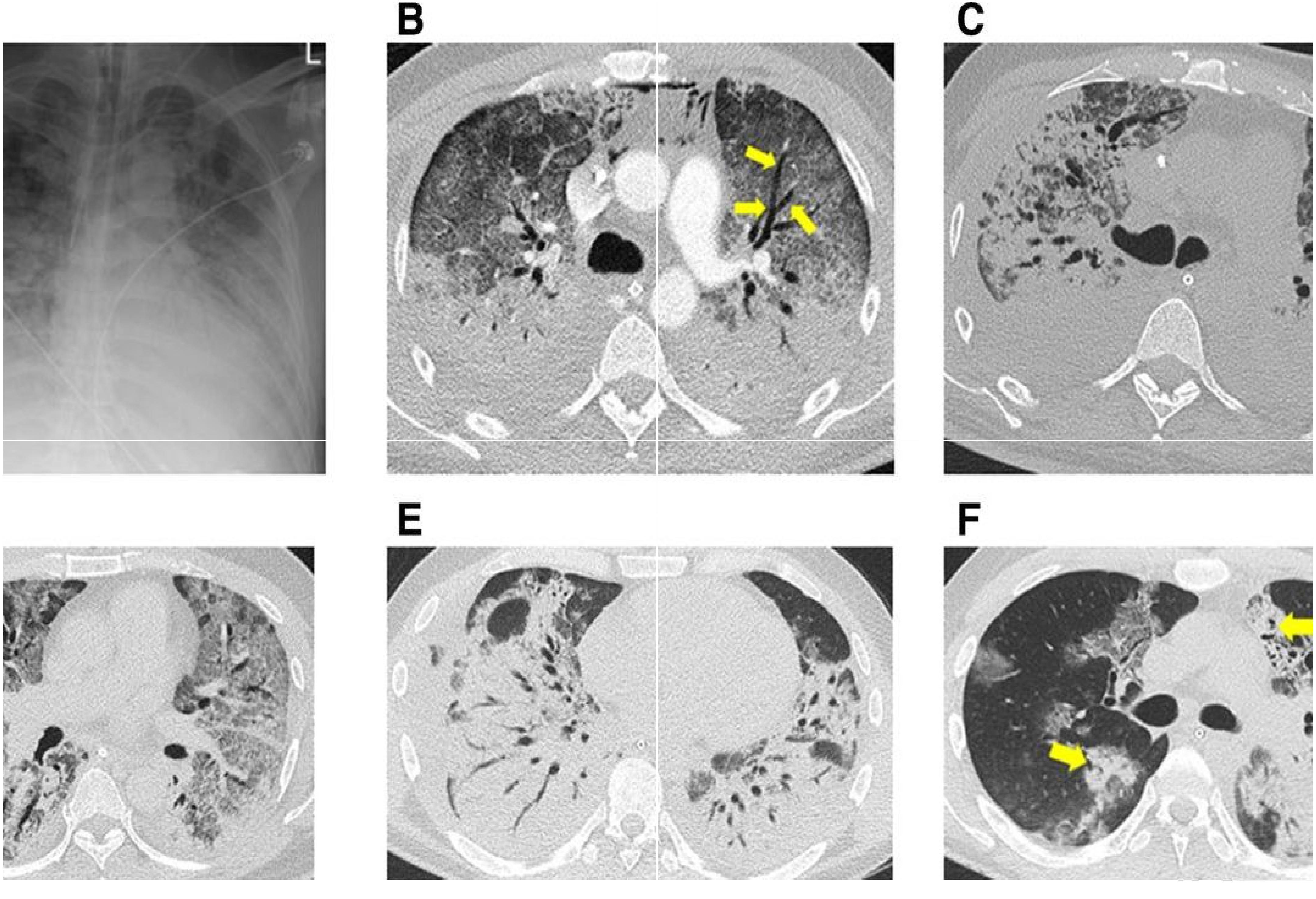
he high percentage of sicker patients that crossed over from the conventional treatment group to the ECMO group for rescue herapy (28 percent; median PaO_2 was 51 mmHg compared with '3 mmHg at study entry),

and the high utilization in the control group of ARDS therapies associated with improved outcome or oxygenation including prone positioning (90 percent), inhaled pulmonary vasodilators 83 percent), and neuromuscular blockade (100 percent). In our opinion,.

- this study supports the conclusion that patients with severe ARDS who fail to respond to optimal treatment (eg, low tidal volume ventilation with or without a short trial of prone ventilation, pulmonary vasodilators, and neuromuscular blockade) should be managed with ECMO promptly rather than later as a rescue treatment


I CHANGED MY REWARMING STRATEGY TO ECMO.
© Artificial Orga

- ECMO AND COVID-19


B
C
E
F

OBSERVATION COVID-19

In a review of 4812 patients in 41 countries who received ECMO treatment for COVID-19 infection throughout 2020 the cumulative incidence of in-hospital mortality was 36.9 percent before May 1, 2020, but mortality rates increased to 58.9 percent during the remainder of 2020, possibly due to changes in decisions regarding indications for ECMO in a 2020 retrospective study of 492 COVID-19 patients receiving ECMO in French hospitals, the estimated mortality was 31 percent

These results are comparable to mortality in adult patients receiving ECMO support for acute respiratory failure due to other diagnoses

Other 2020 reviews include the Extracorporeal Life Support Organization (ELSO) Registry that included 1035 COVID-19-positive patients in more than 200 internationally located hospitals, which reported a 40 percent estimated mortality after 90 days of ECMO support

ELSO Centers, 2011

ELSO Centers. . 2020


WHY DONT WE TAKE THE BLOOD
AND OXYGENATE IT SOMEWHERE ELSE
imgflip.com

Thank you