ECMO and Surgical Thromboembolectomy for Massive PE: When, How and Why

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Disclosures
None

John Gibbons Early 1930’s

...and then to inject continuously the now-red blood back into the patient’s arteries, we might have saved her life. We would have bypassed the obstructing embolus and performed part of the work of the patient's heart and lungs outside the body.

Gibbons Stationary Screen Oxygenator

When the final turns of the clamp completely occluded the pulmonary artery, with the blood pressure and respirations remaining normal, we thought something incredible had happened. We fairly exploded with joy and danced around the laboratory.

Gibbons Stationary Screen Oxygenator

This was really the highlight, not only of the first year, 1934-35, but of all the subsequent years of work until the first successful use of the apparatus on a human patient in 1953.
**Classic Indications for Surgery**

- Hemodynamic Instability/CPR
- Contraindication to anticoagulation
- Clot in transit

**Massive PE with Hemodynamic instability**

**RA Clot in Transit**

**Left Atrial Embolus Snared by PFO**
Exposure of Left Main Pulmonary Artery

Exposure of Right Pulmonary Artery

Acute Pulmonary Embolectomy
ECMO: WHEN?
Rarely Pre-Embolectomy

- Best option is immediate transport to operating room.

ECMO Pre-embolectomy

- CPA
- Unavailability of surgical team or operating room
- Uncertainty of neurologic status
- Team expertise for acute on chronic
- Risk of surgical bleeding from anticoagulation

ECMO POST EMBOLECTOMY: Indications

- Reperfusion injury
- RV dysfunction
- Biventricular Dysfunction

CONSIDERATIONS

- Residual Pulmonary Hypertension and RV dysfunction
- Biventricular failure post CPR
- Cerebral oxygenation
- Ilio-femoral vein thrombosis
- IVC filter
- Anticoagulation

HOW?

- Cannulation
  - Peripheral vs. Central
  - Percutaneous or Cutdown
  - Venoarterial (VA-ECMO)
  - Venovenous (VV-ECMO)
VA-ECMO

Femoral artery
Femoral vein

Limb perfusion catheter

Cerebral Hypoxia / Arterial Admixture

- Low or moderate ECMO retrograde perfusion
- Continued cardiac ejection
- Pulmonary dysfunction

Downside to Central – Aortic Cannulation

- Increased bleeding around cannulas
- Difficulty closing the chest
- Increased infections
- Need for reoperations

Side-Graft Arterial Inflow

Right internal jugular vein

VV-ECMO

Right common femoral vein
**Bi-Caval Dual Lumen Catheter**
Bicaval drainage lumen and Right Atrial return lumen which directs oxygenated blood into RV

**Advantages**
- More efficient gas exchange
- Decreased recirculation
- Spontaneously ventilating
- Ambulatory
- Reduced ICU debilitation

**ECMO post PE**
- Sounds simple but complex issues surrounding decisions
- Care coordination with multiple teams
- Adaptability-no rigid protocols
- Conversions common

**Summary**
- Multiple non-surgical treatments available
- Multidisciplinary team
- Pre-arrest surgical embolectomy very safe and effective
- Need to be prepared to perform an endarterectomy
During that long night, helplessly watching the patient struggle for life as her blood became darker and her veins more distended, the idea naturally occurred to me that if it were possible to remove some of the blue blood from the patient’s swollen veins, put oxygen into that blood and allow carbon dioxide to escape from it...