TEL AVIV UNIVERSITY

RABIN MEDICAL CENTER
BEILINSON • HASHARON

*E*xtra *C*orporeal *L*ife *S*upport
for Acute Heart failure

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Director Heart and Lung Transplantation

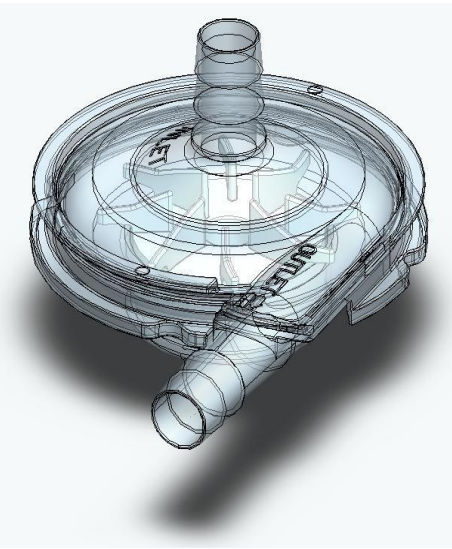
Department of Cardiothoracic Surgery

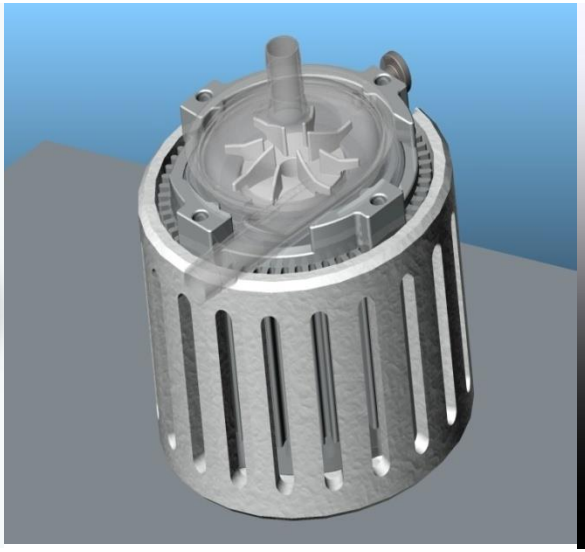
Rabin Medical Center, Beilinson Campus, Israel

Mechanical Assistance availabe

- Short term (Centrifugal/Axial pumps)
  - LVAD
  - RVAD
  - BiVAD
  - ECMO

Levitronix

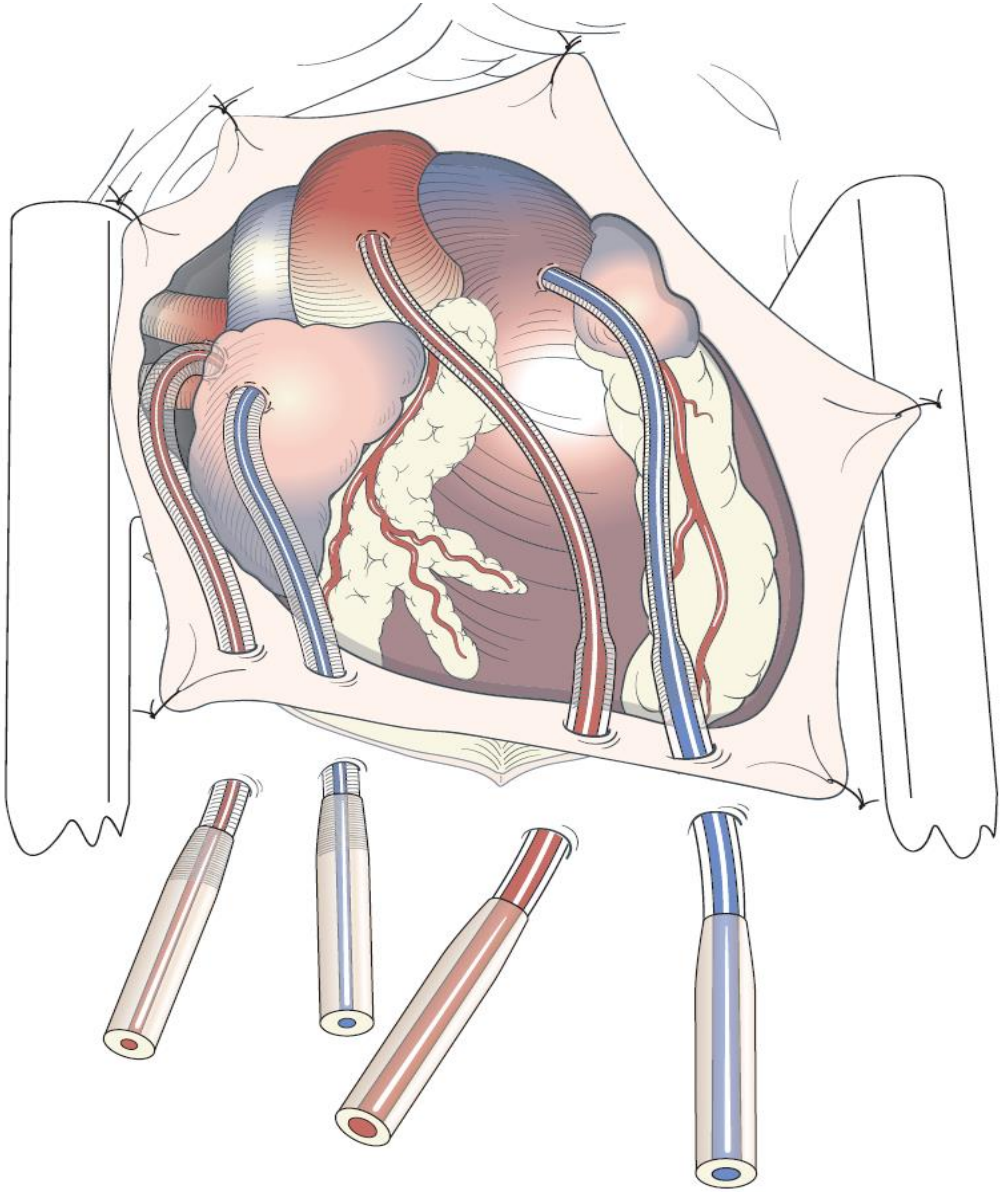




The Levitronix® CentriMag VAS is designed to provide temporary support for patients suffering potentially reversible cardiogenic shock.

FDA approved for up to 30 days of use.

Cannulation



Outcomes of a multicenter trial of the Levitronix CentriMag ventricular assist system for short-term circulatory support

Ranjit John, MD,[a] James W. Long, MD,[b] H. Todd Massey, MD,[c] Bartley P. Griffith, MD,[d] Benjamin C. Sun, MD,[e] Alfred J. Tector, MD,[f] O. Howard Frazier, MD,[g] and Lyle D. Joyce, MD[a]

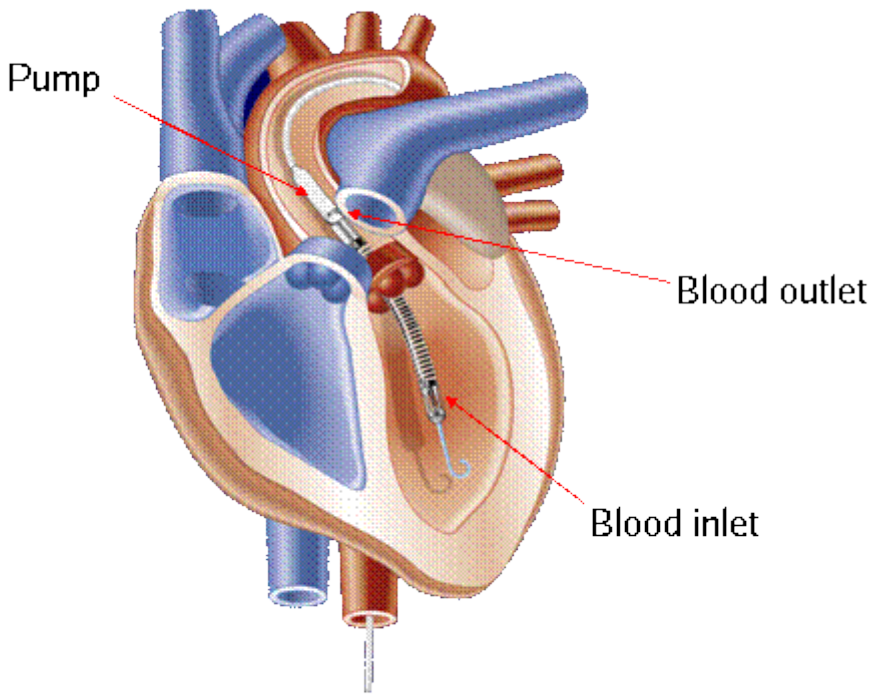
J Thorac Cardiovasc Surg 141:932-9;2011

TABLE 3. Survival by group

	30 d	Discharge	6 mo
All (n = 38)	18 (47%)	16 (42%)	12 (32%)
RVAD (n = 12)	7 (58%)	5 (42%)	4 (33%)
PMICS (n = 14)	7 (50%)	7 (50%)	6 (43%)
PCCS (n = 12)	4 (33%)	4 (33%)	2 (17%)
LVAD (n = 8)	3 (38%)	2 (25%)	2 (25%)
BVAD (n = 18)	8 (44%)	8 (44%)	6 (33%)

All times are measured from device removal; all data are numbers of patients with percentages. *RVAD*, Right ventricular assist device; *PMICS*, post–acute myocardial infarction cardiogenic shock; *PCCS*, postcardiotomy cardiogenic shock; *LVAD*, left ventricular assist device; *BVAD*, biventricular assist device.

Impella



The Impella 2.5 is inserted percutaneously The Impella 5 is inserted surgically

Both provide temporary support for patients suffering potentially reversible cardiogenic shock.

It is intended to be used up to 7 days

The Impella 2.5 and 5.0 devices for ST-elevation myocardial infarction patients presenting with severe and profound cardiogenic shock: The Academic Medical Center intensive care unit experience*

Annemarie E. Engström, MD; Ricardo Cocchieri, MD; Antoine H. Driessen, MD; Krischan D. Sjauw, MD; Marije M. Vis, MD; Jan Baan, MD, PhD; Mark de Jong, RN; Wim K. Lagrand, MD, PhD; Jos A. P. van der Sloot; Jan G. Tijssen; Robbert J. de Winter; Bas A. S. de Mol; Jan J. Piek; José P. J. M. Henriques, MD, PhD

Crit Care Med 2011 Vol. 39, No. 9

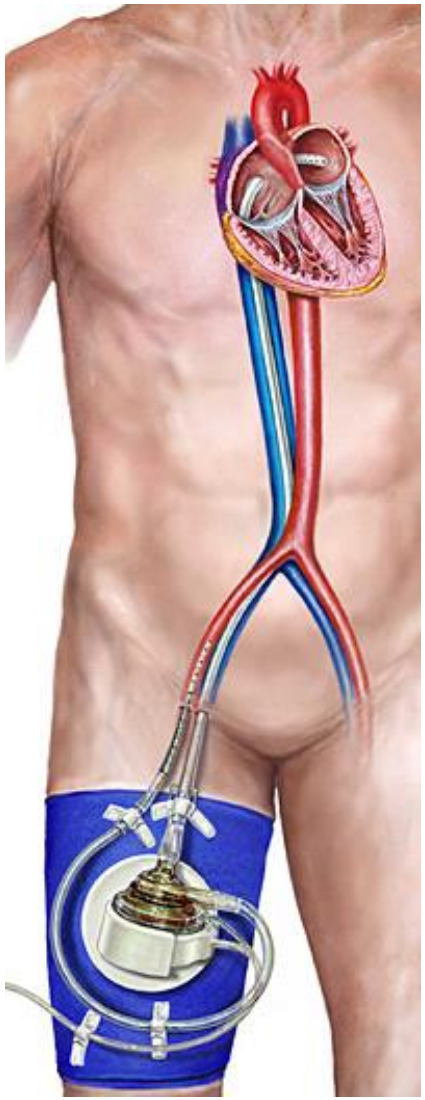
- At 30 days - alive
  - 6/23 (26%) Impella 2.5
  - 6/12 (50%) Impella 5

Comparative outcomes in cardiogenic shock patients managed with Impella microaxial pump or extracorporeal life support

Yoan Lamarche, MD,[a] Anson Cheung, MD,[a] Andrew Ignaszewski, MD,[a] Jennifer Higgins, MD,[a] Annemarie Kaan, MCN RN,[a] Donald E. G. Griesdale, MD, MPH,[b] and Robert Moss, MD[a]

(J Thorac Cardiovasc Surg 2011;142:60-5)

- At 30 days - alive
  - 11/29 (38%) Impella 5
  - 13/32 (41%) ECLS



Tandem Heart

The Tandem Heart is inserted percutaneously transeptal.

It provides temporary support for patients suffering potentially reversible cardiogenic shock.

It is intended to be used up to 7 days

Randomized comparison of intra-aortic balloon support with a percutaneous left ventricular assist device in patients with revascularized acute myocardial infarction complicated by cardiogenic shock

Holger Thiele*, Peter Sick, Enno Boudriot, Klaus-Werner Diederich, Rainer Hambrecht, Josef Niebauer, and Gerhard Schuler

European Heart Journal (2005) 26, 1276–1283

- IABP = 20
- Tandem Heart = 21

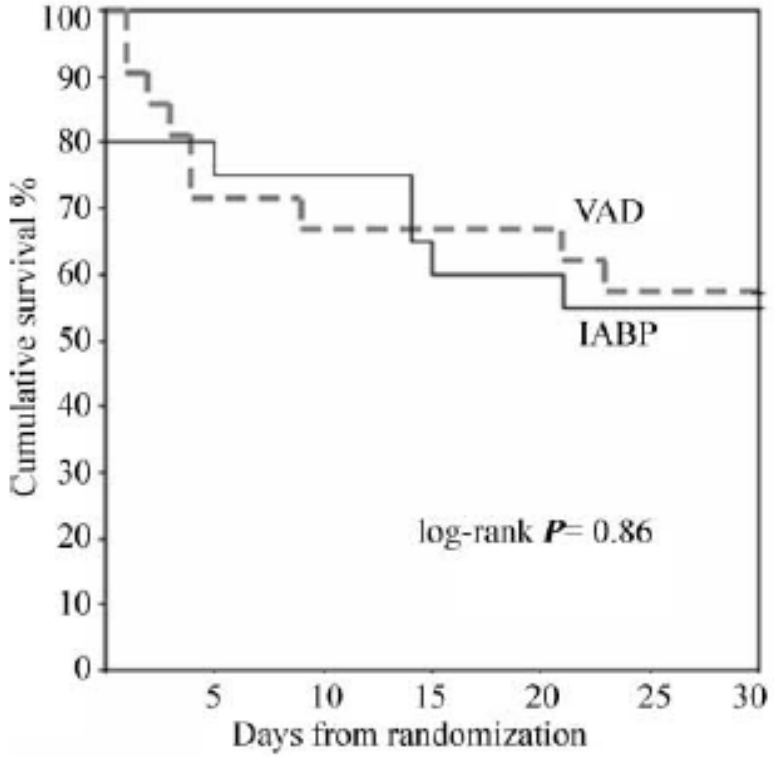


Figure 4 Kaplan–Meier survival estimates for 30 day survival for IABP and VAD.

ECLS

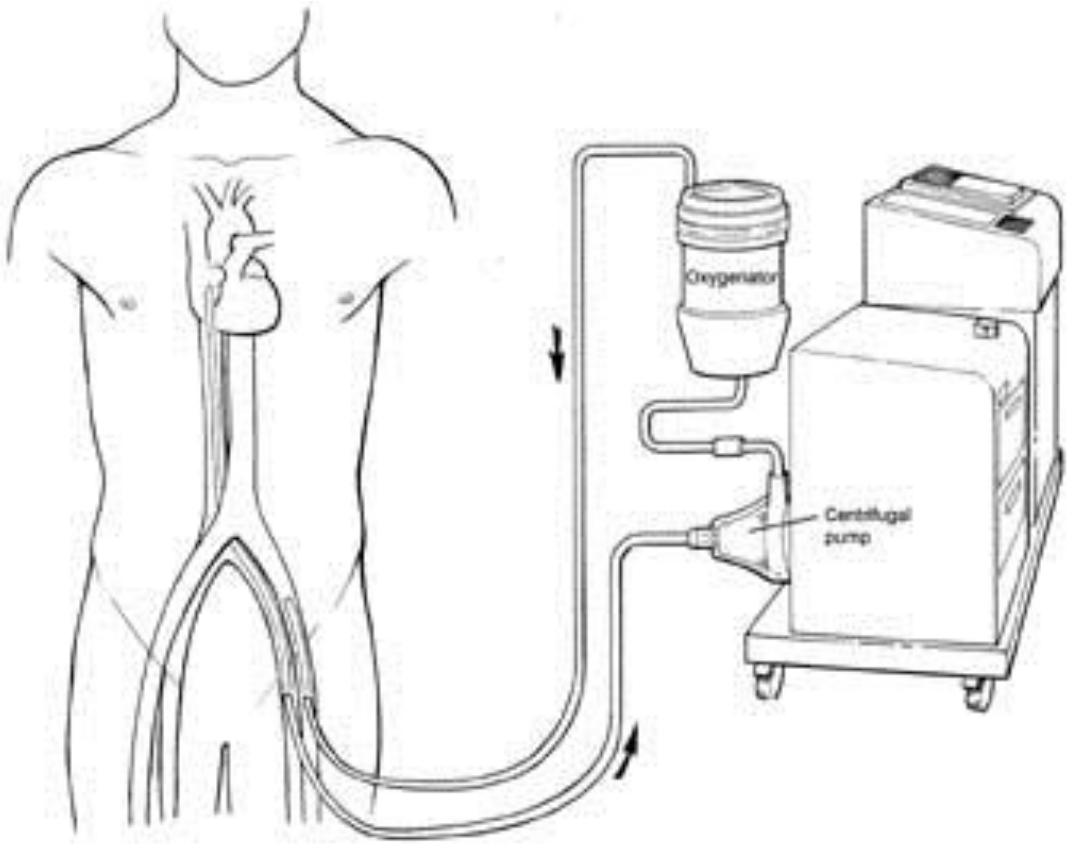
Extra Corporeal Life Support

- A bedside mobile cardiopulmonary bypass system that can replace the Heart and Lung function.
  - Pump
  - Oxygenator
  - Heater/Cooler

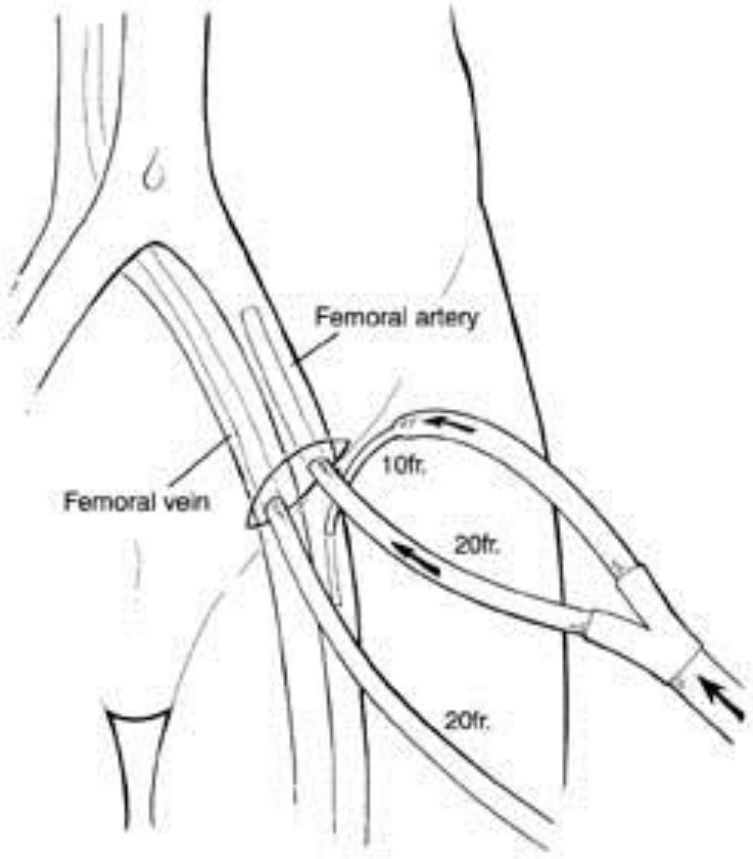
Purpose of Treatment

- Providing organ perfusion during Heart and/or Lung failure
  - Fast less invasisve and reliable Cannulae insertion
  - Awake ECMO whenever possible

VA ECMO



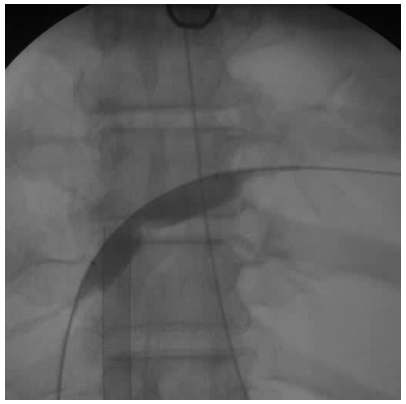
Distal Perfusion

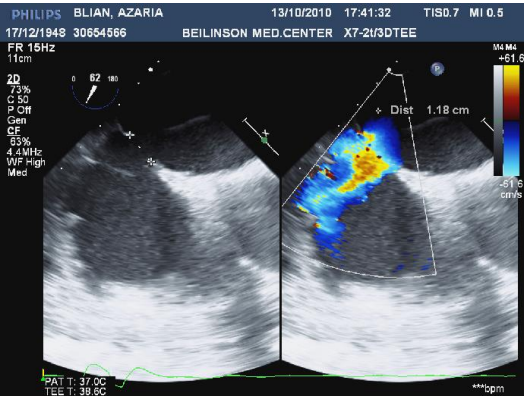


Physiology

- Blood is actively drained by a pump from right atrium into an
- Oxygenator where gas exchange is taking place
- Blood is than warmed and returned into the arterial circulation

VA ECMO





- Hemodynamic and Respiratory support
- Non pulsatile flow
- Decrease in preload (Rt>Lt)
- Increase in LV afterload
  - LV ejection is mandatory to prevent:
    - LV distension
    - LV clotting
    - Pulmonary congestion
  - IABP, surgical drainage, atrial septostomy

Complications

- Hemolysis – 5%
- Infection – 40%
- Leg or Arm ischemia – 25%
- Organ dysfunction – 33%
- Mechanical – 4%
- Bleeding – 48%
  - DIC
  - Heparin
- Stroke – 12%
  - Hemmorhagic
  - Embolic

Cove and MacLaren *Critical Care* 2010, **14**:235

Indications

- Reversible insult or as a bridge
  - Post cardiotomy
  - Post MI
  - Myocarditis
  - Post Heart TX or LVAD impalntation

Results

- Wide range (30% – 70%)
- Five years survival of 30 days survivors – 63%
- Length of support (golden period – 3 – 5 days)

Table 3. Evidence supporting extracorporeal membrane oxygenation use in cardiogenic shock complicating an acute myocardial infarction

Study	Patients	Survival rate[a]	Cardiogenic shock etiology
Golding *et al.* [42] (1992)	91	25.3%	Post-CABG[b]
Muehrcke *et al.* [43] (1996)	23	30.4%	Post-CABG[b]
Magovern *et al.* [44] (1999)	27	85%	UA or CHF
Formica *et al.* [39] (2008)	18	27.8%	AMI/Post-CABG
Combes *et al.* [38] (2008)	16	31.3%	AMI
ELSO [33] (2009)	153[c]	39%	Not defined

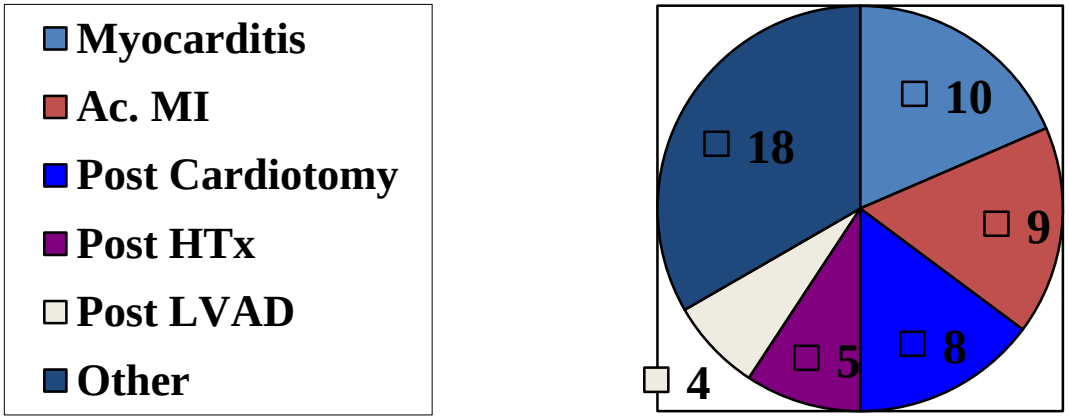
[a]Survival to hospital discharge. [b]Postcardiotomy patients who were unable to wean off bypass or developed postoperative cardiogenic shock. [c]Number of extracorporeal membrane oxygenation runs. AMI, acute myocardial infarction; CABG, coronary artery bypass graft; CHF, congestive heart failure; ELSO, Extracorporeal Life Support Organization; UA, unstable angina.

Cove and MacLaren *Critical Care* 2010, **14**:235

Beilinson Experience
9/08 – 6/13

CARDIAC

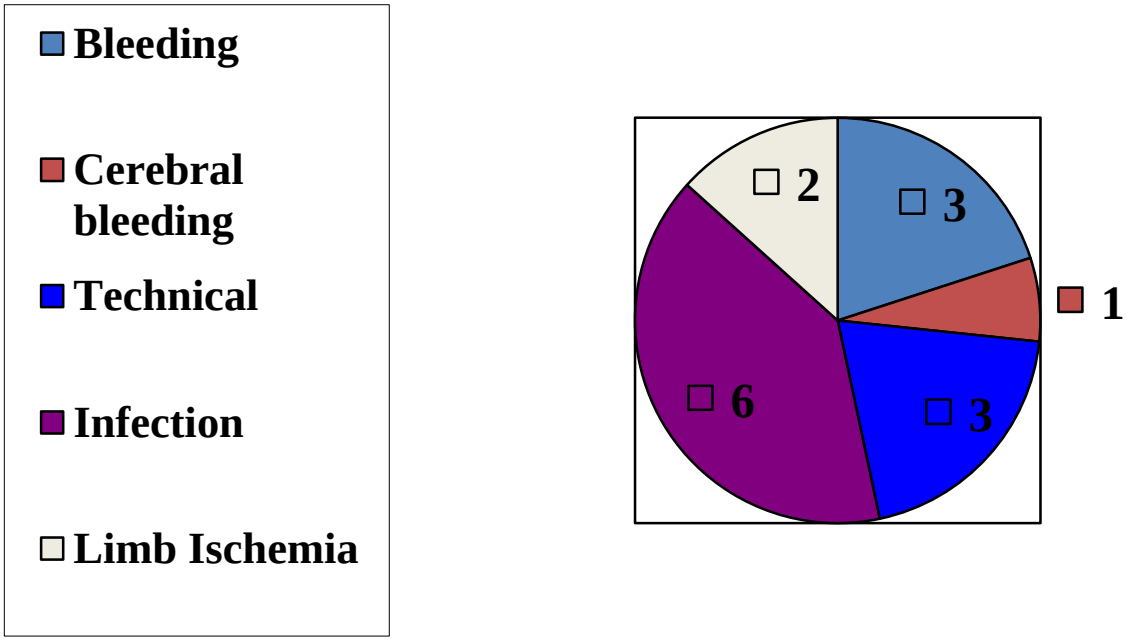
N= 54



Beilinson Experience

9/08 – 6/13

COMPLICATIONS



Beilinson Experience
9/08 – 6/13

	Cardiac
N*	54
Weaned	38 (70%)
Early Survival	23 (43%)

*14 (26%) transported from different hospitals

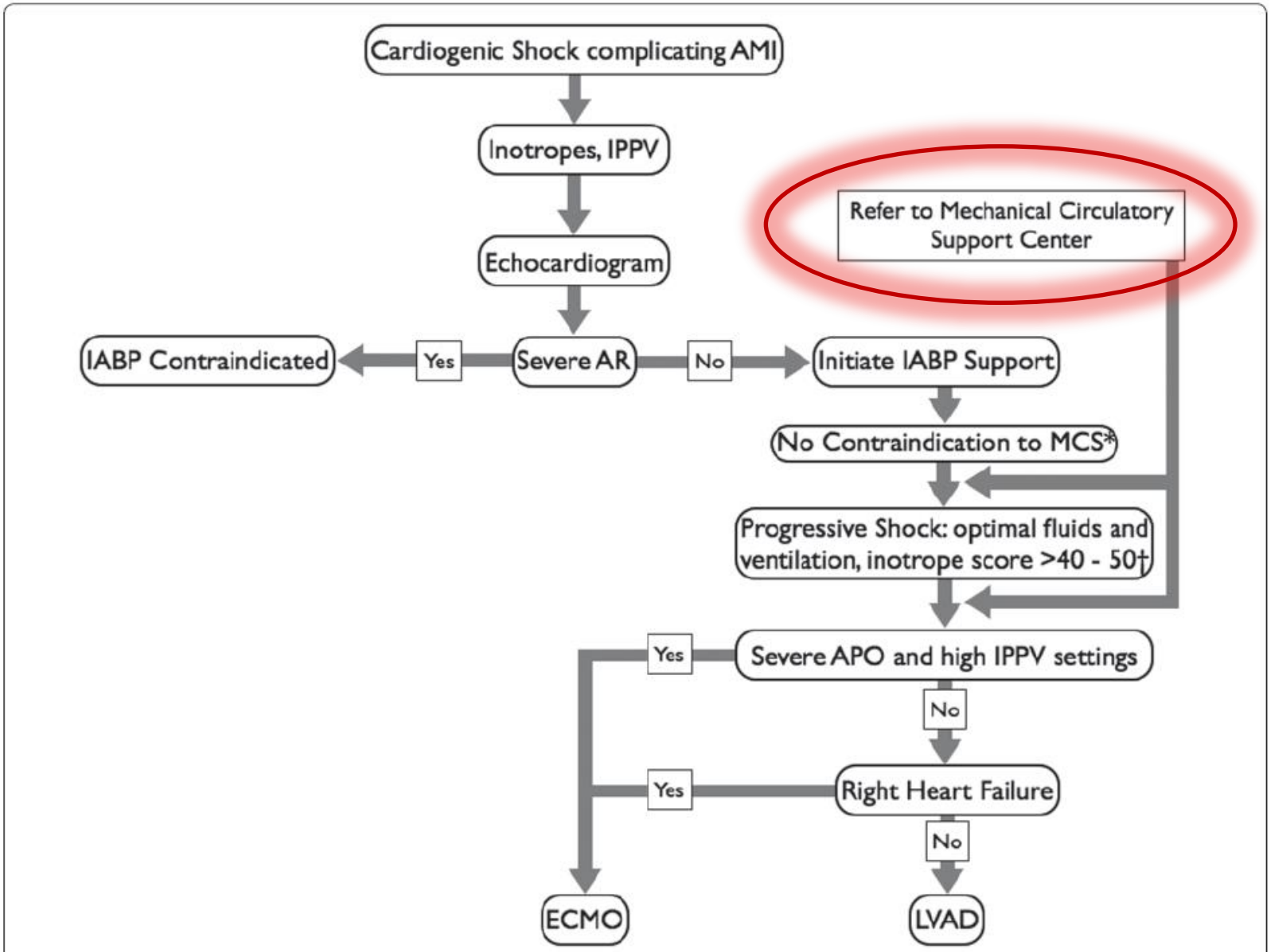


Figure 3. Simplified flow diagram of initiation of mechanical circulatory support. Patients requiring full mechanical circulatory support should be referred to experienced, high-volume centers. *See Table 4 for contraindications to mechanical circulatory support. †Inotrope score = doses of dopamine + dobutamine μg/kg per min + [(epinephrine + norepinephrine + isoproterenol μg/kg per min) × 100] + [milrinone μg/kg per min × 15]. AMI, acute myocardial infarction; APO, acute pulmonary edema; AR, aortic regurgitation; ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump; IPPV, invasive positive pressure ventilation; LVAD, left ventricular assist device; MCS, mechanical circulatory support.

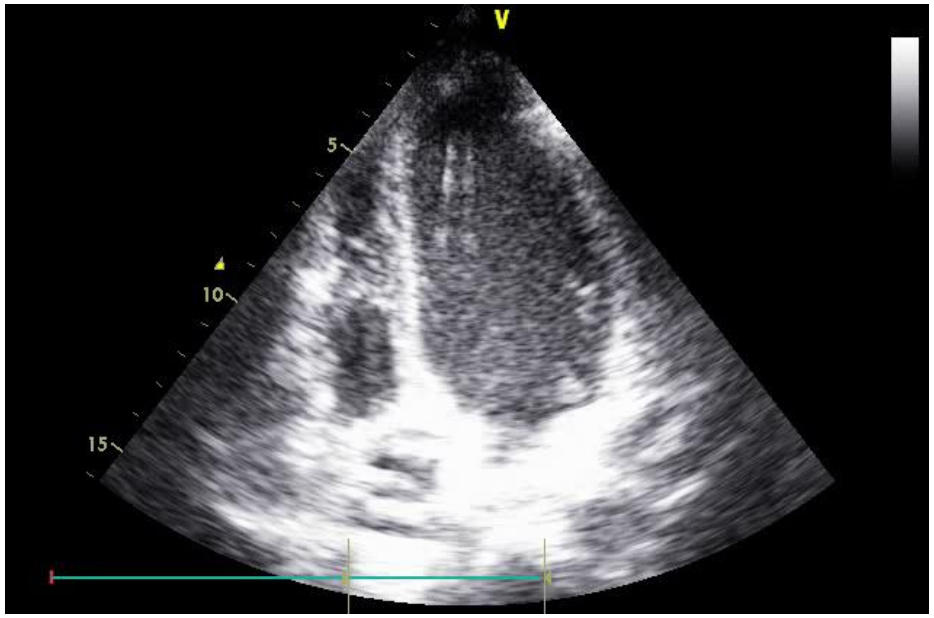
Case Presentation#1 CARDIAC

- Male, 21 years old
- Fever and abdominal pain for 3 days
- Pulmonary edema and cardiogenic shock
- Diffuse ST changes
- Normal coronaries by cath.
- Myocarditis? → Influenza A
- Transferred with IABP under massive inotropic support

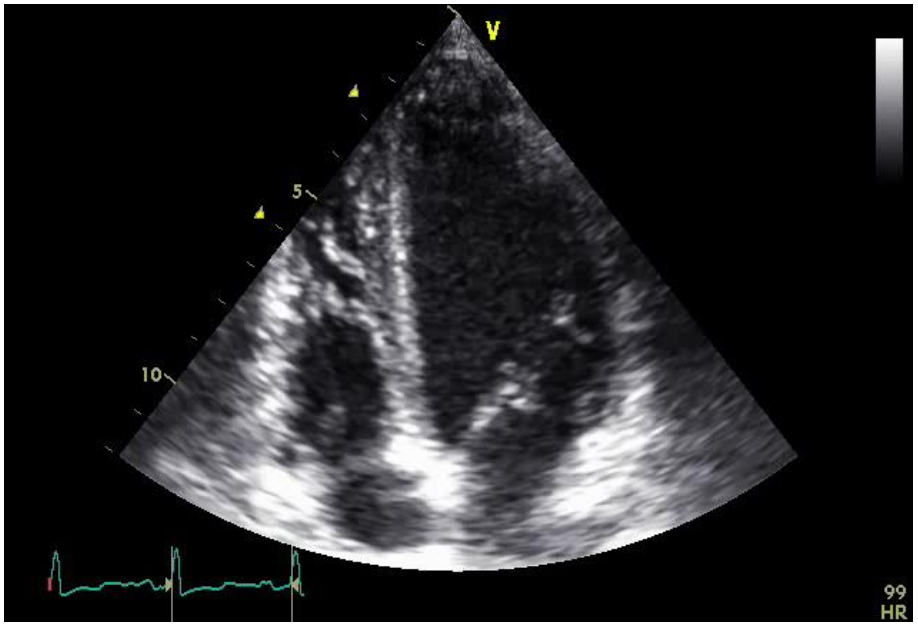
ECMO

- Placed on Veno Arterial ECMO (28/04/10)
- Extubation (29/04/10)
- Removal of ECMO (3/05/10)
- Doing Well

ECHO Pre



ECHO 2 weeks Post

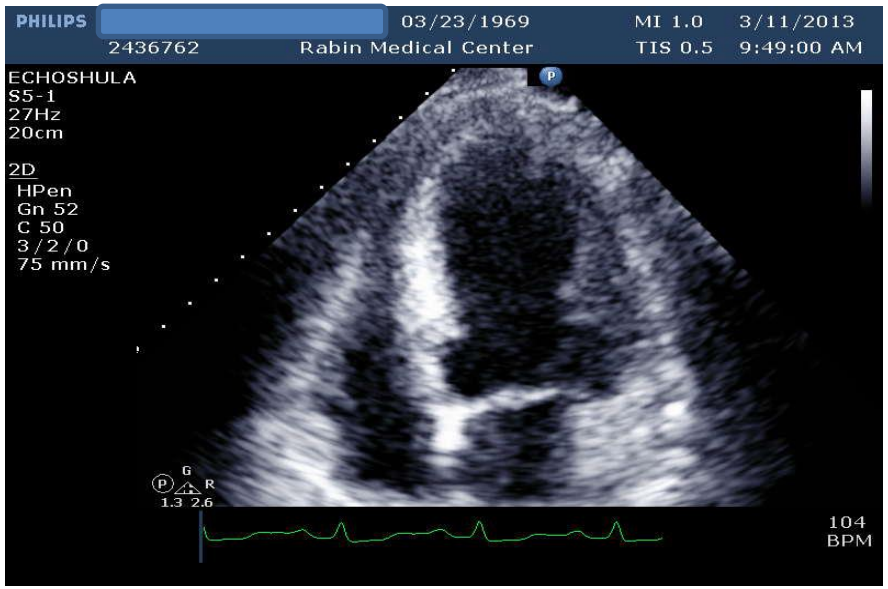


Case Presentation#2 CARDIAC

- Male, 44 years old
- Extensive anterior wall MI (late arrival)
- Emergency PCI to LAD (total ostial LAD)
- Severe LV
- Progressive cardiogenic shock
- IABP, inotropic support, temp pacemaker, mechanical ventilation

- The patient was connected to VA ECMO – 13/3/13
- Extubated a day later
- Weaned from ECMO after 8 days
- Discharged home after 24 days

ECHO Pre



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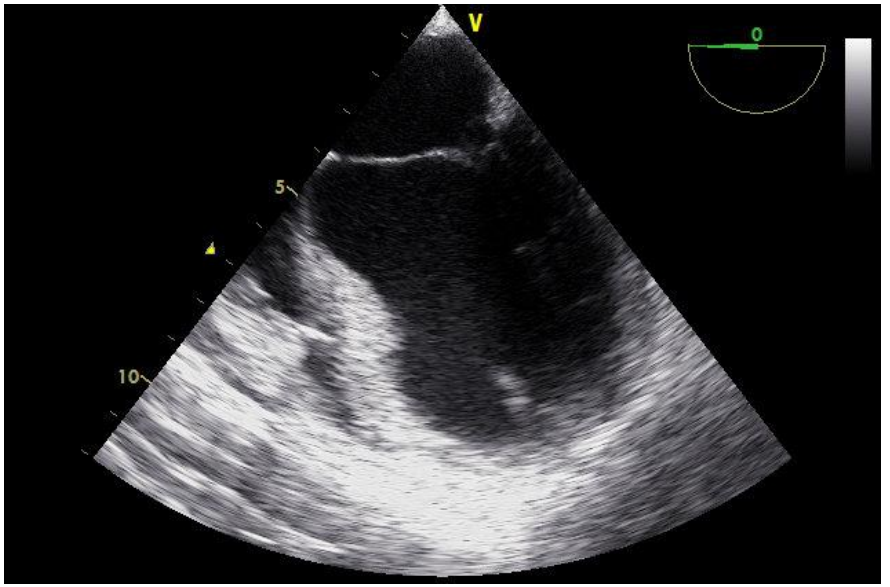
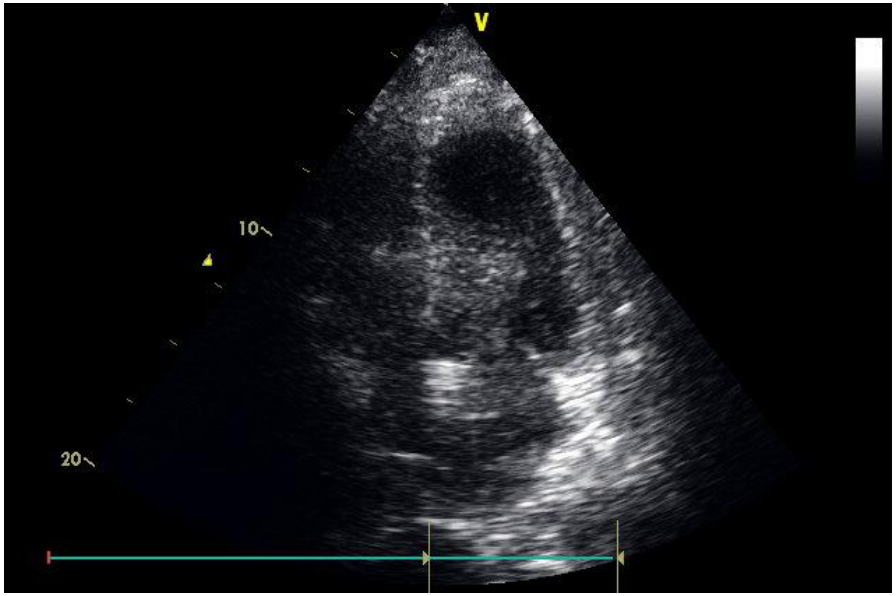


Case Presentation#3 CARDIAC

- Male, 63 years old
- Extensive anterior wall MI (late arrival)
- VF, CPR, Mechanical ventilation
- Emergency PCI to LAD, D and later to RCA
- Severe LV
- Progressive cardiogenic shock
- IABP, inotropic support.

- A dedicated team went to the other hospital
- The patient was connected to VA ECMO and transferred to Beilinson – 5/11/12
- Multiorgan failure
- Organ recovery
- Weaned from ECMO after 7 days
- Discharged home

ECHO Pre



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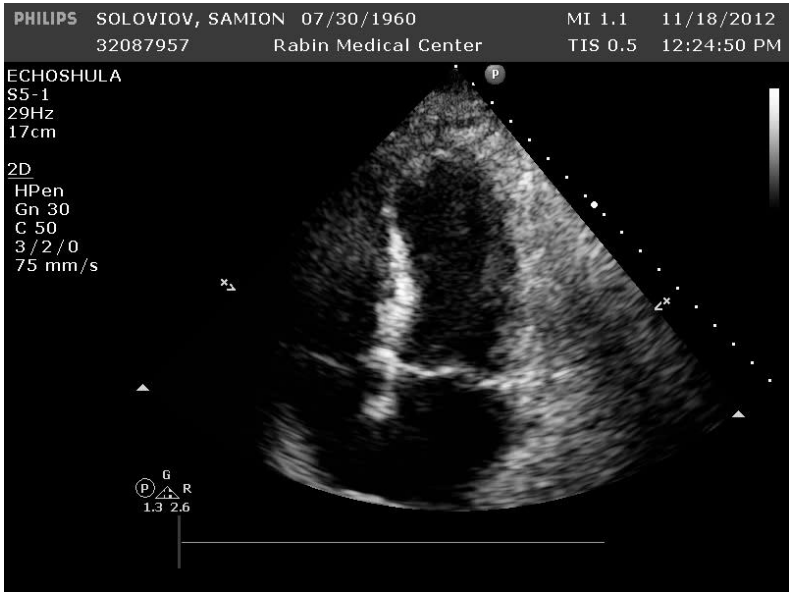

- Followed in our heart failure clinic
- Developed progressive CHF
- Implanted with LVAD (HeartMate II) as bridge to transplant – 6 months later
- Doing well

Case Presentation#4 CARDIAC

- Male, 23 years old
- Admitted in cardiogenic shock to a another hospital
- Severe LV dysfunction
- Giant aneurysm of distal LM and LAD with occlusion of LAD, Cx and communication with LV
- Underwent surgical correction
- Connected to central ECMO and chest was left open
- We were consulted

- A dedicated team went to the other hospital
- The patient was transferred to our OR and ECMO was changed to temporary LVAD (CentriMag) – 13/5/13
- Multiorgan failure
- Organ recovery
- Weaned from LVAD after 16 days
- Recovering

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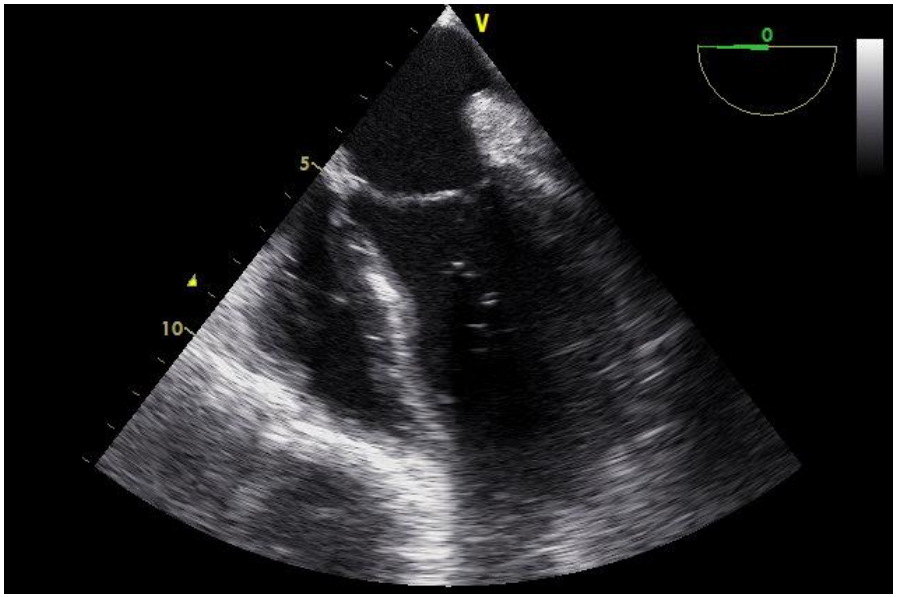

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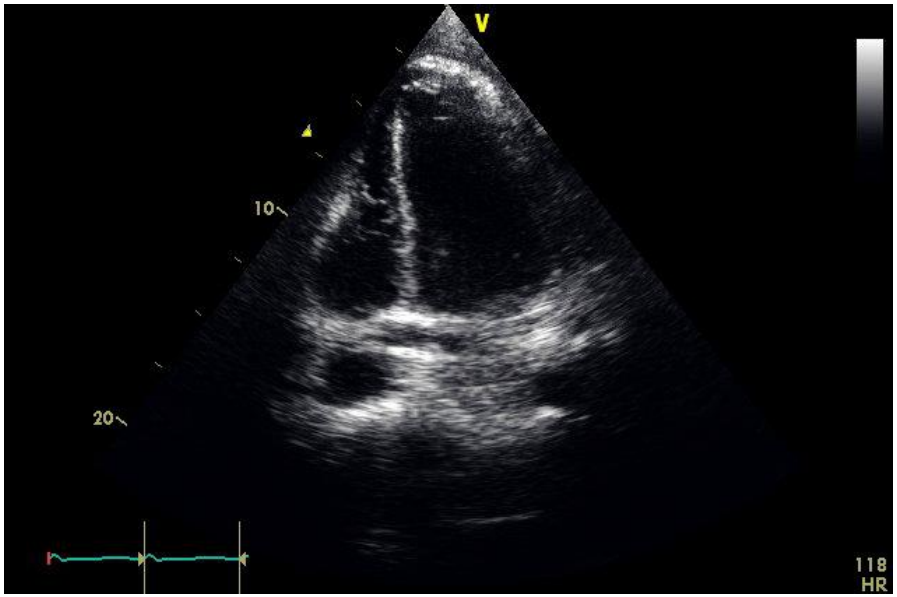

After

During support

ECLS is an important technology to support patients in acute cardio-respiratory failure

It is prudent to use it early to increase success rate

Thank You!