



XIII Congresso



Bologna 9 – 11 dicembre 24

ECMO: insertion techniques and TIP location



A .M. Dell'Anna, MD

Dept of Anesthesiology, Intensive Care and Emergency
Medicine

UOC Rianimazione, Terapia Intensiva e Tossicologia clinica

Fondazione Policlinico "A. Gemelli" IRCSS

Catholic University of Rome

Gemelli



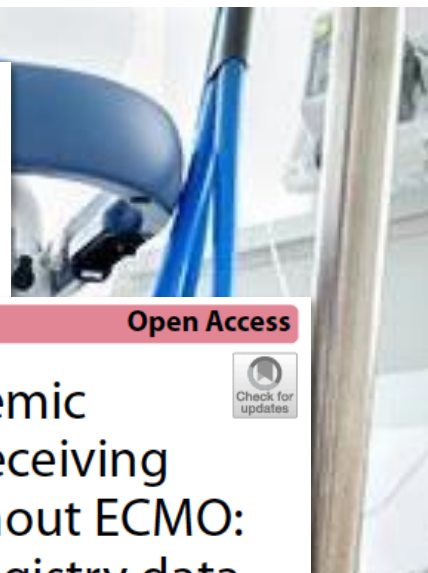
Fondazione Policlinico Universitario Agostino Gemelli IRCSS
Università Cattolica del Sacro Cuore



REVIEW

Respiratory indications for ECMO: focus on COVID-19

Alexander Supady^{1,2}, Alain Combes^{3,4}, Ryan P. Barbaro⁵, Luigi Camporota^{6,7}, Rodrigo Diaz⁸, Eddy Fan^{9,10,11}, Marco Giani¹², Carol Hodgson¹³, Ahmed A. Rabe²⁰, Jordi Ri



RESEARCH

Open Access

Trends in survival during the pandemic in patients with critical COVID-19 receiving mechanical ventilation with or without ECMO: analysis of the Japanese national registry data



Shinichiro Ohshiro¹, Nobuaki Shime¹, Network

In-hospital and 6-month outcomes in patients with COVID-19 supported with extracorporeal membrane oxygenation (EuroECMO-COVID): a multicentre, prospective observational study



Roberto Lorusso*, Maria Elena De Piero*, Silvia Mariani, Michele Di Mauro, Thierry Folliguet, Fabio Silvio Taccone, Luigi Camporota, Justyna Swol, Dominik Wiedemann, Mirko Belliato, Lars Mikael Broman, Alain Vuylsteke, Yigal Kassif, Anna Mara Scandroglio, Vito Fanelli, Philippe Gaudard, Stephane Ledot, Julian Barker, Udo Boeken, Sven Maier, Alexander Kersten, Bart Meyns, Matteo Pozzi, Finn M Pedersen, Peter Schellongowski, Kaan Kirali, Nicholas Barrett†, Jordi Riera†, Thomas Mueller†, Jan Belohlavek†, on behalf of the EuroECMO-COVID Study Group‡



REVIEW

Respiratory indications for ECMO: focus on COVID-19

Alexander Supady^{1,2}, Alain Combes^{3,4}, Ryan P. Barbaro⁵, Luigi Camporota^{6,7}, Rodrigo Diaz⁸, Eddy Marco Giani¹², Carol Hodgson¹³, Ahmed A. Rabe²⁰, Jordi Riera¹⁴

RESEARCH

Trends in survival during mechanical ventilation in patients with critical illness: a systematic analysis of the literature

Shinichiro Ohshiro¹, Nobuaki Shime¹, Network

In-hospital and 30-day mortality in COVID-19 patients requiring extracorporeal membrane oxygenation (Euro-ELSO): an observational study

Roberto Lorusso*, Maria Elena De Piero*, Silvio Dominik Wiedemann, Mirko Belliato, Lars M. Steinhilber, Stéphane Ledot, Julian Barker, Udo Boeken, S. Kaan Kirali, Nicholas Barrett†, Jordi Riera†, T. J. ...

FEATURE ARTICLES

OPEN

Prevalence and Survival of Prolonged Venovenous Extracorporeal Membrane Oxygenation for Acute Respiratory Distress Syndrome: An Analysis of the Extracorporeal

Resuscitation Science

Survival Analysis After Extracorporeal Membrane Oxygenation in Critically Ill Adults

A Nationwide Cohort Study

Chia-Hsueh Chang, MD, DSc; Hsi-Chieh Chen, MS; James L. Caffrey, PhD; Jiun Hsu, MD; Ion-Wei Lin, MD, MPH, PhD; Mei-Shu Lai, MD, PhD; Yih-Sharn Chen, MD, PhD

RESEARCH

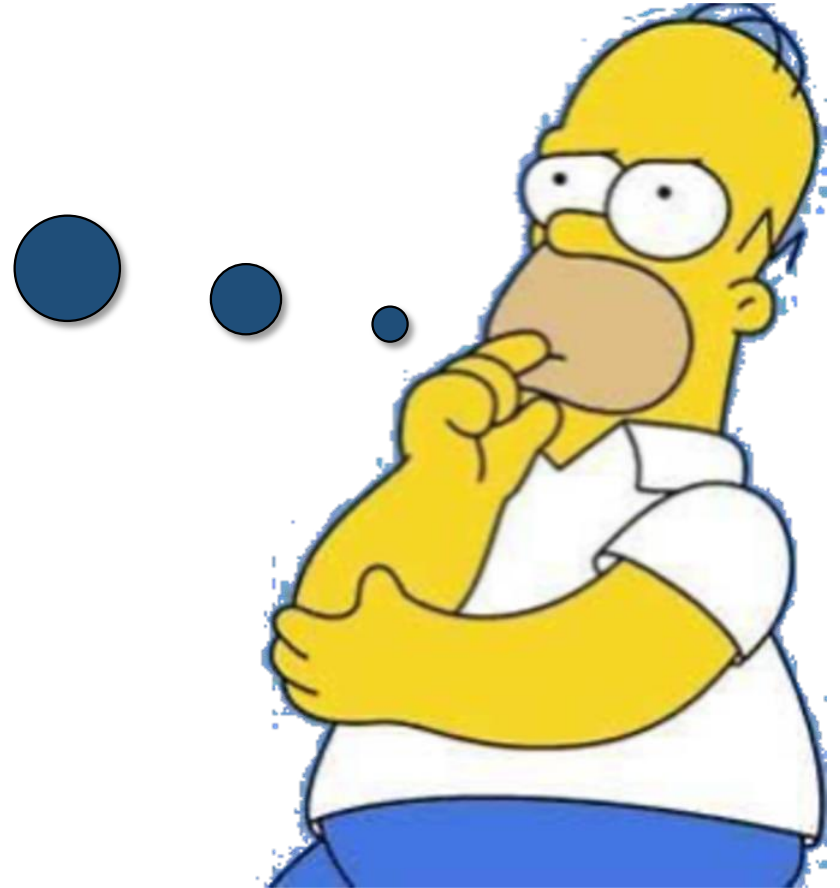
Open Access

Insight into ECMO, mortality and ARDS: a nationwide analysis of 45,647 ECMO runs

Benjamin Friedrichson^{1*}, Haitham Mutlak^{1,2}, Kai Zacharowski¹ and Florian Piekarski¹

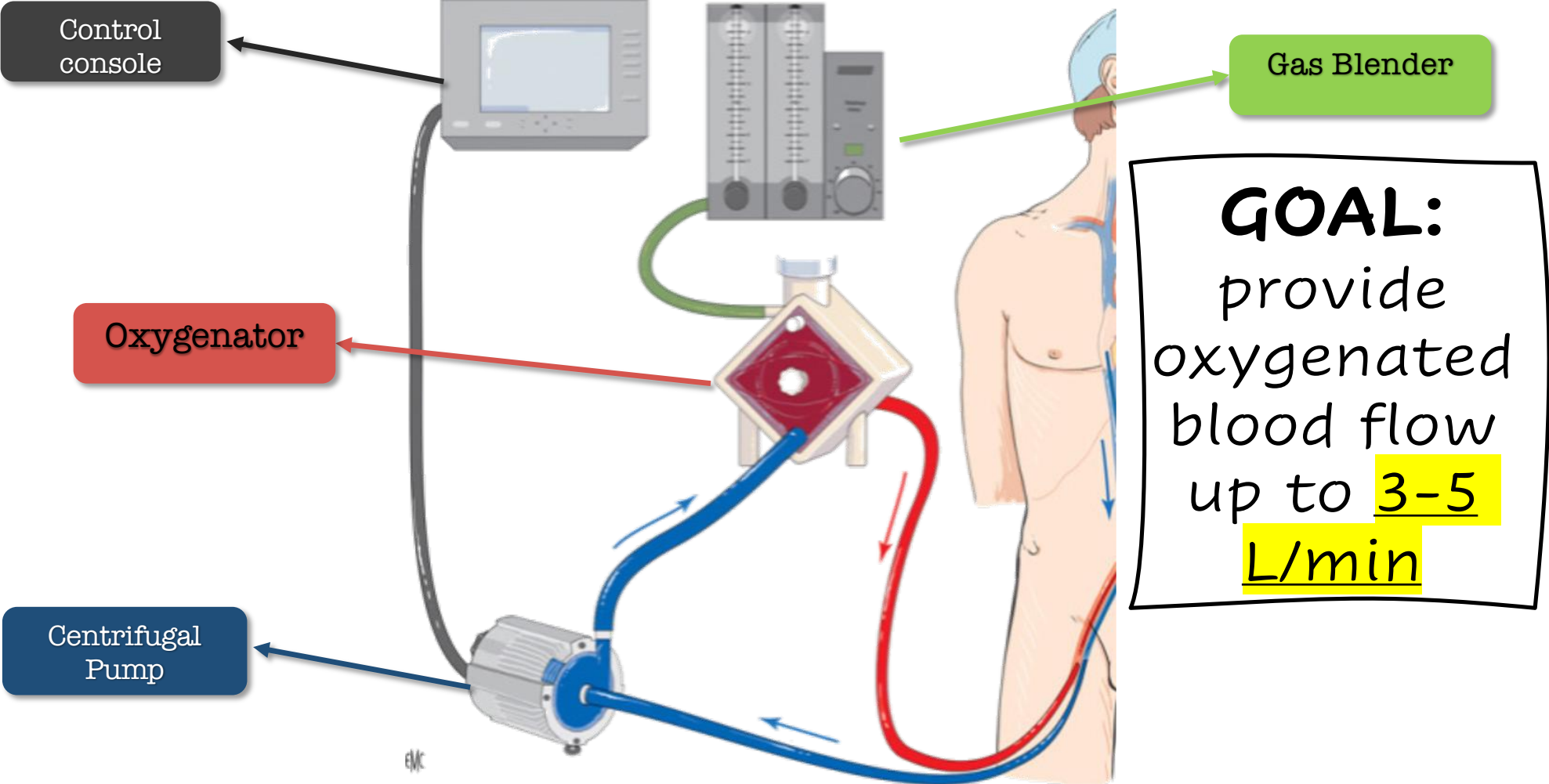


ECMO
mmmmm yes...
but...
What is it?



ECMO
YES YES YES YES YES
yes... but...
What is it?

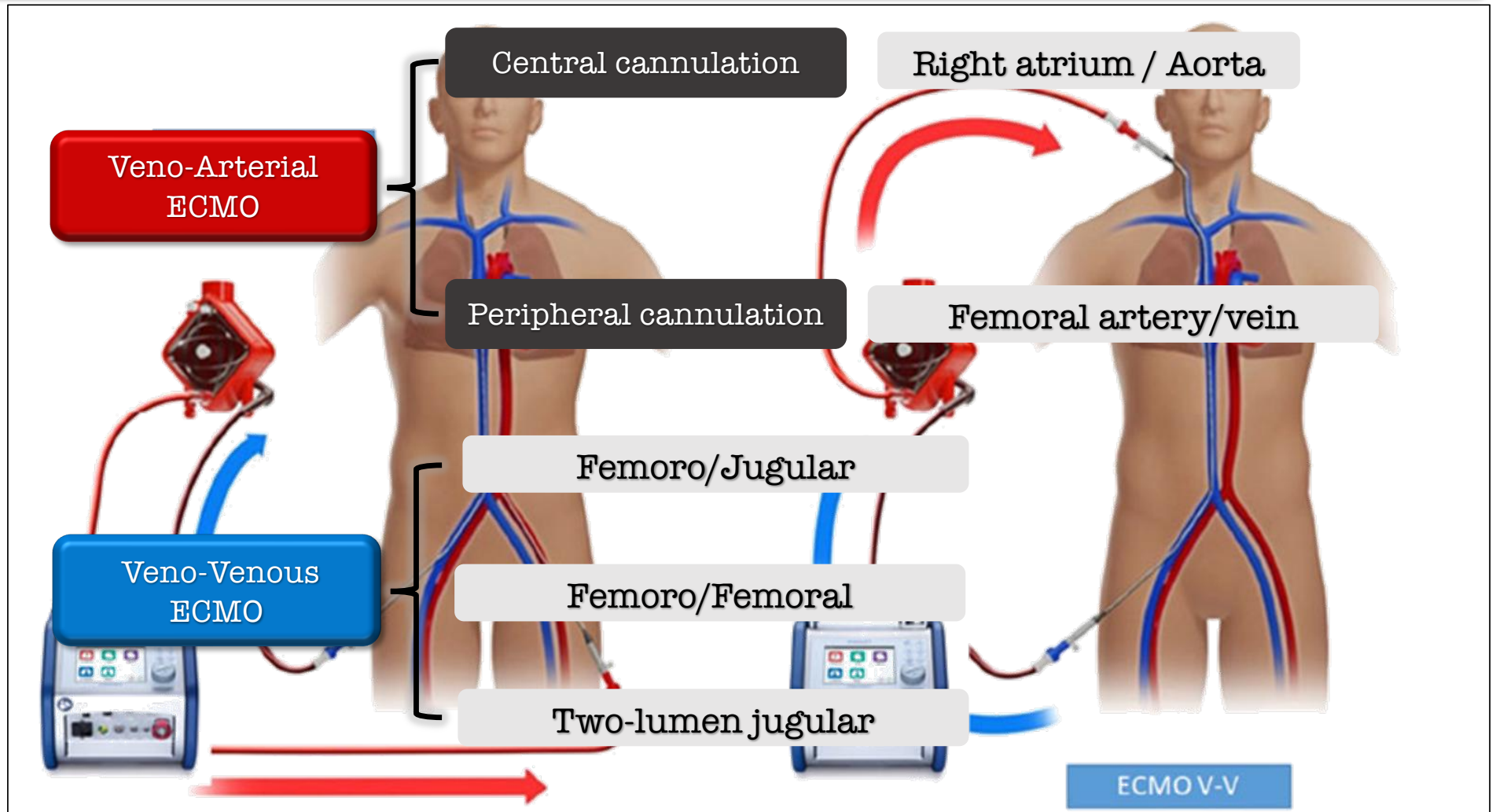
ECMO: definitions



J Thorac Dis 2015;7(7):E166-E176

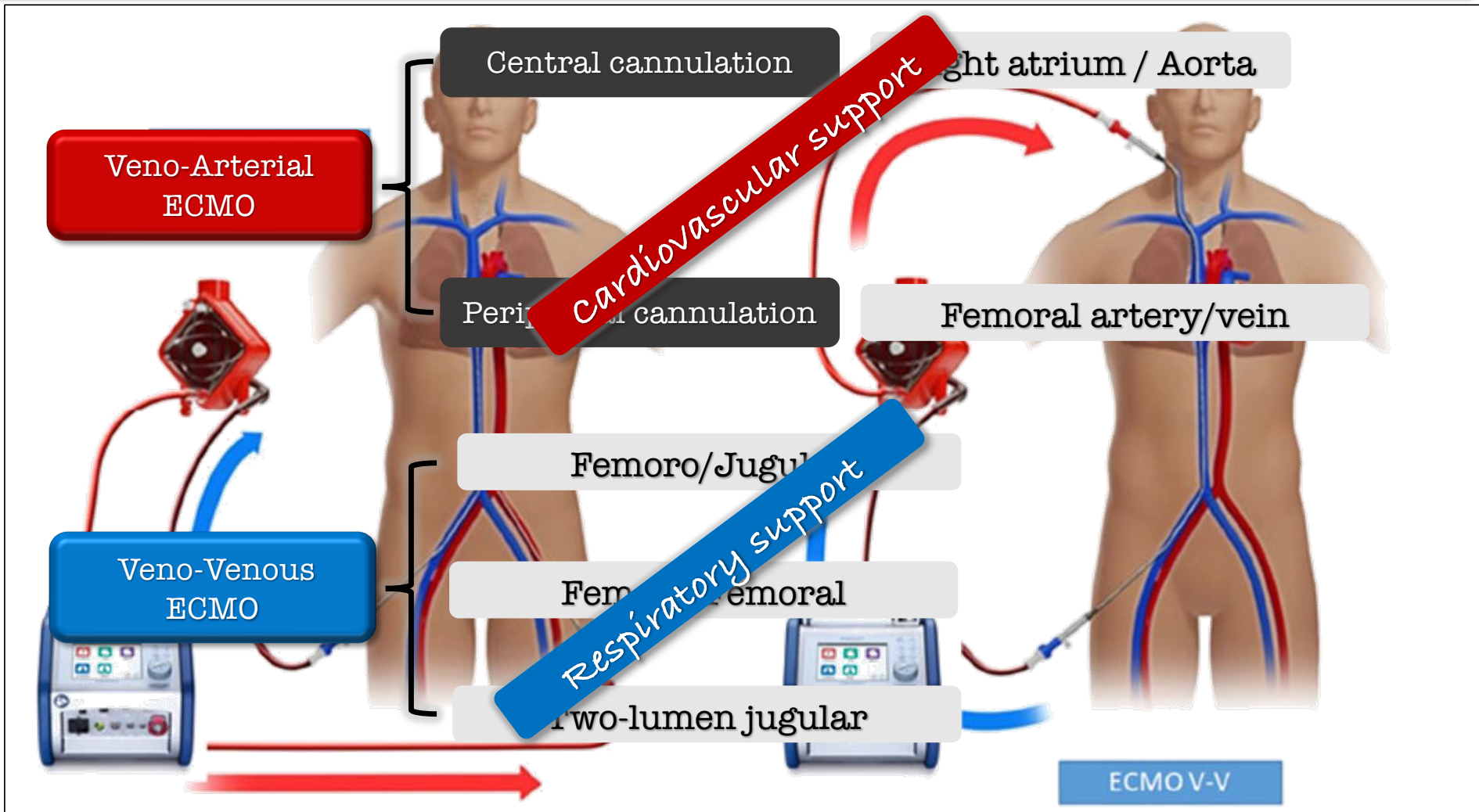


ECMO: definitions





ECMO: definitions



*What am I
supposed to do
with these??*



ECMO: definitions cannulas and insertion

Venous cannula

*"To select the correct cannula size, first priority should be given to titrating to estimated patient **cardiac output needs**. For example, in a 180cm tall male, a **25F** drainage cannula will often be sufficient, although in cases of severe respiratory failure, a larger (**~29F**) cannula will provide better flow and therefore oxygenation."*

Lorusso, ASAIO Journal: August 2021 - Volume 67 - Issue 8 - p 827-844

Arterial cannula

*"A **15-17 French** arterial cannula is usually adequate to supply sufficient flow depending on the patient's needs. Larger **19 or 21** French cannulas may be necessary in rare clinical scenarios such as sepsis when higher flow is desired. Larger arterial cannulas might be associated with increased vascular complications, including limb ischemia.."*

Tonna, ASAIO Journal: June 2021 - Volume 67 - Issue 6 - p 601-610

What am I supposed to do with these??



ECMO: definitions

cannulas and insertion

Drainage Cannula

- *Femoral/jugular vein*
- *Length 20 → 55 cm*
- *Distal portion configuration made to optimize blood flow (multi-hole)*
- *Adult 21 → 29 Fr*

Return Cannula

- *Femoral artery/vein or jugular vein*
- *Length 15 → 23 cm*
- *Distal portion with a single-hole*
- *Adult 15 → 21 Fr*

**Polyurethane +/- Silicone
and wire reinforcement**



ECMO: definitions cannulas and insertion

VV ECMO

*"For single-lumen cannula placement, **surface ultrasound for vascular access** is preferred and has been demonstrated to be **safest** compared with blind placement. Depth of cannula placement can be estimated before placement, and then confirmed with radiography or echocardiography."*

Lorusso, ASAIO Journal: August 2021 - Volume 67 - Issue 8 - p 827-844

VA ECMO

*"Image-guided cannulation, particularly **vascular ultrasound** as a first choice, is recommended. **Fluoroscopy** can be useful in certain circumstances, for example, implantation in the **cath lab**."*

"We recommend starting in the short-axis view, identifying the common femoral artery and vein, the superficial and profunda femoral arteries then rotating 90° to the longitudinal view. This affords visualization of the common femoral artery and bifurcation. It optimizes anterior entry of the needle into the vessel and avoids posterior wall puncture."

Tonna, ASAIO Journal: June 2021 - Volume 67 - Issue 6 - p 601-610

What am I supposed to do with these??



ECMO: definitions cannulas and insertion

VV ECMO

"For single-lumen cannula placement, **surface ultrasound for vascular access** has been demonstrated to be **safest** compared with blind placement. Depth of cannula placement can be determined by ultrasound placement, and then



Ultrasound Guidance for Extra-corporeal Membrane Oxygenation

General Guidelines

used in certain circumstances, for example, implantation in the **cath lab**.

"We recommend starting in the short-axis view, identifying the common femoral artery and bifurcation. It optimizes anterior entry of the needle into the vessel lumen and minimizes the risk of vessel wall puncture.

Journal: August 2021 - Issue 8 - p 827-844

first choice, is **Fluoroscopy** can be

Tonna, ASAIO Journal: June 2021 - Volume 67 - Issue 6 - p 601-610

What am I supposed to do with these??





ECMO: definitions cannulas and insertion

Review Article on Extracorporeal Life Support

Cannulation techniques for extracorporeal life support

Evgeny Pavlushkov, Marius Berman

REVIEW

Cannulation strategies for percutaneous extracorporeal membrane oxygenation in adults

Review Article

Veno-arterial extracorporeal membrane oxygenation: an overview of different cannulation techniques

Vogel-Claussen⁴ ·

Carlo Banfi^{1,2,3}, Matteo Pozzi⁴, M. Mugnai^{1,2}, Jean-Francois Obadia⁴, K

Review Article

Veno-venous extracorporeal membrane oxygenation: cannulation techniques

Carlo Banfi^{1,2,3}, Matteo Pozzi⁴, Nils Siegenthaler^{2,3,5}, Marie-Eve Brunner⁵, Didier Tassaux⁵, Jean-Francois Obadia⁴, Karim Bendjelid^{2,3,5}, Raphaël Giraud^{2,3,5}



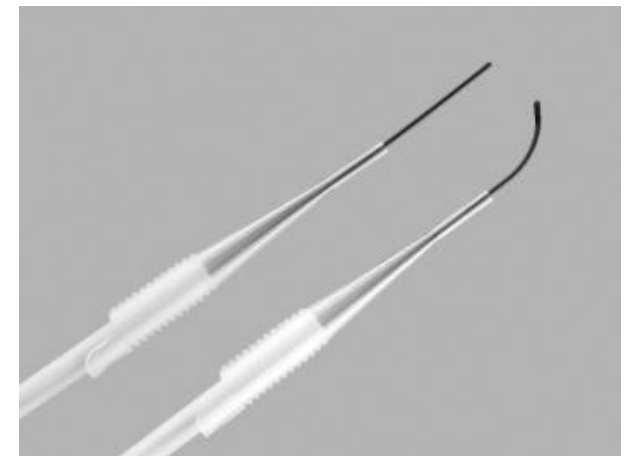
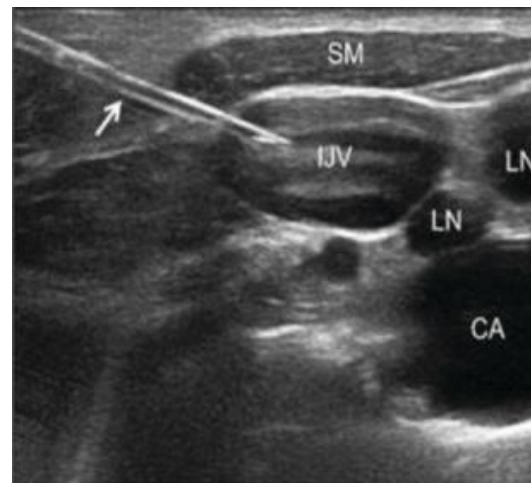
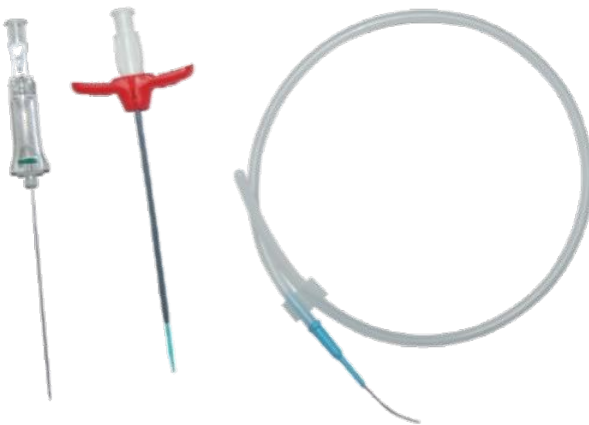
ECMO: definitions

cannulas and insertion

Our protocol

1 step

- RaFeVA e RaCeVA to study and choose vessels (Femoral-Jugular/Brachiocephalic)
- Cannula choice and disinfection
- US-guided puncture with micro-introducer
- Nitinol 0.035" 80 cm (jugular-arterial) and 150 cm (femoral) guidewire positioning



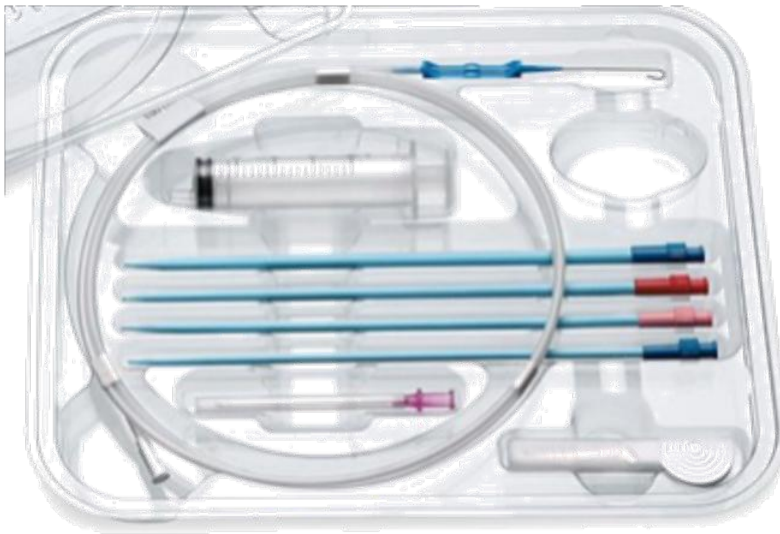
ECMO: definitions

cannulas and insertion

Our protocol

2 step

- Purse-string suture to control exit site and secure the cannula
- Introducer removal
- Progressive dilatation with dilators of increasing size (10 Fr→25Fr)
- Estimation of the distance between exit site and right atrium



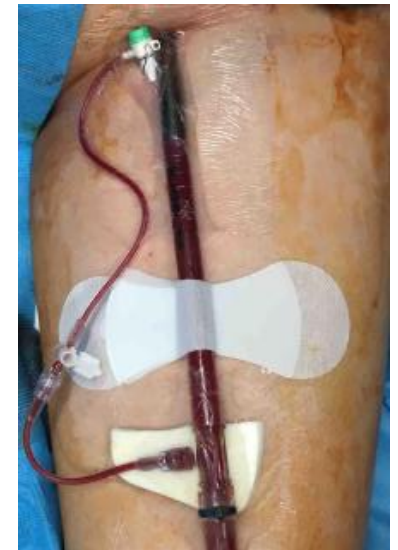
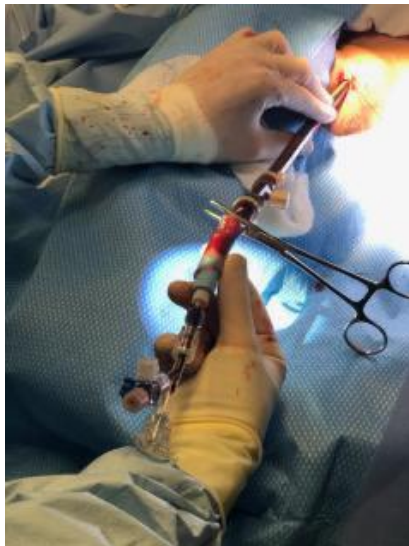
ECMO: definitions

cannulas and insertion

Our protocol

3 step

- Cannula insertion
- Guidewire removal
- Clamp of the cannula
- Lavage with NaCl 0.9% + Heparin
- ECMO connection and beginning of extracorporeal circulation
- Securement and medication

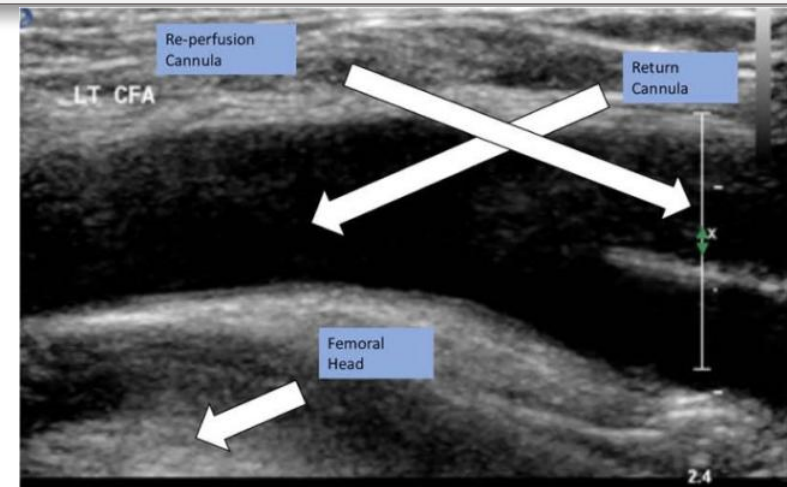
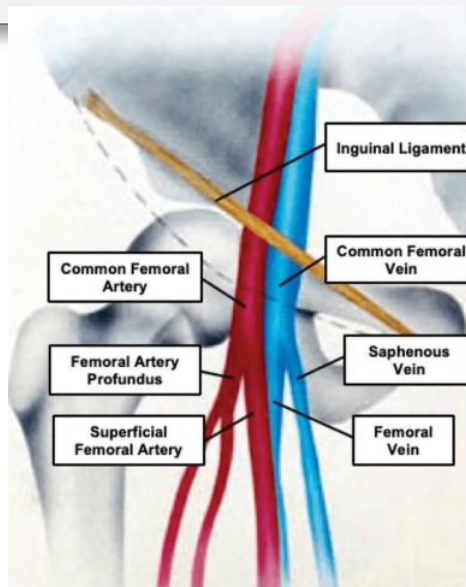


ECMO: definitions cannulas and insertion

Reperfusion

VA ECMO

"Distal perfusion catheters should be placed under ultrasound guidance or under direct vision into the **superficial femoral artery**. If the approach is percutaneous, access should start with a **puncture in the common femoral artery** below the arterial cannula but above the bifurcation and guided into the **superficial femoral artery**. Confirmation of the guide wire in the superficial femoral artery by ultrasound or fluoroscopy may be considered, and confirmation of flow by continuous flow Doppler and ultrasound of the popliteal artery is recommended. distal perfusion is recommended with a short 6 Fr-8 Fr armored cannula."



ECMO: definitions

cannulas and insertion

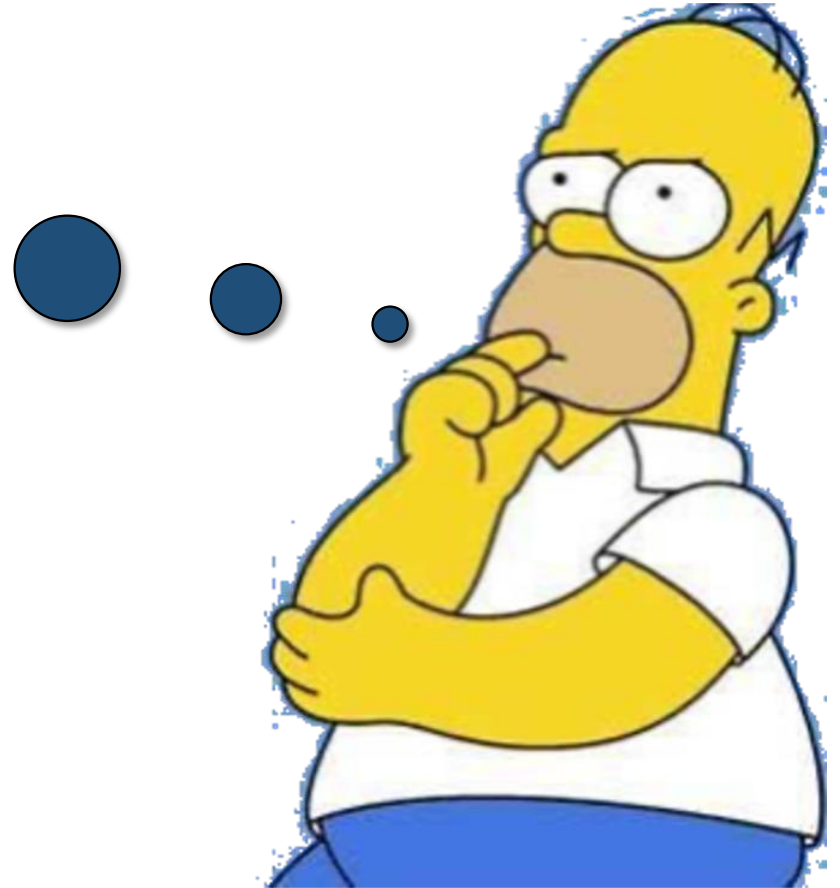
Return
Cannula
(femoral artery)

Drainage
Cannula

Reperfusion
Cannula



*What about tip
location?*

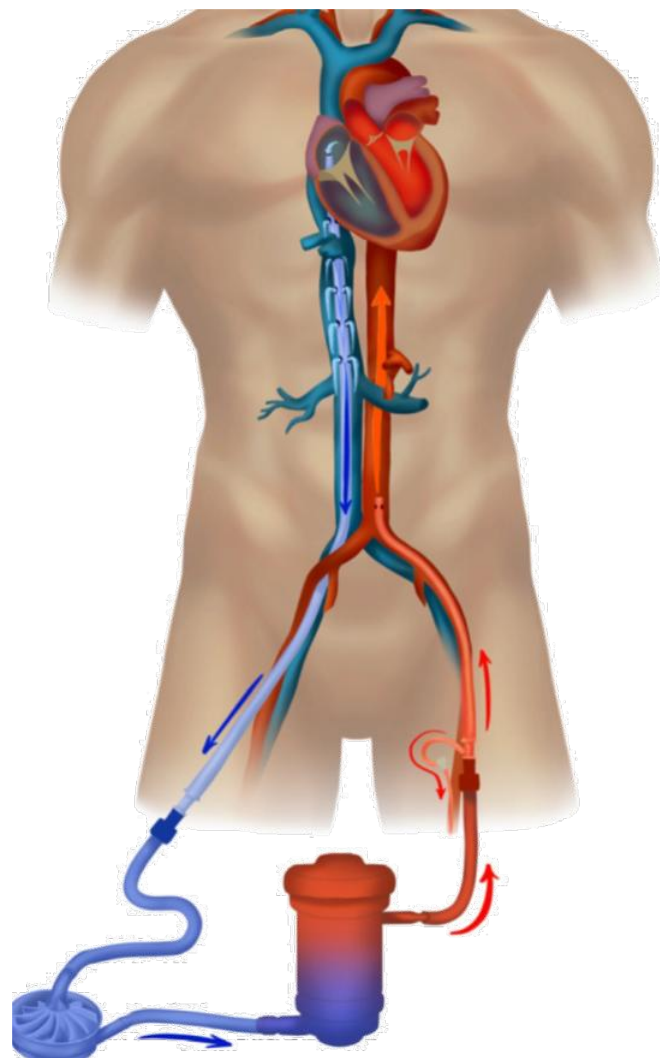




ECMO: definitions

cannulas and
insertion

TIP location



VA ECMO

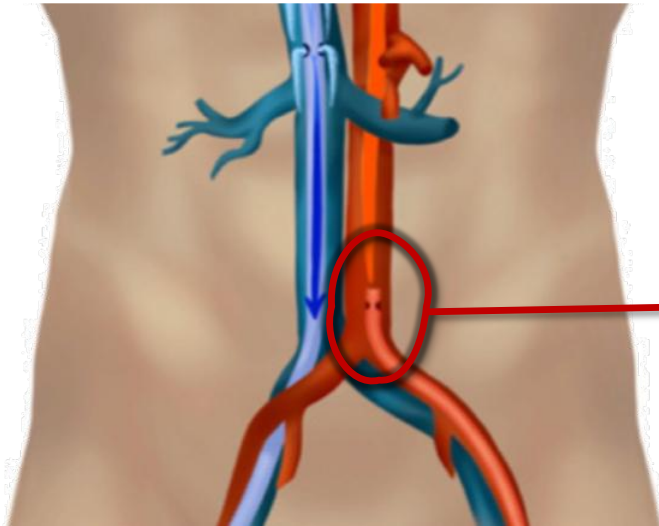


ECMO: definitions

cannulas and
insertion

TIP location

VA ECMO: return cannula



- ✓ Return cannula tip in iliac artery/aorta
- ✓ Tip position does not affect function
- ✓ No need for precise TIP location





ECMO: definitions

cannulas and
insertion

TIP location

Drainage cannula



Maximize blood flow

TIP closest to the RA

Adequate caliber

Adequate CO

Return cannula



Avoid recirculation

Adequate distance between
the two cannulas

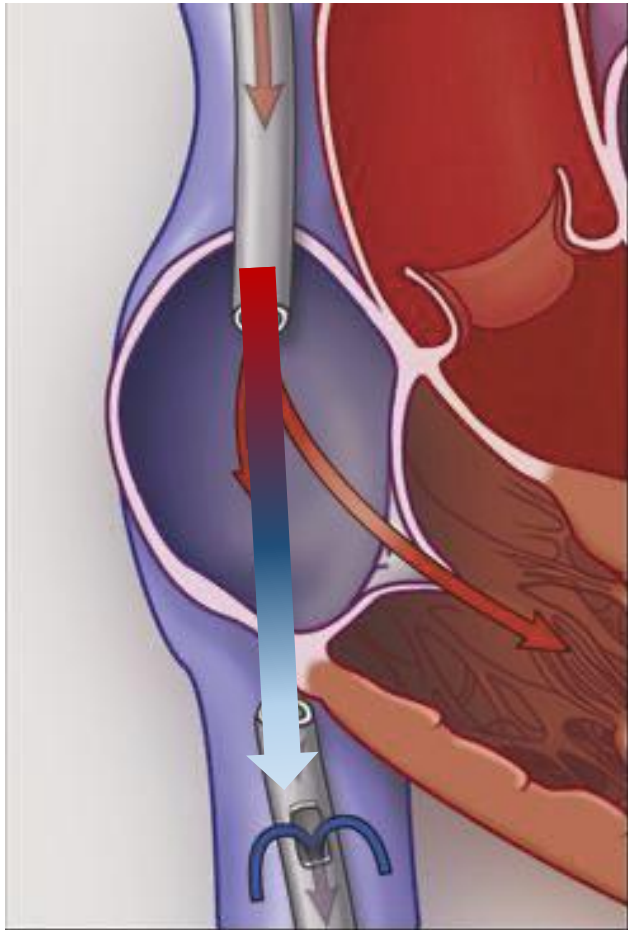




ECMO: definitions

cannulas and
insertion

TIP location



VV ECMO: femoro-jugular

- ✓ Drainage cannula between suprahepatic veins and RA
- ✓ Return cannula in front of TV
- ✓ Distance between cannulas of 8-11 cm to avoid recirculation





ECMO: definitions

cannulas and
insertion

TIP location

How to check



- US are more precise than chest x-ray to check cannula position
- Return cannula can be withdrawn in case of recirculation
- Drainage cannula should be as close as possible to RA to maximize blood flow



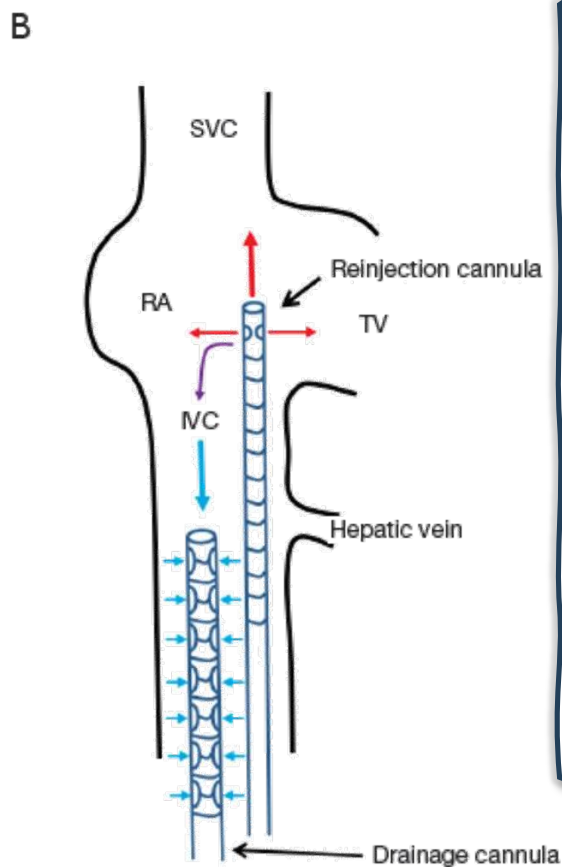
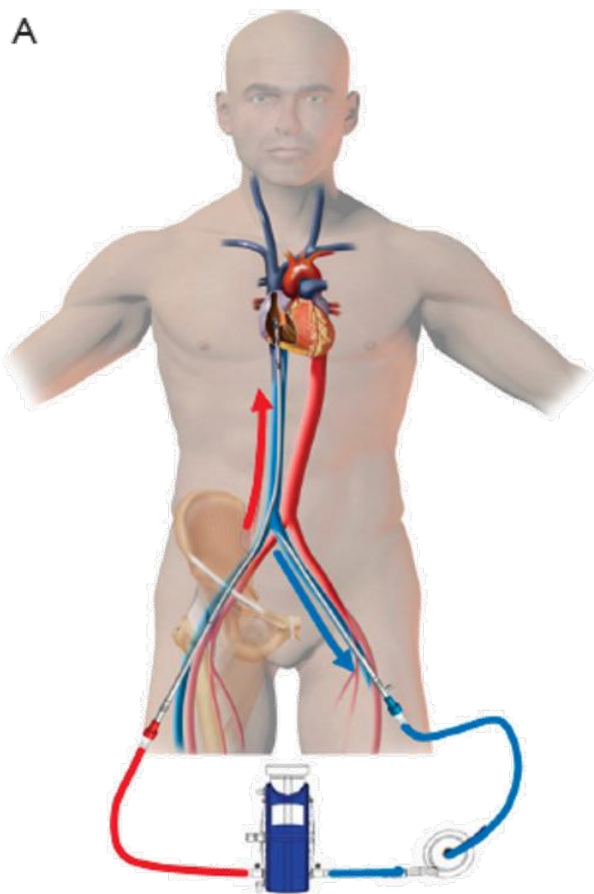


ECMO: definitions

cannulas and
insertion

TIP location

VV ECMO: femoro-femoral



- ✓ Drainage cannula just above renal veins
- ✓ Return cannula in front of TV
- ✓ Distance between cannulas of 8-11 cm

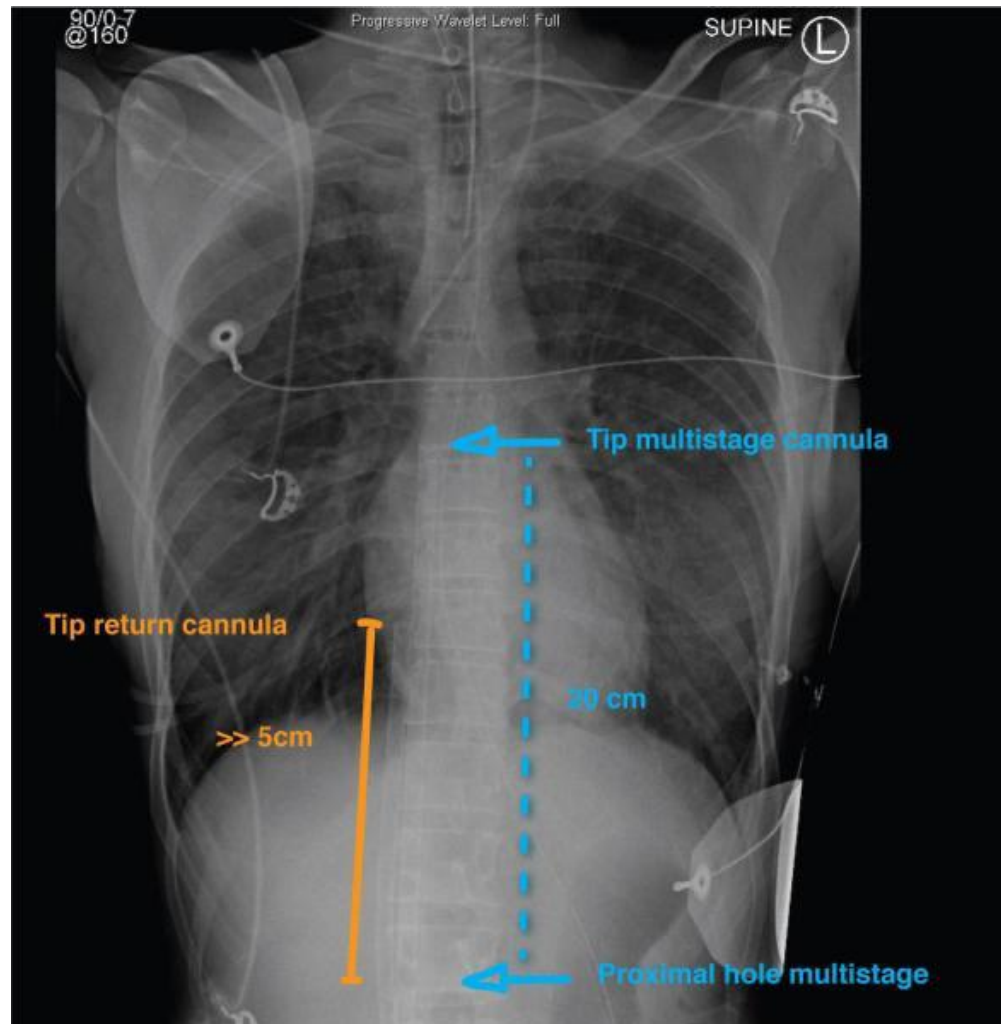


ECMO: definitions

cannulas and insertion

TIP location

How to check



- US are useful for return cannula but can be useless for drainage one if below renal arteries
- Chest and abdomen x-ray may be a valid option



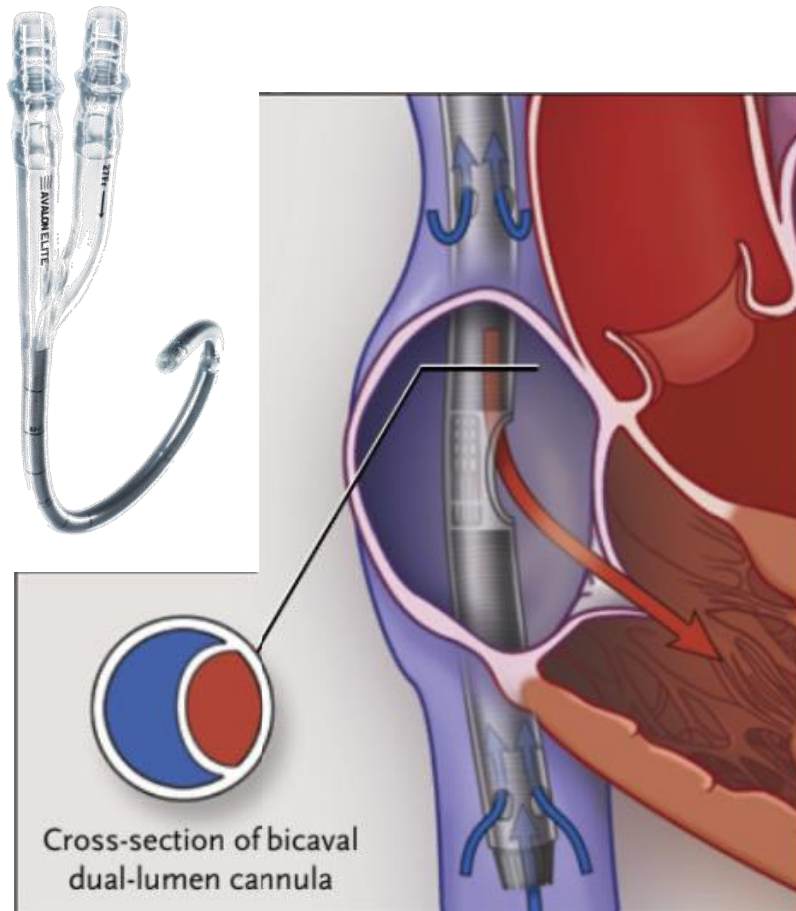


ECMO: definitions

cannulas and
insertion

TIP location

VV ECMO: single cannula



Cross-section of bicaval
dual-lumen cannula

- ✓ Drainage from SVC and IVC
- ✓ **Return cannula** in front of TV
- ✓ Correct positioning is crucial to avoid recirculation

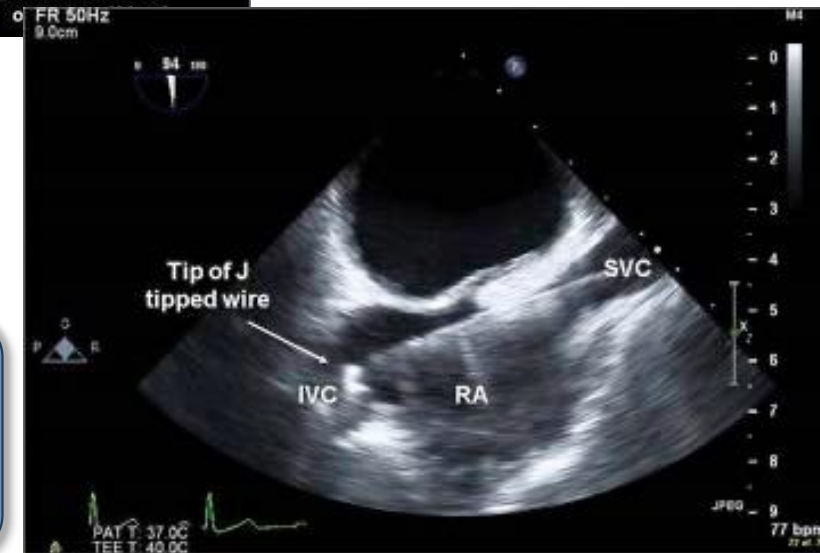
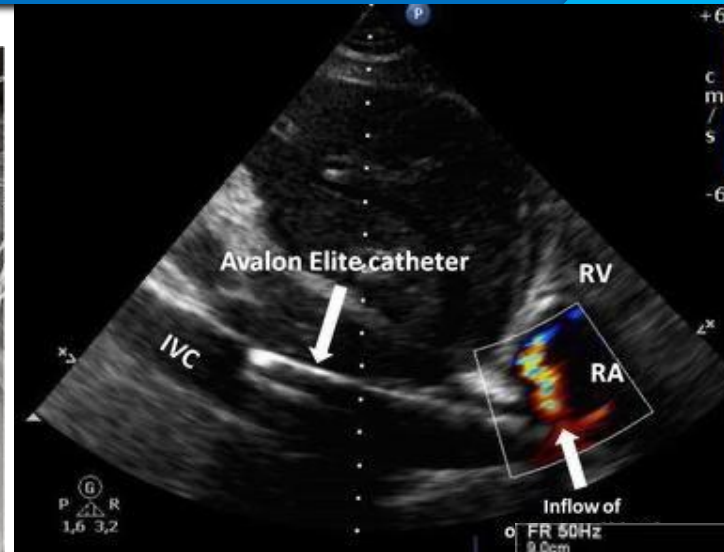
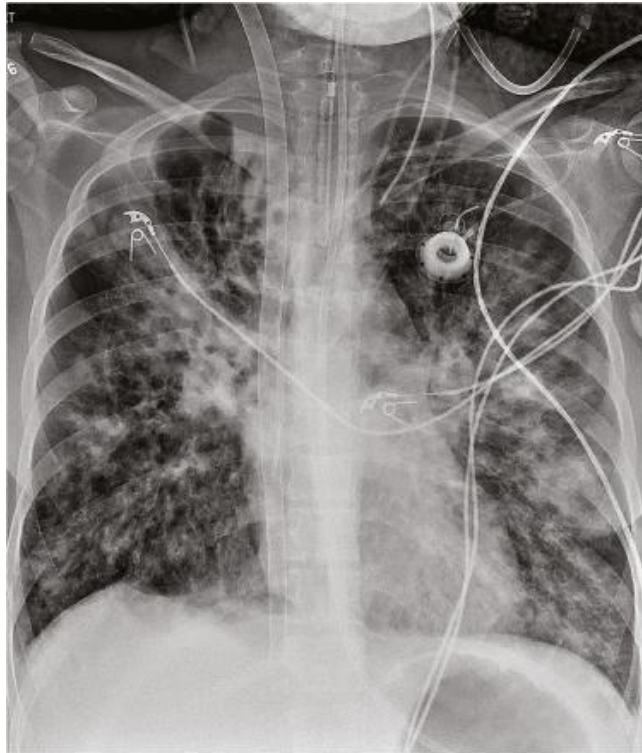


ECMO: definitions

cannulas and insertion

TIP location

How to check



- US (TEE >> TTE) are crucial for correct guidance of cannulation and tip position control
- Chest x-ray is important for check complications



What
about tip
location?



ECMO: definitions

cannulas and
insertion

TIP location

And EKG?

WATCH OUT!!!

- ❖ Need for a **clamp** to avoid bleeding out and AIR EMBOLISM
- ❖ Cannula must be moved gently and always **flushed with saline**
- ❖ Need for a **syringe of 50 mL with Luerlock**
- ❖ Drainage cannula does not have LuerLock connector
- ❖ Promising technique but need validation!



Let's go home with...

And now what?



ECMO needs very large cannulas to allow adequate blood flow (3-5 L/min)

US guided and percutaneous vessels cannulation is recommended

US guided TIP location is crucial for drainage (VA and VV) and return (VV) cannulas correct functioning

EKG is theoretically feasible but less applicable. X-ray may be helpful (femoro-femoral VV)



Bologna 9 – 11 dicembre 24

ECMO: insertion and TIP location



Thank you!



Gemelli



Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore

antoniomaria.dellanna@policlinicogemelli.it