1° Udine ECMO Workshop

ECMO and VAD implantation

Prof. Tomaso Bottio

Division of Cardiac Surgery
(Director Prof. Gino gerosa)
Department of Cardiac, Thoracic, Vascular Sciences
University of Padua, Italy

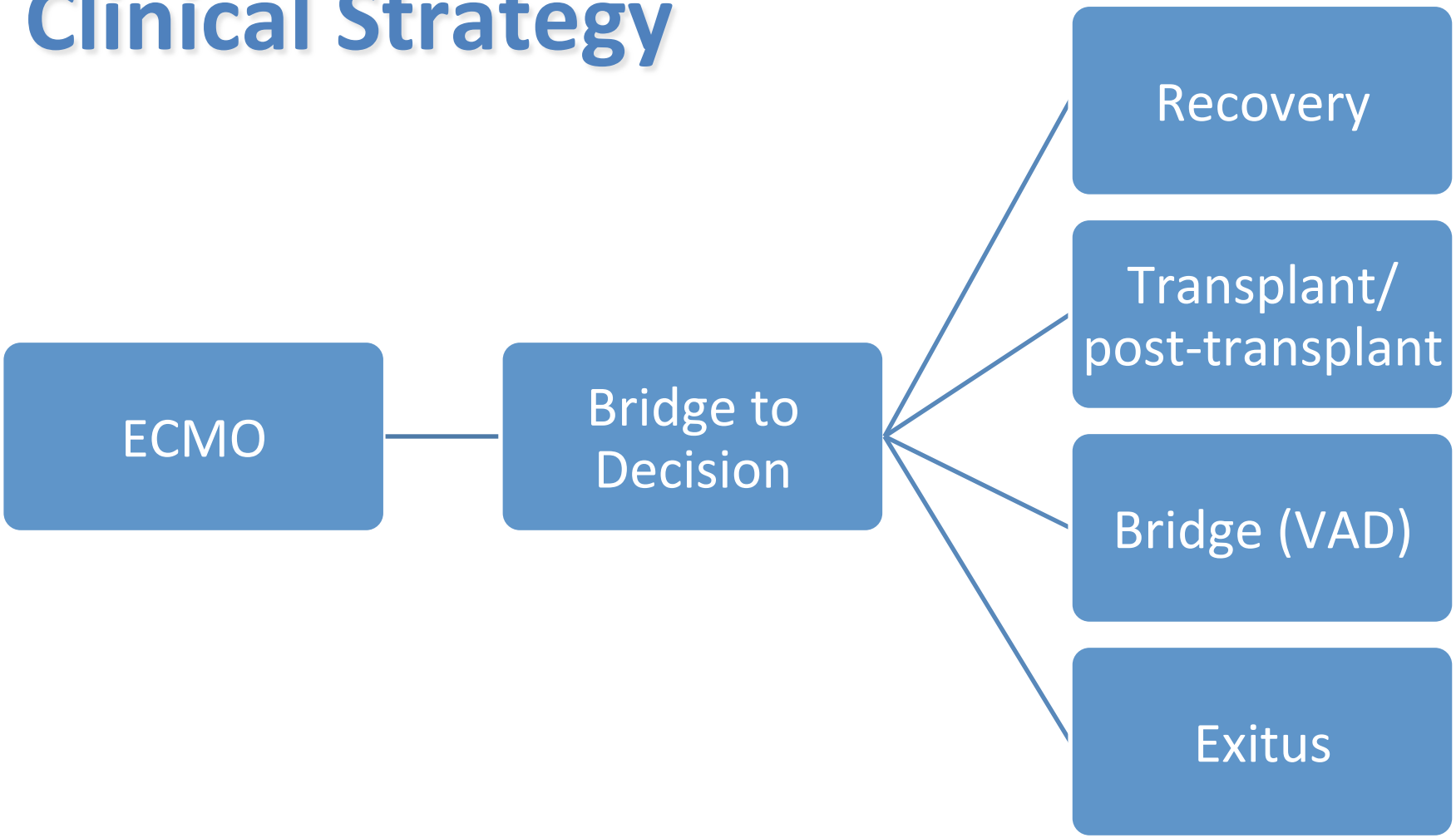
ECMO

Extracorporeal membrane oxygenation (ECMO) is a rescue therapy to support severe cardiac and/or pulmonary failure.

Cardiogenic Shock

- Most commonly following:
  - Acute myocardial infarction
  - Non-ischaemic causes including
    - » Myocarditis
    - » End-stage cardiomyopathy
    - » Sustained arrhythmias.

ECMO:
Clinical Strategy



ECMO Advantages in the setting of cardiogenic shock

- Easy/rapid implantation if peripheral
- No sterno/cardiotomy
- Local anesthesia
- Emergency situations
- Provides high flow

- Triage if of doubt about neurological status
- Mobile Cardiac Assistance Unit
- Low cost (cheaper than other devices)

ECMO Contraindications

- Not candidates for transplantation or durable MCS
- Chronic organ dysfunction (emphysema, cirrhosis, renal failure-dyalisis)
- Prolonged cardiopulmonary resuscitation without adequate tissue perfusion
- Anticoagulant related contraindications
- Compliance limitations (financial, cognitive, psychiatric, and social limitations)?
- Unrecoverable cardiac function?

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2015 BY THE SOCIETY FOR CARDIOVASCULAR ANGIOGRAPHY AND INTERVENTIONS, THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION, THE HEART FAILURE SOCIETY OF AMERICA, AND THE SOCIETY FOR THORACIC SURGERY
PUBLISHED BY ELSEVIER INC.

VOL. 65, NO. 19, 2015
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.03.036

EXPERT CONSENSUS DOCUMENT

2015 SCAI/ACC/HFSA/STS Clinical Expert Consensus Statement on the Use of Percutaneous Mechanical Circulatory Support Devices in Cardiovascular Care

never too early!

"For cardiogenic shock, a support device should be inserted **as soon as possible**, particularly if (…) *fluid resuscitation and pharmacologic support fail* (…).

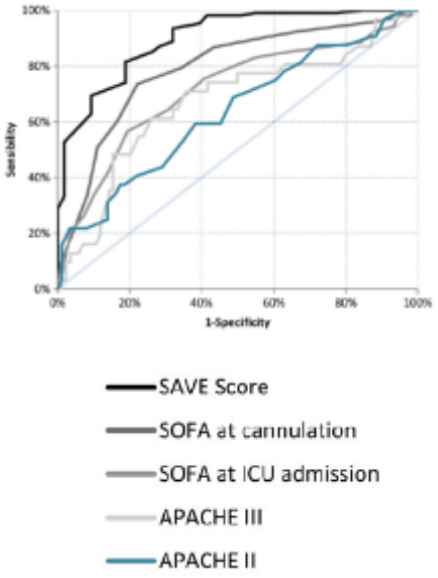
Early initiation of MCS support can mitigate the consequences of systemic hypoperfusion, worsening ischemia, and declining cardiac function."

European Heart Journal (2015) **36**, 2246–2256
doi:10.1093/eurheartj/ehv194

CLINICAL RESEARCH
Myocardial disease

Predicting survival after ECMO for refractory cardiogenic shock: the survival after veno-arterial-ECMO (SAVE)-score

Matthieu Schmidt[1,2]*, Aidan Burrell[1,3], Lloyd Roberts[3], Michael Bailey[1,3], Jayne Sheldrake[3], Peter T. Rycus[4], Carol Hodgson[1,3], Carlos Scheinkestel[3], D. Jamie Cooper[1,3], Ravi R. Thiagarajan[4,5,6], Daniel Brodie[7], Vincent Pellegrino[1,3], and David Pilcher[1,3]



Multivariable modelling on 3846 patients identified

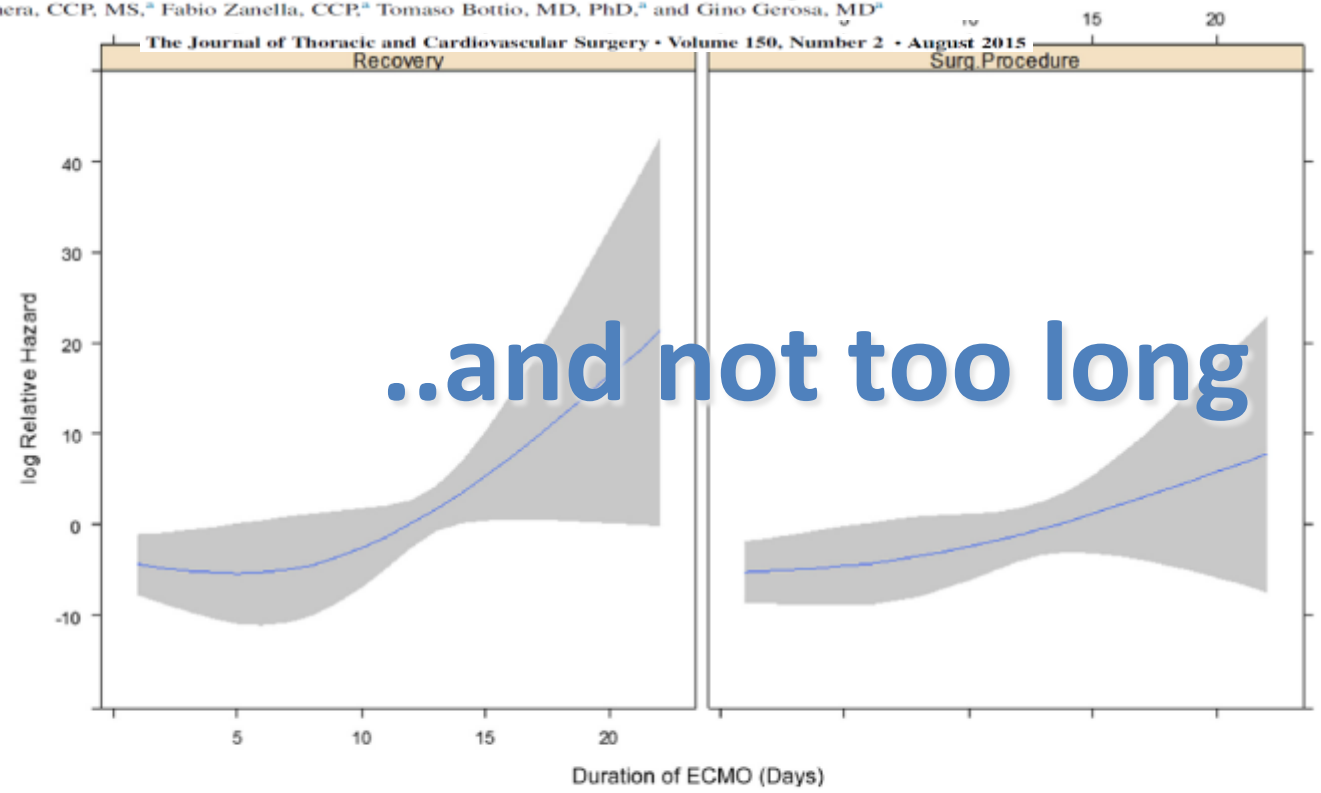
pre-ECMO **risk factors for hospital mortality**:
chronic renal failure,
mechanical ventilation,
others acute organ failure,
cardiac arrest,
congenital heart disease,
lower pulse pressure, and
lower serum bicarbonate

Before it's too late!

Extracorporeal life support in cardiogenic shock: Impact of acute versus chronic etiology on outcome

Vincenzo Tarzia, MD,[a] Giacomo Bortolussi, MD,[a] Roberto Bianco, MD,[a] Edward Buratto, MBBS,[a] Jonida Bejko, MD,[a] Massimiliano Carrozzini, MD,[a] Marco De Franceschi, BSS,[a] Dario Gregori, MA, PhD,[b] Dario Fichera, CCP, MS,[a] Fabio Zanella, CCP,[a] Tomaso Bottio, MD, PhD,[a] and Gino Gerosa, MD[a]

The Journal of Thoracic and Cardiovascular Surgery • Volume 150, Number 2 • August 2015



..and not too long

FIGURE 1. Impact of duration of ECLS on 30-day survival for the 2 distinct states: "recovery" and "surgical procedure." Risk of dying at 30 days increases at a constant rate throughout the duration of ECLS for patients in the surgical procedure stage. In patients who recovered, the risk of dying at 30 days increases steadily only after 9 days on ECLS. *Surg*, Surgery; *ECMO*, extracorporeal membrane oxygenation.

Support < 8 days → Survival

ECMO Disadvantages in the setting of cardiogenic shock

- Time limitation
- Patient must remain supine
- Local Complications (hemorrhages, embolism, acute leg ischemia)
- Infection
- Stroke (ischemic, hemorrhagic)
- Pump highly pre- and afterload dependent
- Non-pulsatile flow?

ECMO Complications

- Mechanical (relating to the ECMO circuit components, cannulas displacement)
- Medical
  - Bleeding (>30% requiring surgical revision, 2 blood units per day median value)
  - Infection (15-20% incidence, median delay 4 days, Gram negative pathogens)
  - Thrombocytopenia
  - Embolism
    - Cerebrovascular and vascular (20%-30%)
  - Limb ischaemia (15%-20%)
  - Pulmonary edema
  - Cardiac Thrombosis
  - Coronary or cerebral hypoxia (site of arterial cannula)

ECMO and Pulmonary edema

- Retrograde flow of blood towards the left ventricle may cause increased increased left ventricular afterload, especially if ventricular ejection is unable to overcome this pressure gradient. This results in progressive left ventricular dilation, pulmonary congestion, and pulmonary edema.
  - IABP and inotropes
  - Atrial septal puncture
  - PA cannula or catheter
  - Impella
  - Switch from peripheral to central ECMO
  - LV cannula

Harlequin syndrome

- Flow competition in the aorta
  - "Blue head": deoxygenated blood directed to the upper part of the body
  - "Red legs": hyperoxygenated blood in the lower part of the body

ECMO and Death

The multivariate logistic regression analysis showed that the only factors independently associated with death are:

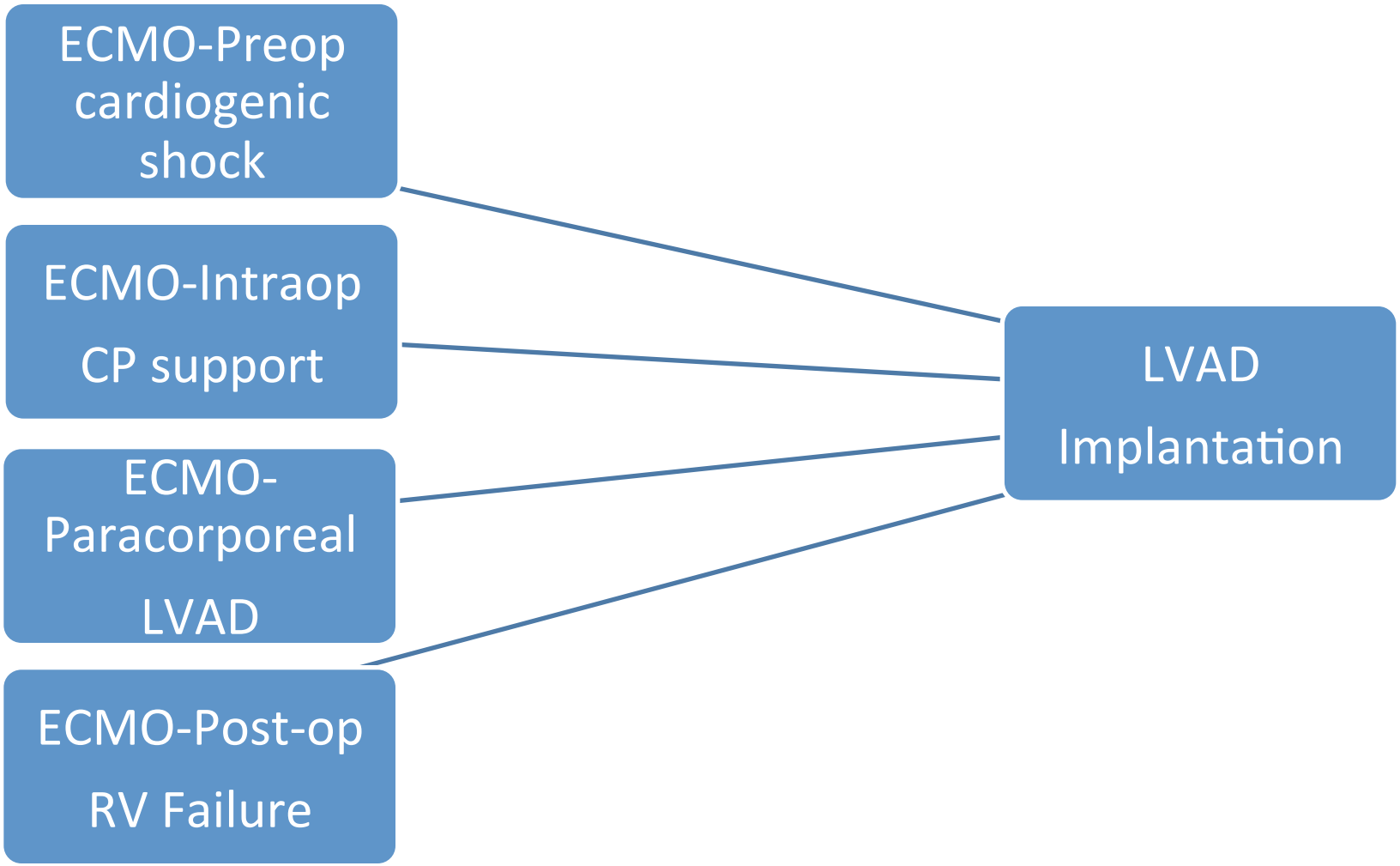
- Transfusions (Blood Units, Platelets, Plasma)
- Age
- CVVH

Duration of ECMO influence or not mortality?

Conclusions

- ECMO is a “Bridge to Life”
- It should be instituted as soon as possible
- It should be weaned/substituted ideally as soon as possible (within ½-1 week)

ECMO: LVAD Implantation

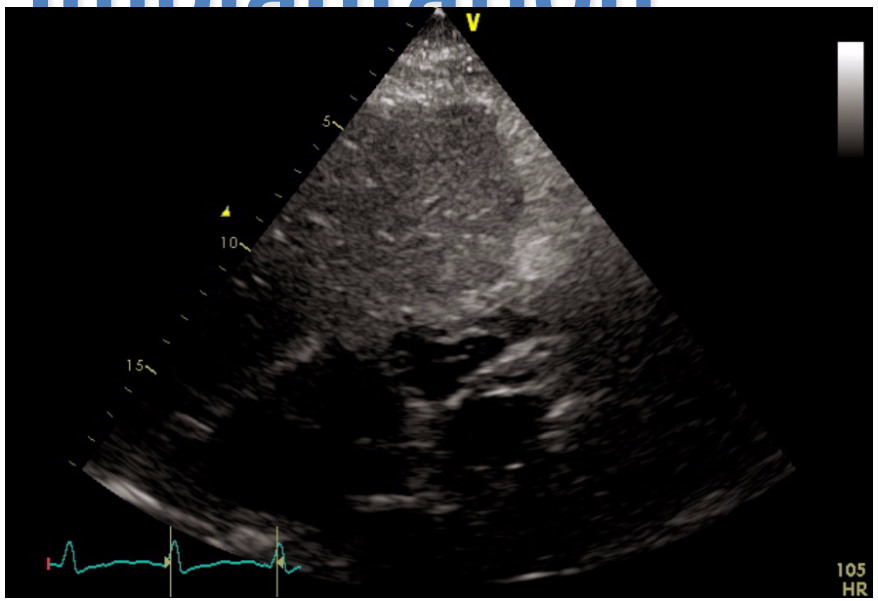


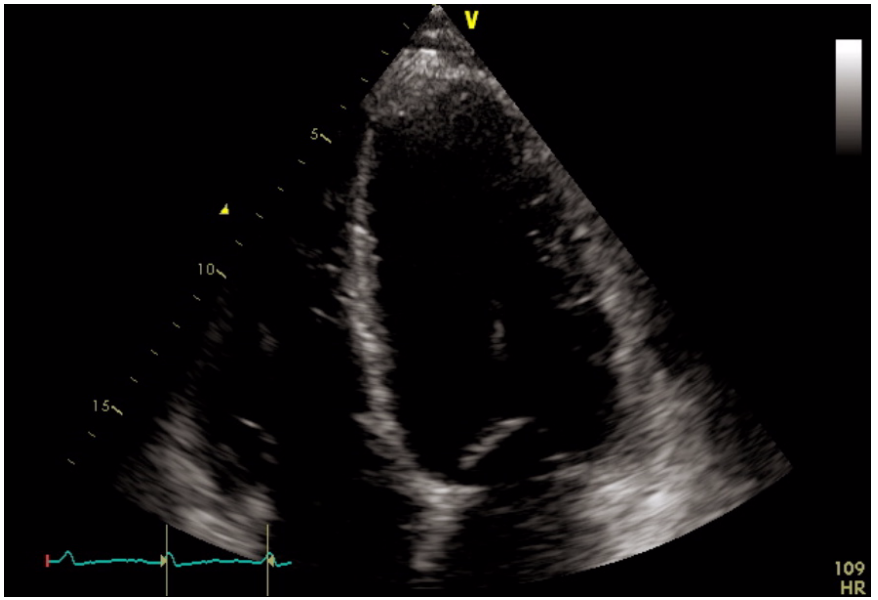
ECMO Pre-op and LVAD Implantation

Padua experience:

• Patients:	21
• Gender:	18 male/3 female
• Mortality (30-days-In-Hospital):	7/21 (33%)
• Bleeding/revision:	10/21 (48%)
• Infection:	10/21 (47,6%)
• MOF:	1/21 (4,7%)
• Stroke:	2/21 (9,5%)
• RV failure and need for RVAD:	5/21 (23,8%)
• Days on RVAD:	7gg (mean)

ECMO Pre-op and LVAD Implantation



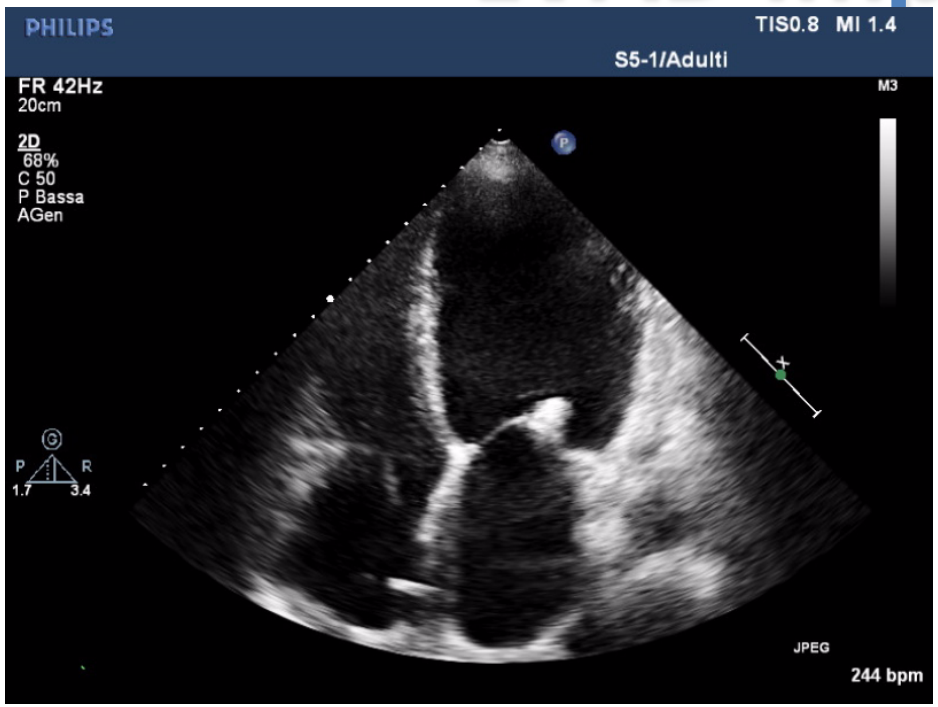


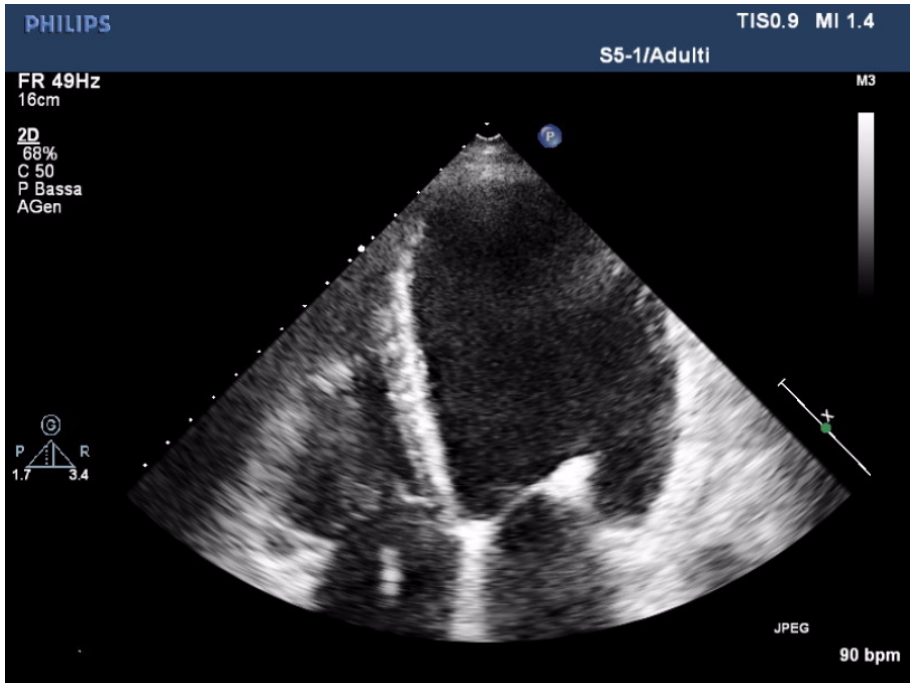
ECMO Intra-op and LVAD Implantation

Padua experience:

• Patients:	15
• Gender:	14 male/1 female
• Mortality (30-days-In-Hospital):	3/15 (20%)
• Bleeding/revision:	7/15 (46%)
• Infection:	8/15 (53%)
• MOF:	0/15 (0%)
• Stroke:	2/15 (13%)
• RV failure and need for RVAD:	7/15 (46%)
• Days on RVAD:	12gg (mean)

ECMO Intra-op and LVAD Implantation



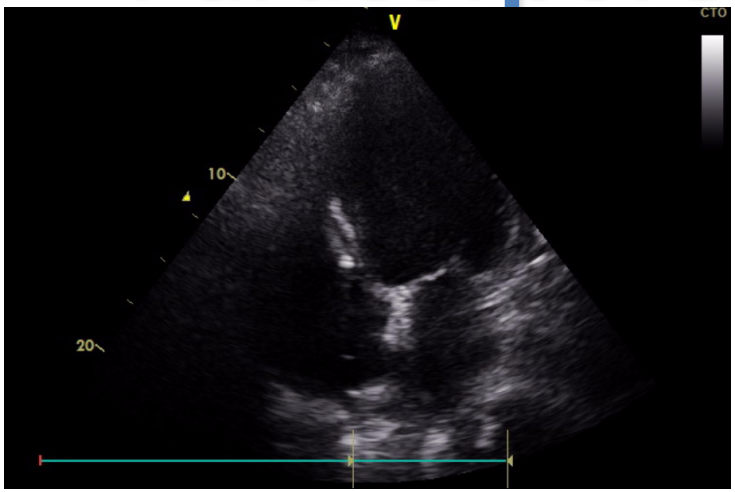


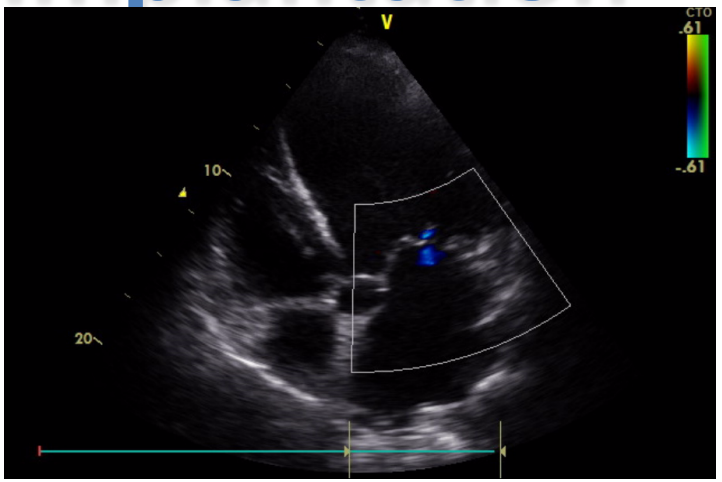
ECMO Pre-op and Paracorporeal LVAD Implantation

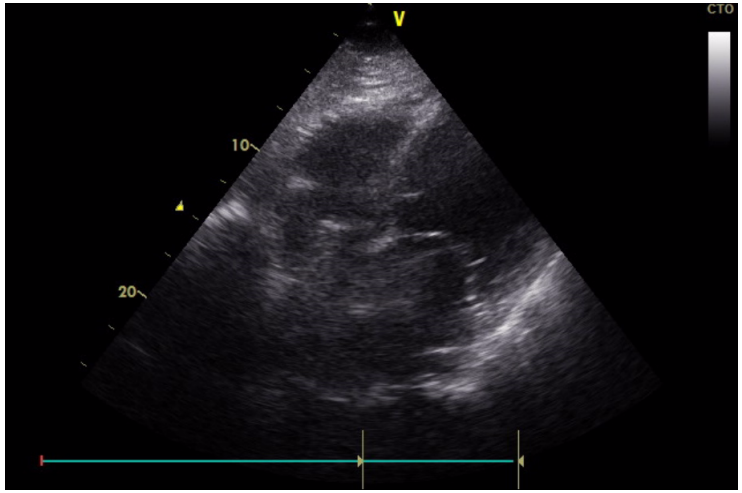
Padua experience:

- Patients: 16
- Gender: 9 male/7 female
- Mortality (30-days-In-Hospital): 6/15 (37,5%)
- Bleeding/revision: 5/16 (31%)
- Infection: 5/16 (31%)
- MOF: 1/16 (6%)
- Stroke: 0/16 (0%)
- RV failure and need for RVAD: 4/16 (24%)
- Days on RVAD: 7gg (mean)

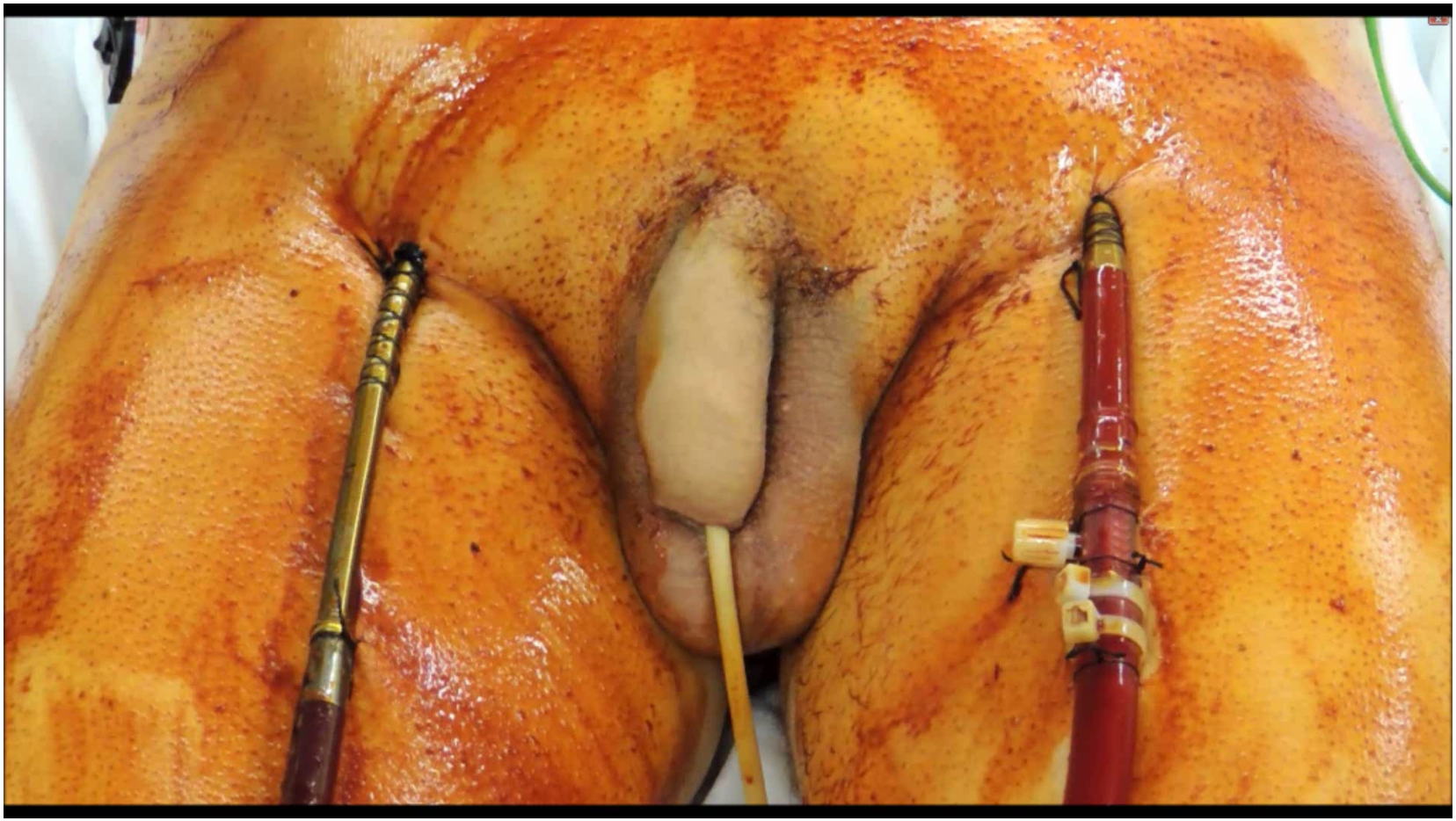
ECMO Pre-op and Paracorporeal LVAD Implantation







ECMO Pre-op and Paracorporeal LVAD Implantation



Cardiopulmonary by-pass and LVAD implantation

Padua experience:

- Patients: 12
- Gender: 11 male/1 female
- Mortality (30-days-In-Hospital): 1/12 (8,3%)
- Bleeding/revision: 8/12 (67%)
- Infection: 7/12 (58%)
- MOF: 0/12 (0%)
- Stroke: 1/12 (8,3%)
- RV failure and need for RVAD: 1/12 (8,3%)
- Days on RVAD: 4gg (mean)

Off-Pump and LVAD implantation

Padua experience:

- Patients: 29
- Gender: 26 male/3 female
- Mortality (30-days-In-Hospital): 3/29 (10%)
- Bleeding/revision: 7/29 (24%)
- Infection: 10/29 (34%)
- MOF: 0/12 (0%)
- Stroke: 2/29 (7%)
- RV failure and need for RVAD: 1/29 (3,4%)
- Days on RVAD: 6gg (mean)

Conclusions

	Pre-op ECMO	Intra-op ECMO	ECMO+LVAD	CPB	OFF-CPB
Mortality	33%	20%	37%	8%	10%
Bleeding/ revision	48%	46%	31%	67%	24%
Infection	48%	53%	31%	58%	34%
Post-op RVAD	24%	46%	24%	8.3%	3,4%