

The History of ECMO

- ▶ *Patti Raval MMSc, PA-C*
- ▶ *Florida Hospital -Orlando*
- ▶ Patricia.Raval.PAC@FHosp.org



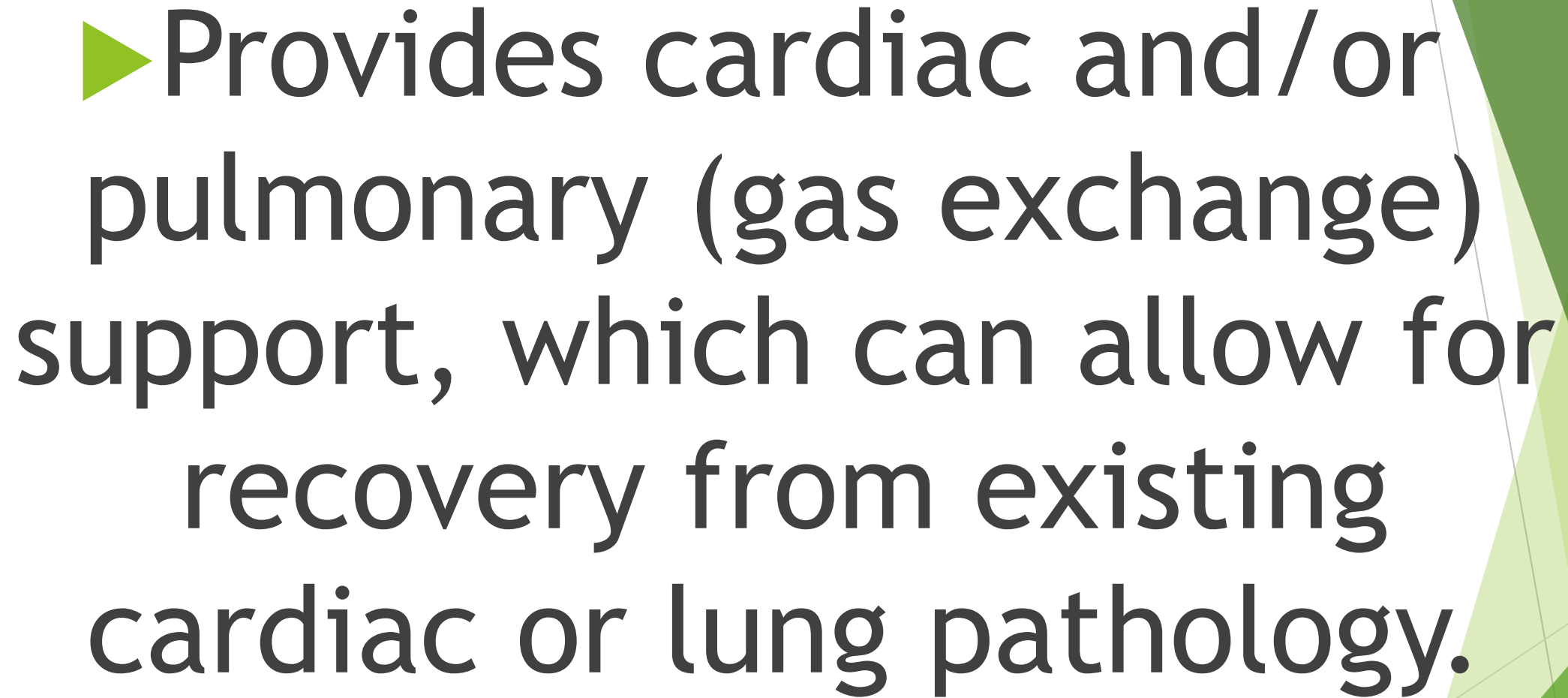
E C M O

got flow?

What is ECMO?

- ▶ E - Extra
- ▶ C - Corporeal
- ▶ M - Membrane
- ▶ O - Oxygenation

- ▶ E -Extra
- ▶ C - Corporeal
- ▶ L - Life
- ▶ S - Support



▶ Provides cardiac and/or pulmonary (gas exchange) support, which can allow for recovery from existing cardiac or lung pathology.

So what you're saying is....

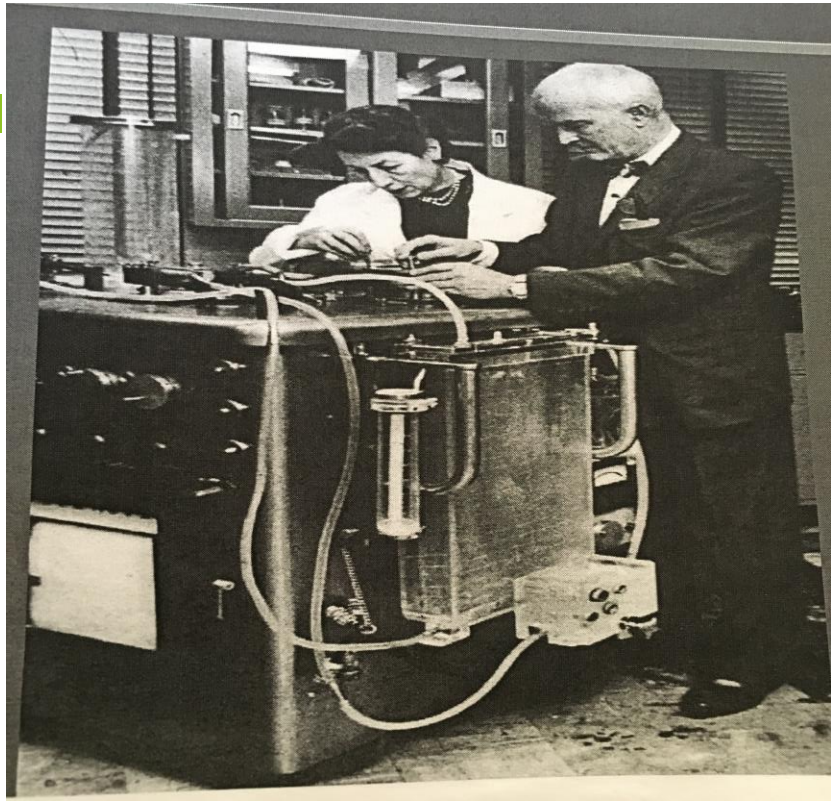
- ▶ It's cardio-pulmonary bypass?
- ▶ No.

What's the difference?

- ▶ **Cardiopulmonary Bypass (CPB)**
 - ▶ Short duration of support for a few hours or less
 - ▶ High dose anticoagulation

▶ ECMO

- ▶ Beating heart (most of the time)
- ▶ Closed or open chest cannulation
- ▶ Lower dose of anticoagulation
- ▶ Awake



- ▶ In the 1930s, Dr. John H. Gibbon, Jr. began working on a heart lung machine via extracorporeal circulation.

▶ “During that long night, helplessly watching the patient struggle for her life as her blood became darker and darker...the idea naturally occurred to me that if it were possible to remove continuously some of the blue blood...put oxygen into that blood...and then to inject continuously the now red blood back into the patient's arteries, we might have saved her life”.

▶ John Gibbon MD



- ▶ Dr. Gibbon developed the initial extracorporeal support system using a free standing rollerpump device
- ▶ On May 6, 1953 he and Dr. Victor Greco performed the first successful extracorporeal assisted ASD repair in 18yr old Cecilia Bavolek
- ▶ She went on to live another 47yrs, dying in 2000 at the age of 65.

- ▶ ECMO support became more feasible in the OR setting
- ▶ Prolonged use was still problematic after several hours
 - ▶ Induced blood component damage
 - ▶ No interface between blood and gas
 - ▶ Gas exchange devices (oxygenators) did not separate the gas from the blood
 - ▶ Hemolysis, thrombocytopenia, and coagulopathy

- ▶ Two innovations allowed for prolonged ECMO use in the OR as well as use in the ICU setting
 - ▶ The invention of silicone
 - ▶ The ability to allow prolonged circuit-blood exposure through controlled anticoagulation

- ▶ The invention of silicone rubber in 1957 gave the strength to withstand hydrostatic pressure and yet remain permeable to gas transfer
- ▶ The use of the silicone membrane oxygenator led to the term ECMO - **ExtraCorporeal Membrane Oxygenation**

The 1970s

- ▶ 1971 - First prolonged ECMO circuit
 - ▶ 24yr old male
 - ▶ Motorcycle accident
 - ▶ Developed ARDS after repair of a transected aorta
 - ▶ 75hr pump run
 - ▶ Successful decannulation



- ▶ 1972 - 1st Pediatric ECMO
- ▶ 2yr old boy
- ▶ Transposition of the Great Vessels
- ▶ Cardiac Failure
- ▶ Mustard Procedure

1975 - First Neonatal ECMO

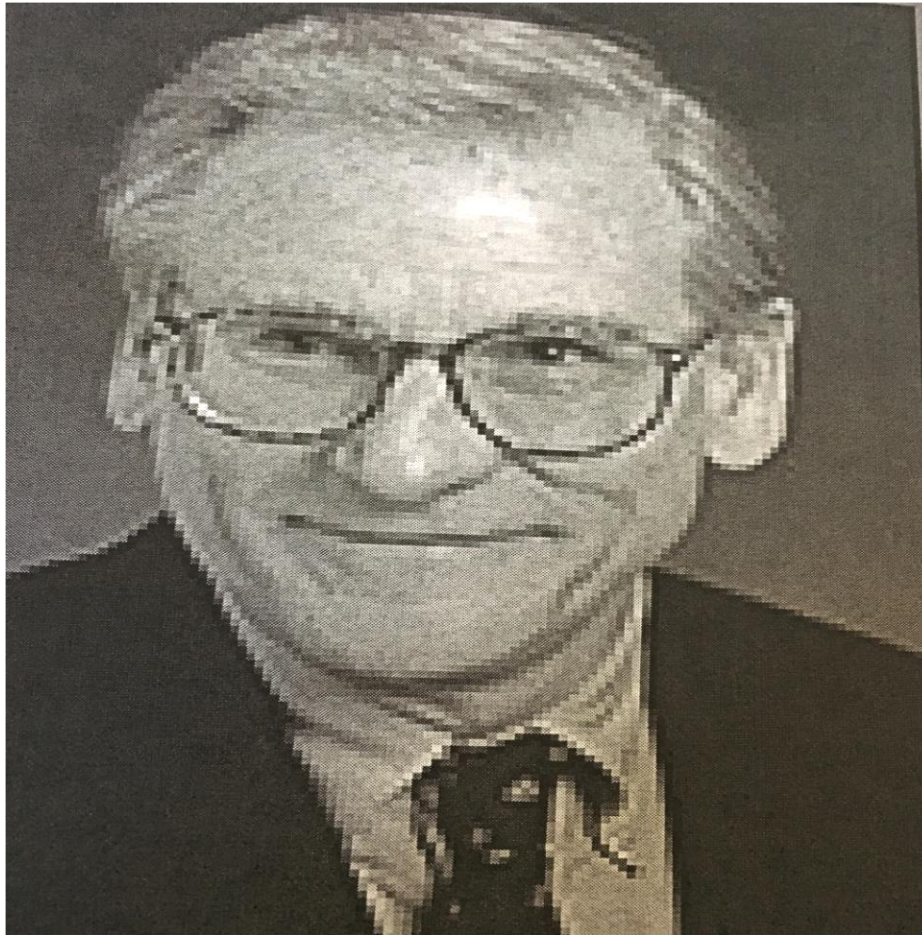
- ▶ Baby Esperanza “Hope”
- ▶ Meconium Aspiration
- ▶ 3 Days on ECMO
- ▶ Successfully decannulated



Baby Esperanza - 21yrs later



The God Father of ECMO - Robert Bartlett, MD



Improvements in ECMO

- ▶ University of Michigan RCT - published 1985
 - ▶ Randomization to ECMO vs Standard Care
 - ▶ Increased preference was given based on the success or failure of the previous patient
 - ▶ 1st pt - ECMO - survived
 - ▶ 2nd pt - Standard Care - died
 - ▶ Next 10 pts - ECMO - survived

- ▶ 2nd RCT published in 1989
- ▶ Dr. Pearl O'Rourke at Boston Children's Hospital
- ▶ 19/20 (97%) ECMO pts survived compared to 60% of standard care

- ▶ In 1986, 19 centers provided ECMO support to neonates
- ▶ In 1989, a steering committee formed to create the bylaws of the organization, called ELSO (ExtraCorporeal Life Support Organization)

CESAR Trial

Conventional Ventilation or ECMO for Severe Adult Respiratory Failure

- ▶ Published February 5, 2008
- ▶ 180 pts from 68 centers
- ▶ 90 randomized to ECMO/ 90 randomized to conventional support
- ▶ Of the 90 randomized to ECMO - 22 did not receive it due to improvement in clinical status
- ▶ 57/90 ECMO pts (63%) made it to primary outcome of recovery without disability at 6 months
- ▶ 41/87 pts (47%) in the conventional group

ECMO through the years

| ECMO 1, 1980-2008 | ECMO 2, 2009-2017 | ECMO 3, 2018-20?? |
|---------------------|------------------------------|--|
| Sedation, Paralysis | Awake, spontaneous breathing | Awake, ambulatory |
| Intubated | Tracheostomy, extubated | Extubated |
| Rest vent settings | CPAP | Off vent |
| Specialists 24/7 | ICU RN, ECMO Team support | Conventional care, weeks Home, months |
| Lung recruitment | Watch and wait | Spontaneous breathing |
| Bleeding: major | Bleeding: minor | No anticoagulation |

Changes in ECMO

Before



Now

