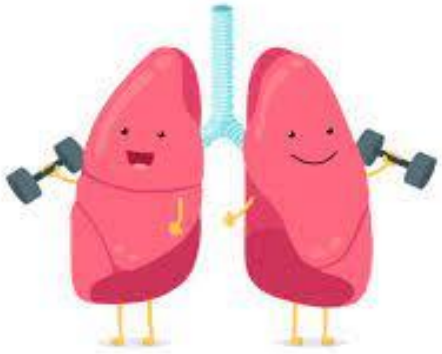

BREATHING WITHOUT OWN LUNGS (ECMO AS BRIDGE TO LUNG TRANSPLANT)

PRESENTOR:

DR.M.HARSHAVARDHAN

RESIDENT CCM

CASE HISTORY

- A 49 year old lady k/c/o post covid lung fibrosis who was on oxygen support at 2 lit/min for 2 years

- Admitted in private hospital with c/o cough and breathlessness

- No H/O Fever/sputum production/prolonged immobilization

- On further evaluation diagnosed spontaneous pneumothorax on left side of chest due to rupture of one of the lung cyst.

- Inspite of Left ICD insertion respiratory distress persisted. Hence taken on NIV and later taken On MV support and requiring vasopressor support.

- worsening hypoxia and hypercapnia i.e.type2 respiratory failure persisted inspite of appropiate ventilatory strategy.

(ABG showing Ph-6.9,pco2-120,po2=60,hco3-22)

- Attendants were counselled for urgent initiation of VV-ECMO

- She was referred to DPU hospital for lung transplant

- With the help of intensivists, CVTS surgeons and cardiac anaesthetists ECMO cannulation was planned

- ECMO cannulation was done(at bhosari)in right IJV and right femoral vein by seldinger technique under USG guidance.

- Transported on ECMO support to DPU on 15 june 2023(following ecmo transport checklist)

- Registered for super urgent lung transplant waiting list of maharashtra state.


R
CVTS-ICU

- Pt on VV ECMO with FiO2-100%,RPM-2250, FLOW-3.58 lit/min, Sweep gas- 4 lit/min, Delta pressure-16mmhg

- Pt tracheostomised and sedated with inj dexmed @ 8mcg/hr. Taken on MV support (control mode) with Fio2 40+PEEP5+RATE10+VT 150ml
  (Lung rest ventilation)

- Vitals : HR-104bpm,IBP-102/67mmhg,CVS-S1&S2+,RS-BAE+,spo2-100%

- Pt started on BIVALIRUDIN Infusion @ 1.5mg/hr

- aPTT MAINTAINED between 45-60 sec


MAQUET

- Within few days patient improved hemodynamically & oxygenation status got better. Gradually ambulated to sit on chair and made to walk with support with ongoing ECMO

FURTHER COURSE

- Pt had fever spikes, tachycardia and increasing need of inotropes. (Norad&vasopressin)
- Biochemical profile-TLC had gone up and showed neutrophilic predominance. Procal Elevated and there is worsening of shock
- Appropiate cultures were sent
- Blood c/s –klebsiella oxytoca
- Urine c/s – Acinetobacter baumanii complex
- Antibiotics escalated as per c&s reports.

Dr D.Y. Patil Medical College
Hospital and Research Centre, Pimpri, Pune
Department of Microbiology
NABL accredited, ISO 15189:2012

PRN = 1291396
SID = 323806002
First name = ANITA
Last name = SHARMA
Age = 40
Sex = f
Diagnosis = POST COVID LUNG FIBROSIS

Location = CVTS ICU
HoD/HoU = DR RAHUL
Department = CVTS
Specimen number = B-4568
Specimen date = 26-Jun-2023
Specimen type = Blood

TEST DONE CULTURE/SUSCEPTIBILITY
Organism = Klebsiella oxytoca

Amikacin	R	32 mcg/ml	Amoxicillin/Clavulanic acid	R	32 mcg/ml
Ampicillin/Sulbactam	R	32 mcg/ml	Aztreonam	R	
Cefepime	R	32 mcg/ml	Cefoperazone/Sulbactam	R	64 mcg/ml
Ceftazidime/Avibactam	R	16 mcg/ml	Ceftolozane/Tazobactam	R	32 mcg/ml
Ceftriaxone	R	64 mcg/ml	Ciprofloxacin	R	4 mcg/ml
Colistin	I	0.5 mcg/ml	Doxycycline	I	8 mcg/ml
Gentamicin	R	16 mcg/ml	Imipenem	R	8 mcg/ml
Meropenem	R	16 mcg/ml	Piperacillin/Tazobactam	R	128 mcg/m
Polymyxin B	I	1 mcg/ml	Tetracycline	R	16 mcg/ml
Tigecycline	S	0.5 mcg/ml	Trimethoprim/Sulfamethoxazole	S	20 mcg/ml
Netilmicin	R	32 mcg/ml			

Carbapenemase Positive
Comment MBL PRODUCER

R = Resistant I = Intermediate S = Susceptible

COPY FOR INTERNAL USE ONLY

(Sign. of Microbiologist)
Dr. Shahzad Mirza
Associate Professor, HICO
Dept. of Microbiology
DYPMC, Pimpri, Pune- 18.

- Aerobic blood culture bottle from central line grew Klebsiella oxytoca.
- Ceftazidime/Avibactam Aztreonam synergy - 0.25

Phenotypic Synergy testing of CZA with Aztreonam is performed to detect synergy effect of the combination 'in vitro against Metallo Beta lactamase producing bacteria. The MIC of the synergistic combination should be interpreted as absolute MIC of the synergistic combination as it is meant to show reduced MIC because of synergistic effect.

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Hospital and Research Centre, Pimpri, Pune
Department of Microbiology
NABL accredited, ISO 15189:2012

= 1291396
= 323806024
name = ANITA
name = SHARMA
= 49
= f
gnosis = POSTCOVID LUNG FIBROSIS

Location = CVTS ICU
HoD/HoU = DR RAHUL
Department = CVTS
Specimen number = U-4739
Specimen date = 26-Jun-2023
Specimen type = Urine, catheter

ST DONE CULTURE/SUSCEPTIBILITY
ganism = Acinetobacter calcoaceticus-baumannii complex

Amikacin	R 64 mcg/ml	Cefepime	R 32 mcg/ml
Cefoperazone/Sulbactam	I 32 mcg/ml	Ceftazidime	R 64 mcg/ml
Ciprofloxacin	R 4 mcg/ml	Colistin	I 0.5 mcg/ml
Gentamicin	R 16 mcg/ml	Imipenem	R 16 mcg/ml
Meropenem	R 16 mcg/ml	Minocycline	S 2 mcg/ml
Piperacillin/Tazobactam	R 128 mcg/ml	Trimethoprim/Sulfamethoxazole	R 320 mcg/ml

Colony forming unit >10^5/mL
Carbapenemase Positive
Comment MBL PRODUCER

R = Resistant I = Intermediate S = Susceptible

COPY FOR INTERNAL USE ONLY

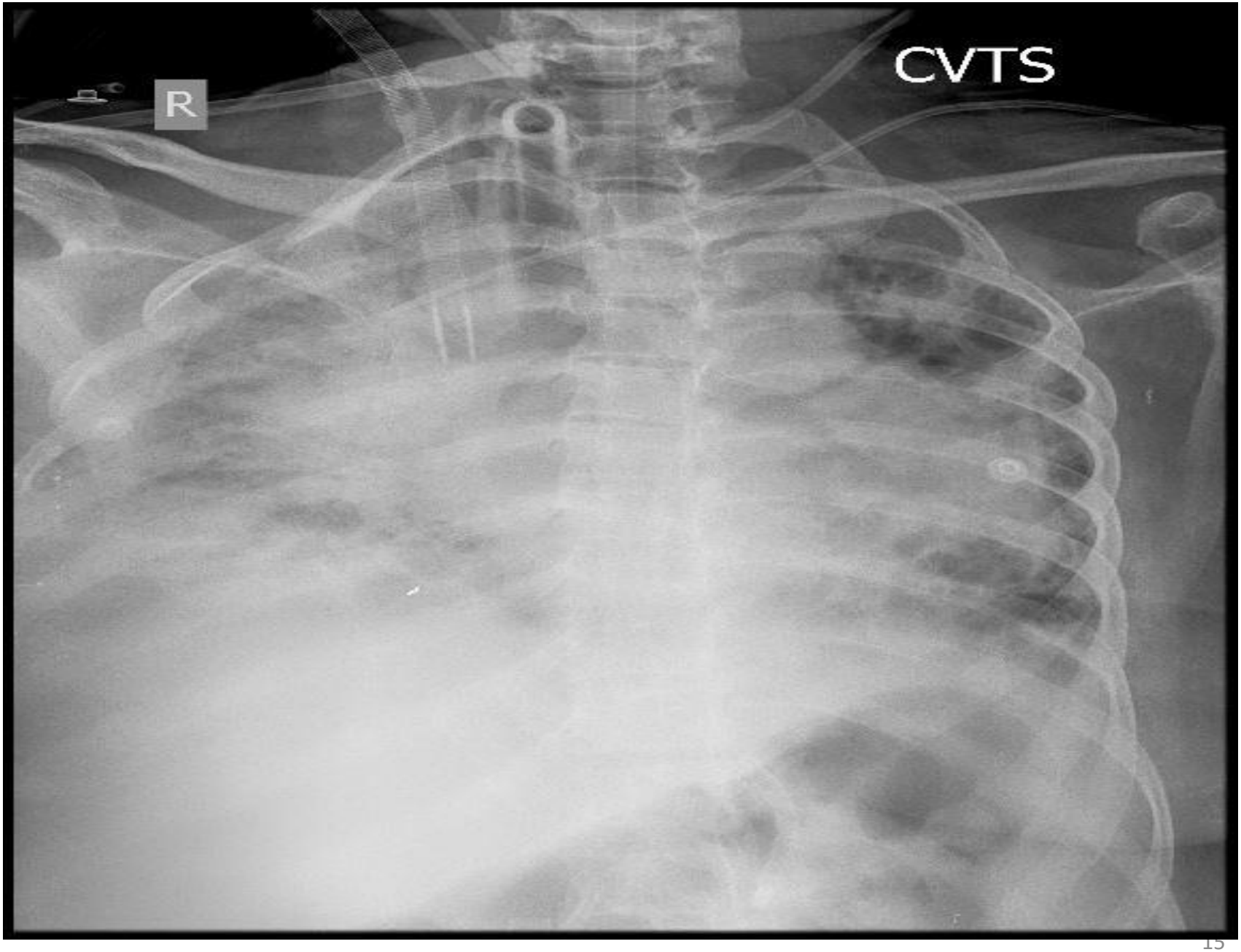
(Sign. of Microbiologist)
Dr. Shahzad Mirza
Associate Professor, HICO
Dept. of Microbiology
DYPMC, Pimpri, Pune- 18.

- Acinetobacter baumannii complex is intrinsically resistant to Ampicillin, Amoxicillin, Amoxicillin + Clavulanic acid, Ertapenem, Aztreonam, Trimethoprim, Chloramphenicol.

- Pt had vaginal discharge. High vaginal swab sent for c/s(negative). Metronidazole added.
- Pt had 4 episodes of loose stools&elevated LFT's – Sepsis induced. Minocycline and voriconazole stopped.
- Pt had thrombocytopenia- 1 SDP transfused.
- Pt had VPC's- hypokalemia and hypomagnesemia corrected.
- Circuit along with oxygenator changed after 2 weeks.


BLOOD IN


PHILIPS
Efficia CM12
ECG III
1.0mV
Pace Detect Off
Filtered
HR bpm
150
50
84
PVC 24
IBP1(ART)
120 mmHg
50 mmHg
ART mmHg
Sys
160
82
113/65
(82)
SpO2
SpO2 %
100
84
92
Perf 4.0
IBP2(CVP)
30 mmHg
CVP mmHg
17
0
(17)
CO2
0 mmHg
50 mmHg
CO2 Standby
CO2 Standby
0 mmHg
NBP mmHg
Sys
160
90
Off
T1 °C
39.0
36.0
T2 °C
39.0
36.0
35.9
Resp Disabled
Replace Battery Immediately
Bed2
Adult - ID Unknown
01/23/
09:5


CVTS
R

MEDICATIONS

MEROPENEM

TEICOPLANIN

MINOCYCLINE

POLYMYXIN B

FLUCONAZOLE

VORICONAZOLE

METRONIDAZOLE

RIFAXIMIN

PANTOPRAZOLE

GLUTATHIONE

URSODEOXYCHOLIC ACID

OSELTAMIVIR

TOBRAMYCIN NEB

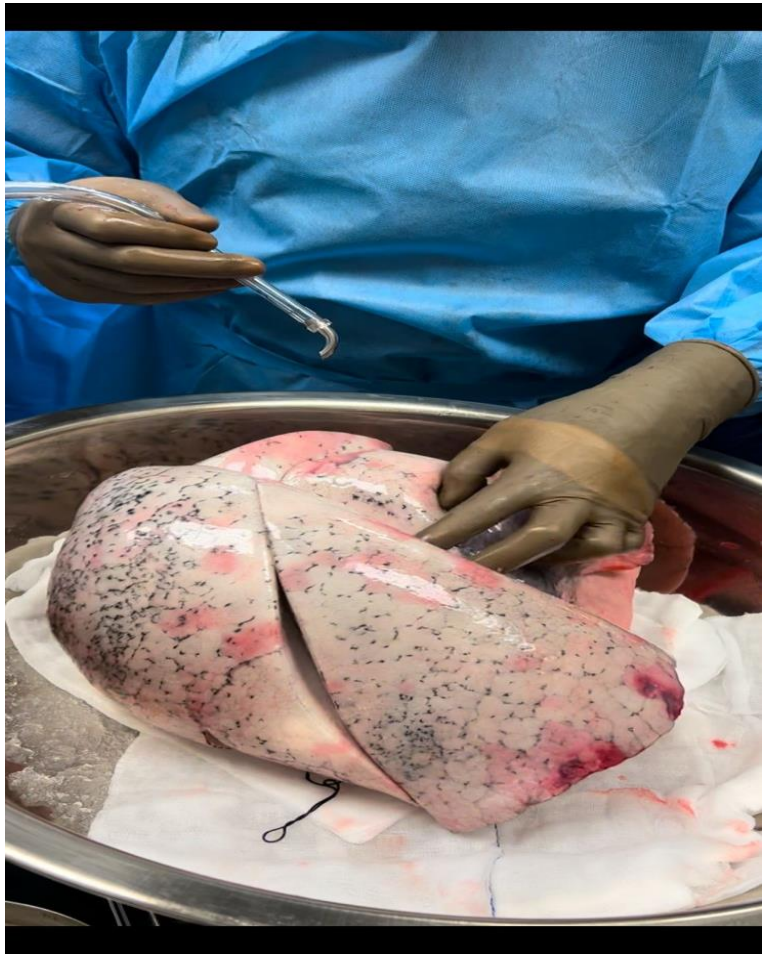
LACTOFERRIN+BACILLUS CLAUSII CAPSULES

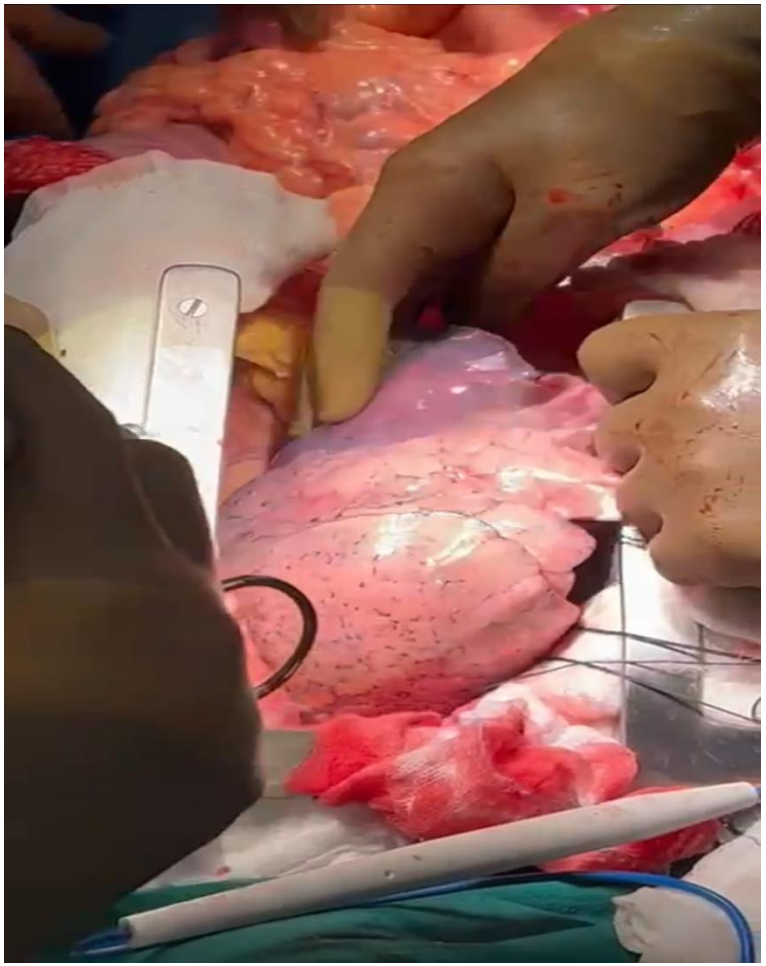
CEFTAZIDIME+AVIBACTAM

AZTREONAM

DAYS ON ECMO:20

B/L LUNG TRANSPLANTATION DONE





- Pt shifted from OT on minimal inotropic support (norad,adr) ,NAC infusion,Frusemide infusion and NO (24 ppm)
- Gradually inotropic support tapered off
- Nitric oxide slowly tapered off and tab.SILDENAFIL added to combat PAH
- Pt thoracic cavity was kept open and closed on third day.
- Underwent post transplant rehabiltation intially in icu and her ventilatory support was weaned.

- Later oxygen support was also tapered and stopped and was on intermittent Bipap support as per protocol

- Underwent regular physiotherapy during the stay

- Regular bronchoscopies were done for therapeutic toileting and BAL sample sent for R/M and C/S.

- Antibiotics and anti-infective prophylaxis and immunosuppressants managed as per standard post transplant protocol


SONY

IMMUNOSUPRESSANTS

- Intravenous Immunoglobulins
- Inj.MPS
- T.Tacrolimus
- T.Mycophenolate mofetil
- T.Wysolone

➢ Serum tacrolimus levels are monitored every alternate day and dose adjusted accordingly

ANTI-BIOTICS

- CEFTAZIDIME+ AVIBACTAM
- AZTREONAM
- MEROPENEM
- TEICOPLANIN
- PIPERACILLIN+TAZOBACTAM
- CEFUROXIME

ANTI-INFECTIVE PROPHYLAXIS

- T.TRIMETHOPRIM/SULFAMETHOXAZOLE
- T.VALGANCYCLOVIR
- T.VORICONAZOLE
- MUPIROCIN OINTMENT

CARDIAC DRUGS

- ECOSPIRIN
- APIXABAN
- FRUSEMIDE
- ACETAZOLAMIDE
- IVABRADINE

GI DRUGS

- ESMOPRAZOLE
- ITOPRIDE
- DOMPERIDONE
- PANTOPRAZOLE
- LACTULOSE SYRUP

NUTRITION

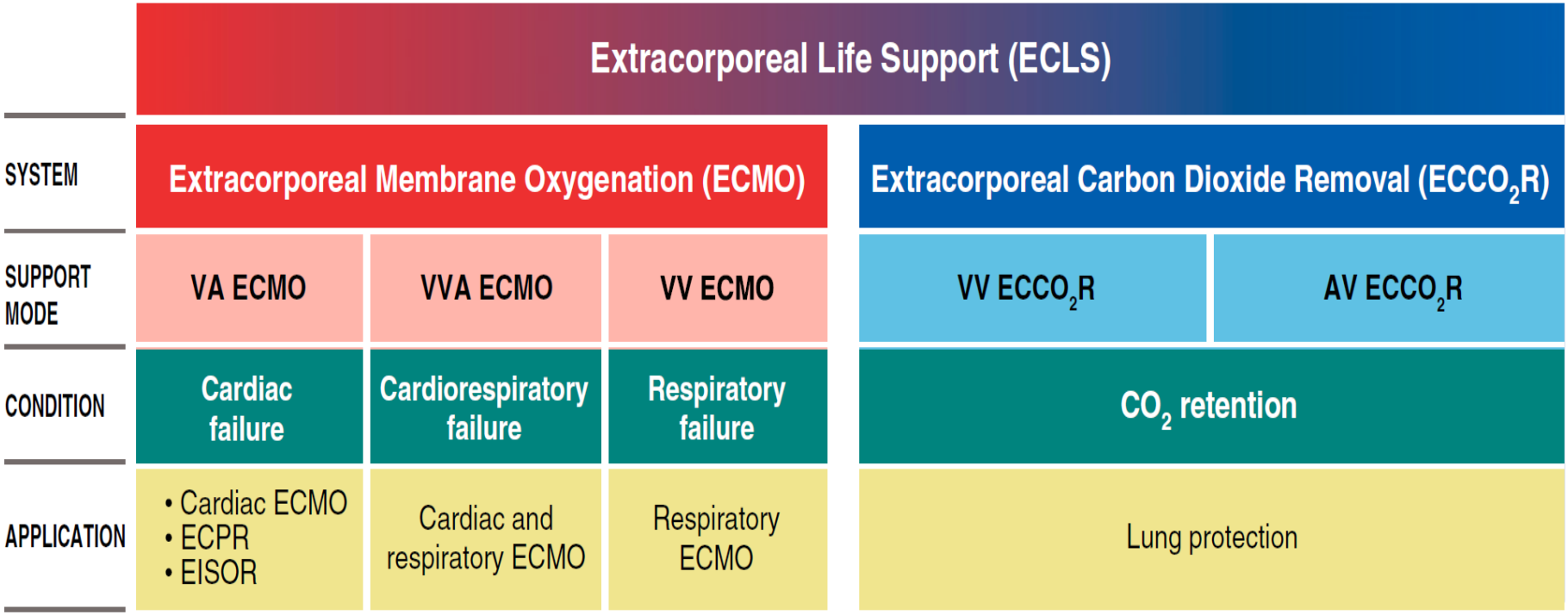
- Polymeric enteral high protein diet is recommended
- MCT are also supplemented
- Vitamins and trace elements are also supplemented
- Electrolyte correction done accordingly.

PSYCHOLOGICAL SUPPORT

- Psychological and emotional support is must
- Anti-depressants were given(T.QUETIAPINE)

TEAM WORK

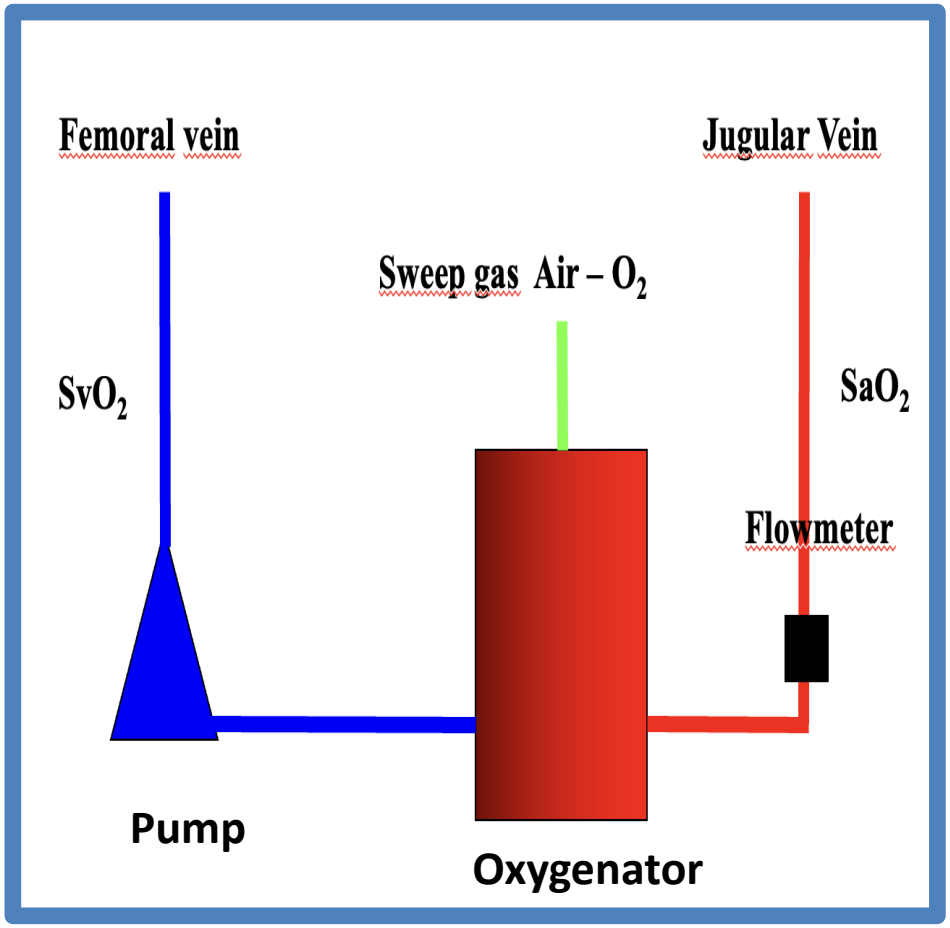
ECLS systems Nomenclature

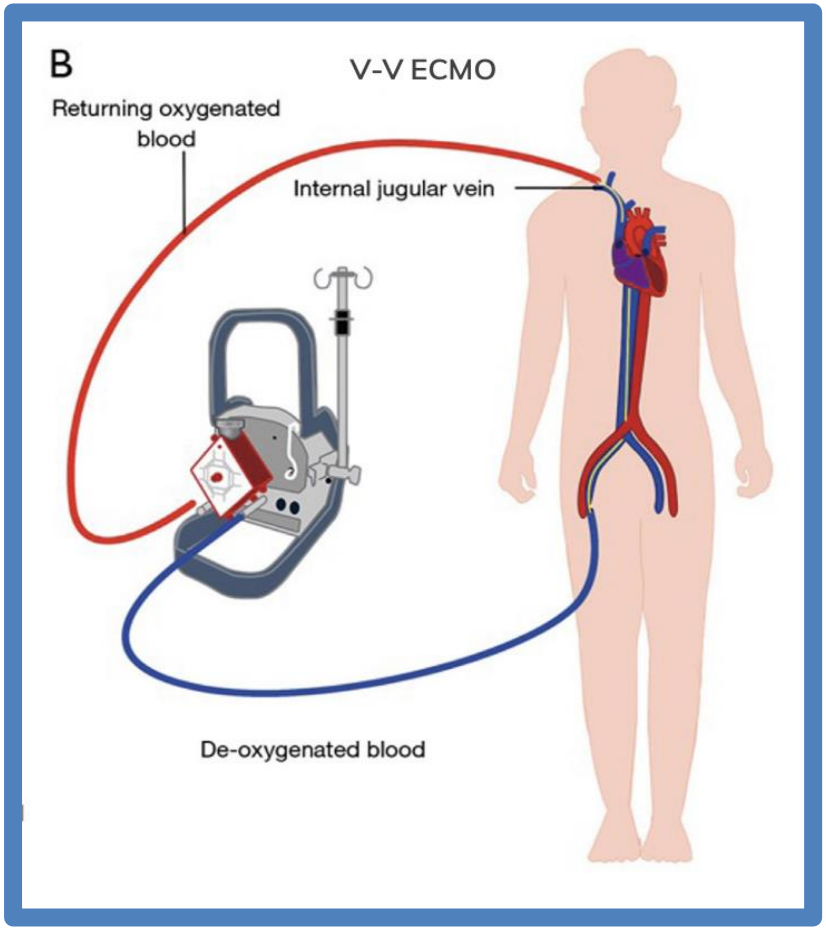


Am J Respir Crit Care Med Vol 198, Iss 4, pp 447–451, Aug 15, 2018

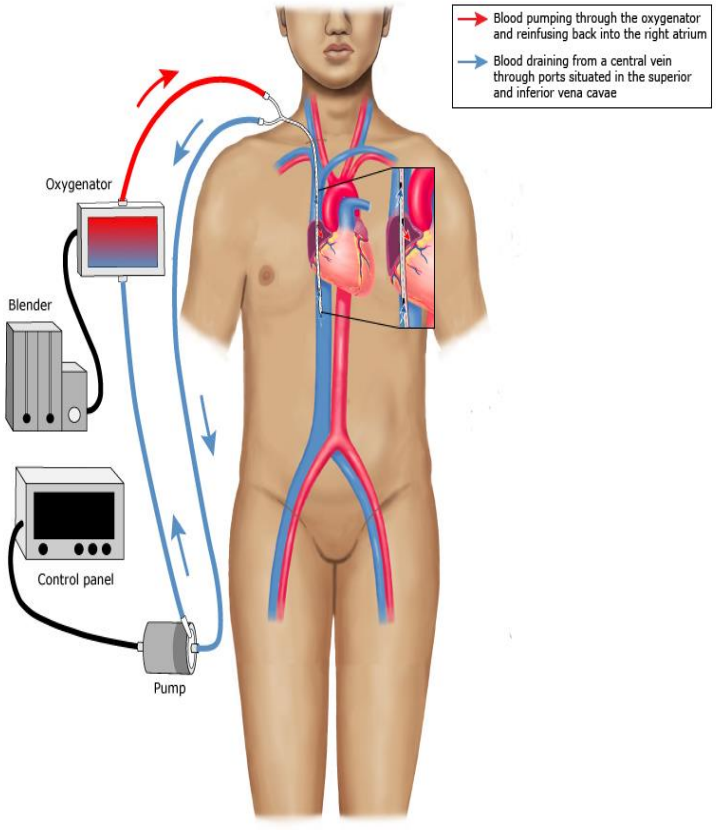
VV ECMO

VV CIRCUIT

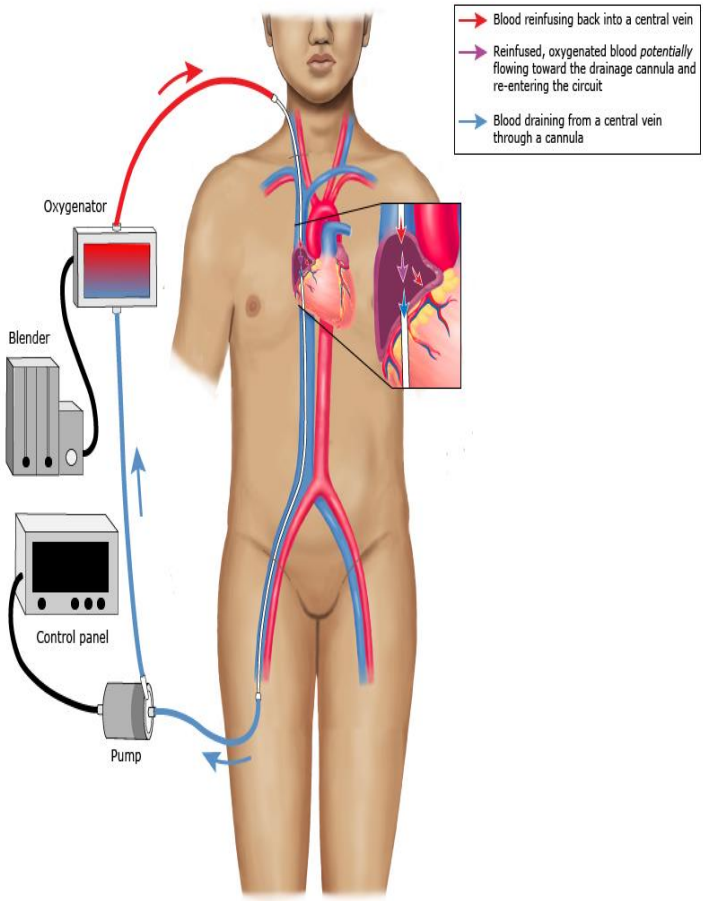

Femoral vein
Jugular Vein
Sweep gas Air – O_2
SvO_2
SaO_2
Flowmeter
Pump
Oxygenator


B
V-V ECMO
Returning oxygenated blood
Internal jugular vein
De-oxygenated blood

Single site venovenous extracorporeal membrane oxygenation



Two-site venovenous extracorporeal membrane oxygenation



VV ECMO PHYSIOLOGY

- CO2 clearance is relatively easy
- O2 delivery is the key and can be troublesome
- Goal diversion of venous blood is 75% or greater (goal 50 cc/kg/min in adults)
- Needs large drainage cannula
- If lungs nonfunctional sats will be in the 80s

Determinants of Oxygenation on ECMO

Oxygenation	CO_2 removal
Blood flow rate (L/minute; ie, blood flow entering membrane from the pump)	**Sweep gas flow rate (L/minute; ie, fresh gas [mix of oxygen and air] flowing into the membrane)**
Blood flow:cardiac output ratio*	Blood flow rate (L/minute) (ie, blood flow entering membrane from the pump) CO_2 removal will be more dependent on blood flow rate at lower flow rates (eg, <3 L/minute)
Diffusion properties of the membrane¶ Membrane lung surface area and design	Diffusion properties of the membrane¶ Membrane lung surface area and design
Native lung gas exchange$^{\Delta}$	Native lung gas exchange$^{\Delta}$
Degree of recirculation$^{\diamond}$	Partial pressure of CO_2 entering the membrane lung
Dual circulation/competitive flow phenomenon§	

Indications of VV-ECMO

- RESPIRATORY FAILURE (not manageable by conventional therapy)
- As a bridge for Lung Transplantation
- Primary graft dysfunction after Lung Transplant
- ECMO is also used for neonatal and pediatric respiratory support – HMD
  - Meconium aspiration syndrome
  - Congenital diaphragmatic hernia

Murray Score

Murray Score = Average Score of all 4 parameters					
Parameter/ Score	0	1	2	3	4
PaO2/FiO2 (on 100% FiO2)	< 300 mmHg (> 40kPa)	225-299 (30-40)	175-224 (23-30)	100-174 (13-23)	< 100 (< 13)
CXR	Normal	1 point per quadrant infiltrated			
PEEP	≤ 5	6-8	9-11	12-24	≥ 15
Compliance ml/cm H2O)	≥ 80	60-79	40-59	20-39	≤ 19

EOLIA CRITERIA

- One of the 3 following disease severity criteria
  - PaO_2:FIO_2 <50 mmHg for >3 hours
    - Despite potential use of inhaled NO, recruitment maneuvers
    - Prone position, HFO ventilation, almitrine infusion
  - PaO_2:FIO_2 <80 mmHg for >6 hours
    - Despite similar criteria as above
  - pH <7.25 with $PaCO_2$ ≥60 mmHg for >6 hours
    - Resulting from MV settings to keep Pplat ≤32 cm H_2O
    - Despite respiratory rate increased to 35/minute

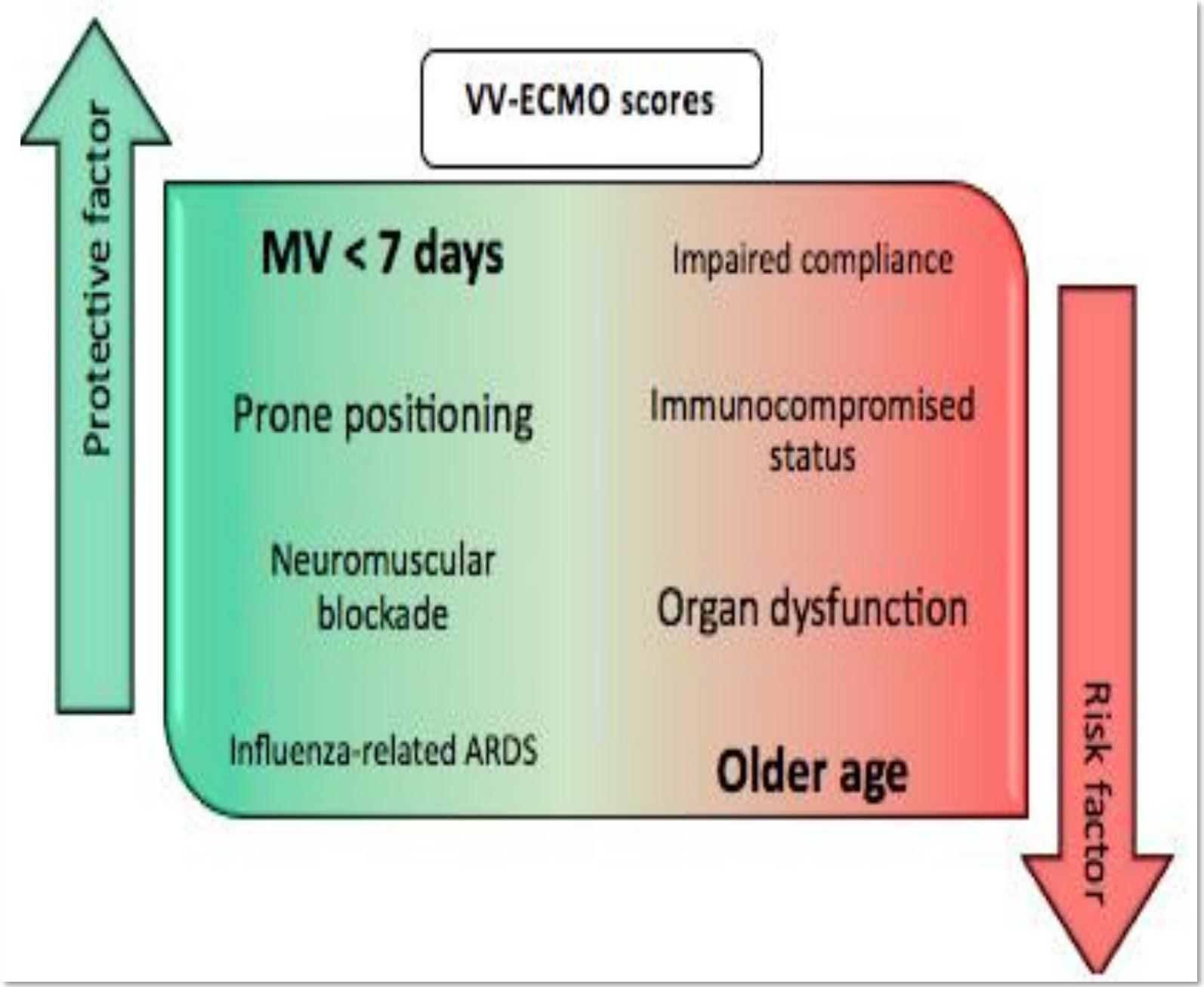
Contraindications

Absolute

Severe irreversible noncardiac organ failure or condition limiting survival (eg, severe anoxic brain injury, end-stage malignancy)
No transition to a well-defined end point (eg, recovery, transplantation, assist device; "a bridge to nowhere")
Severe aortic insufficiency*
Aortic dissection*

Relative Contra Indications

Severe coagulopathy or contraindication to anticoagulation
Limited vascular access*
Severe PAD*
Advanced age[¶]
Morbid obesity[¶]
Severe immunocompromised status
Advanced comorbid conditions that would otherwise limit recovery
Prolonged duration of mechanical ventilation (eg, ≥7 days)[Δ]
Lack of resources to support ECMO-associated care


VV-ECMO scores
Protective factor
MV < 7 days
Prone positioning
Neuromuscular blockade
Influenza-related ARDS
Impaired compliance
Immunocompromised status
Organ dysfunction
Older age
Risk factor

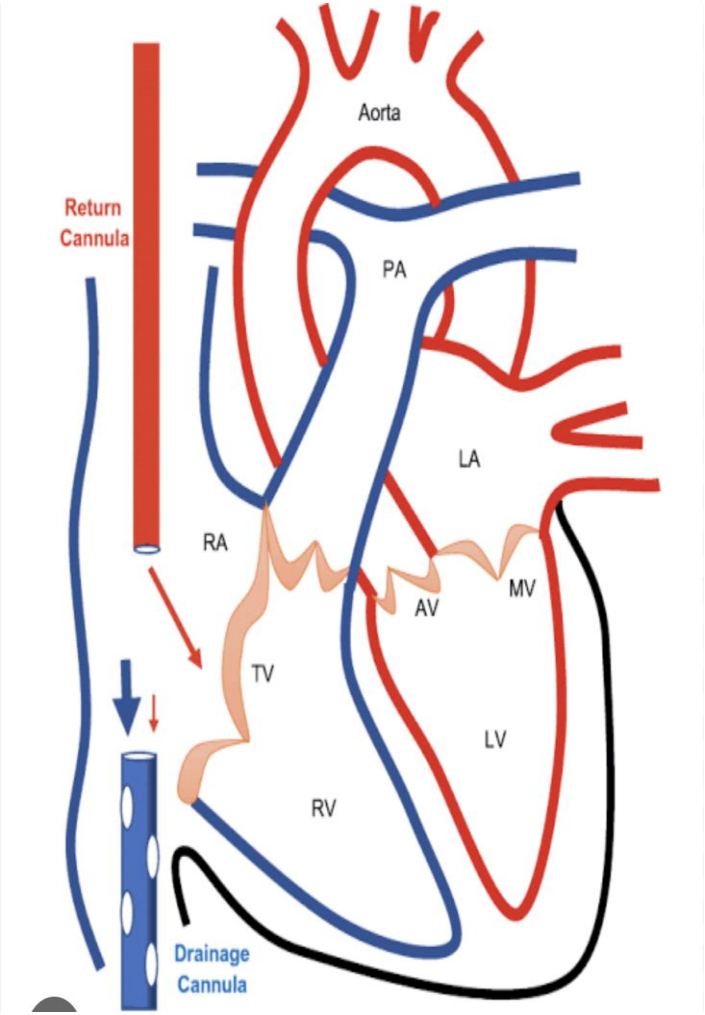
Complications - Mechanical

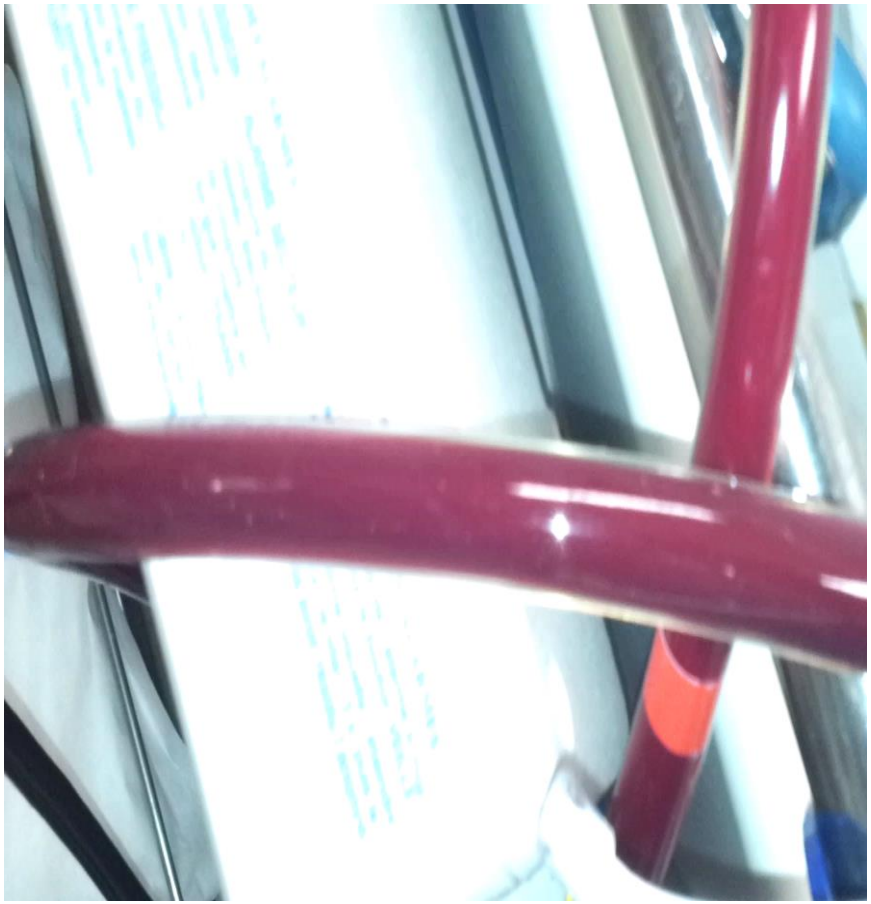
- Pump
- Membrane failure
- Air embolism
- Catheter related vascular or cardiac perforation
- Circuit clotting & Haemolysis

Complications

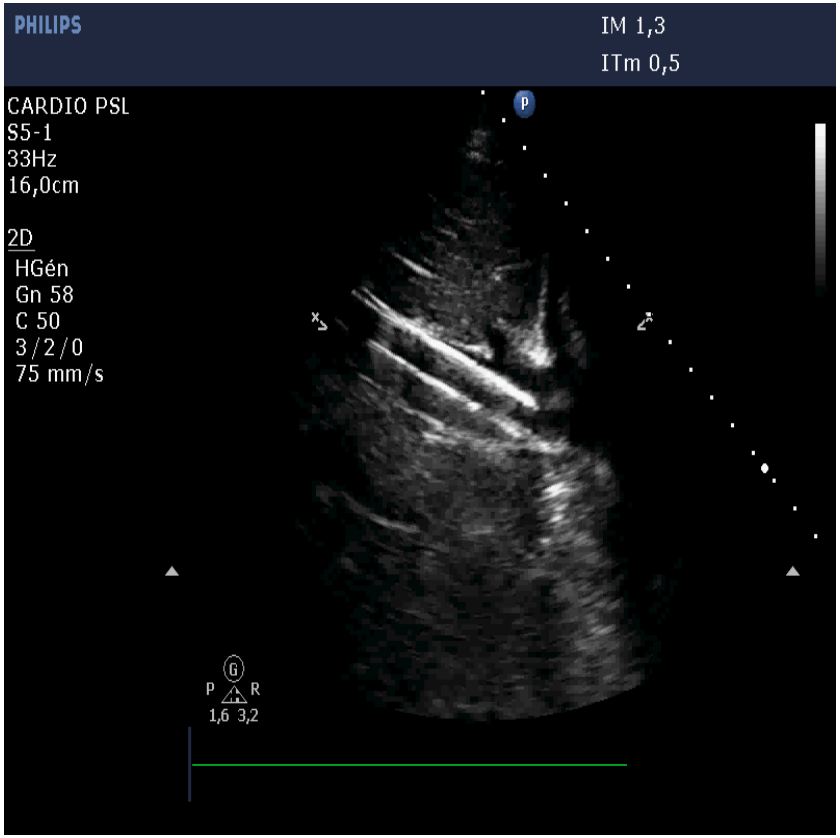
- Bleeding
  - Cerebral hemorrhage or stroke
  - Surgical site hemorrhage
- Ischemia & end organ multi-organ failure
  - Stroke & Limb Ischemia
  - Renal failure
  - Lung injury or failure of lung recovery
- Skin ulcerations
- Infection & systemic inflammatory syndrome
- Exposure to transfusions and other blood products
- Pain, delirium, fear, awareness if awake & NMB

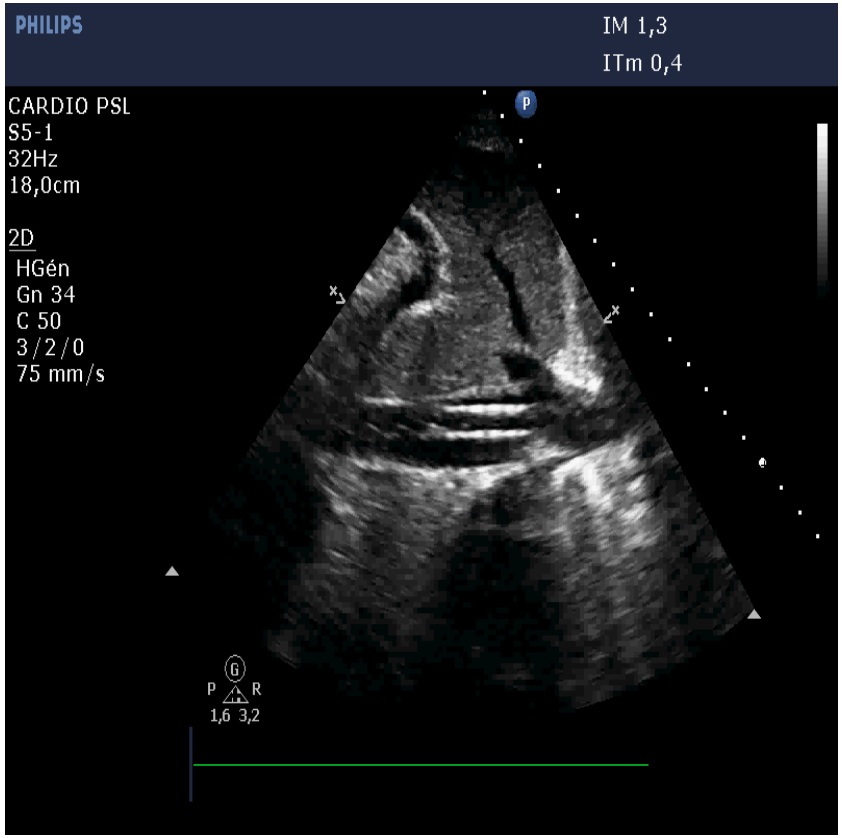
Recirculation





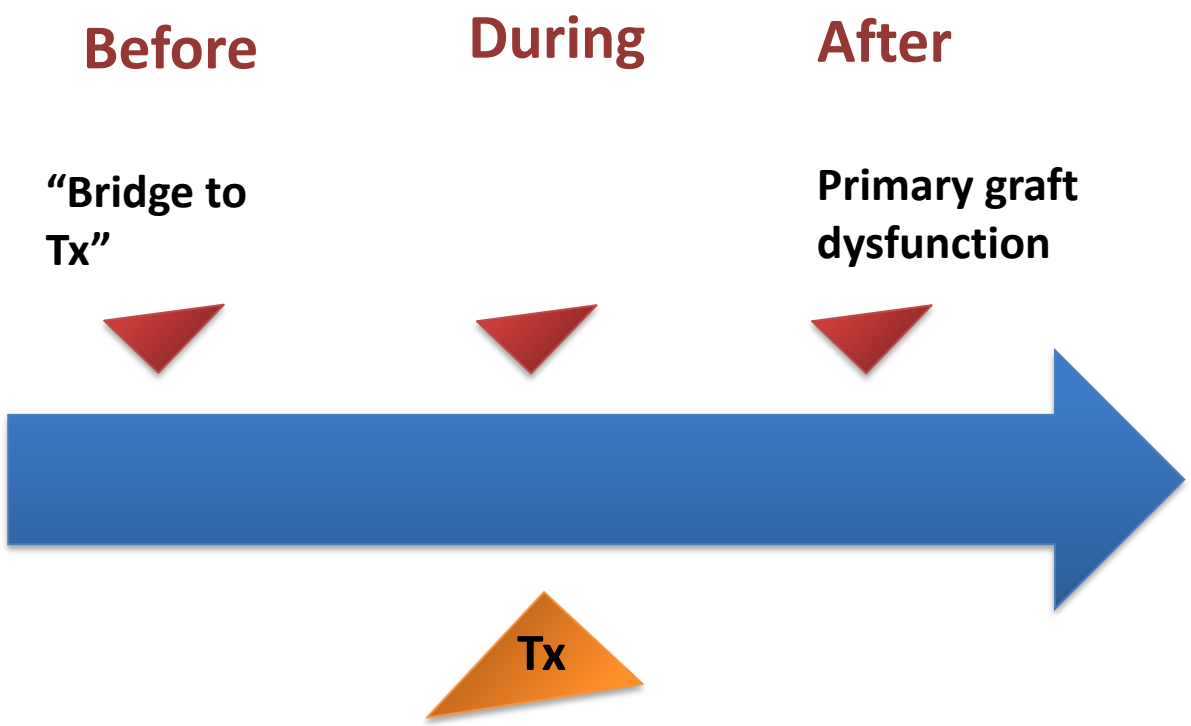
USG to verify position of the cannulas



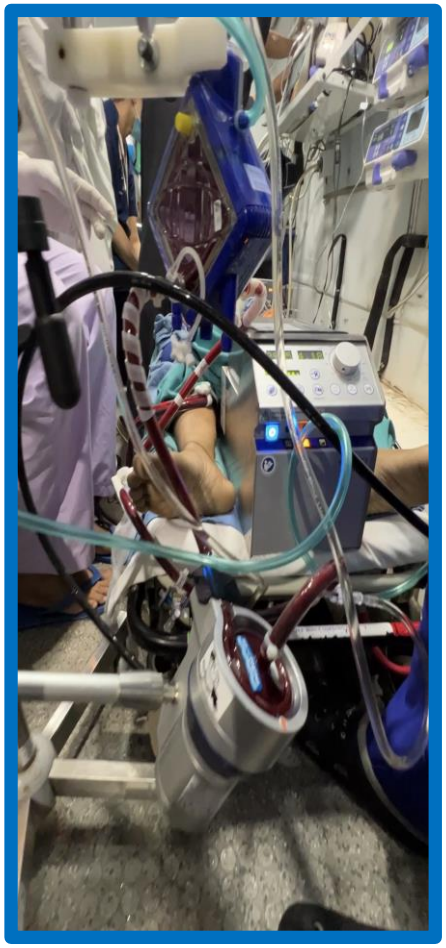


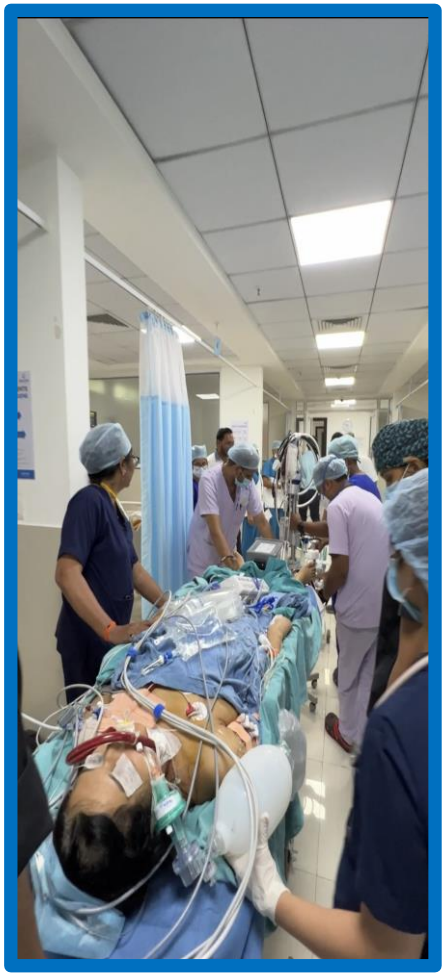
Tip of the venous cannula at the inferior vena cava- right atrium junction

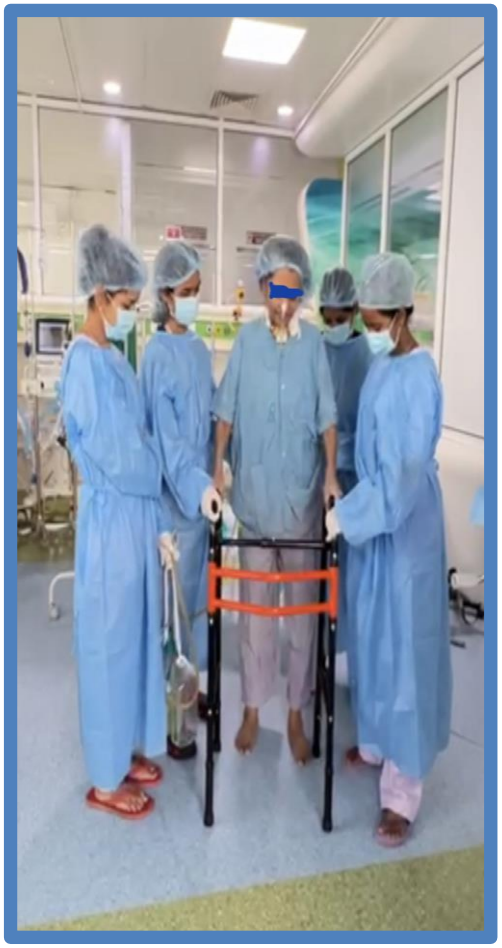
ECMO and Lung Tx

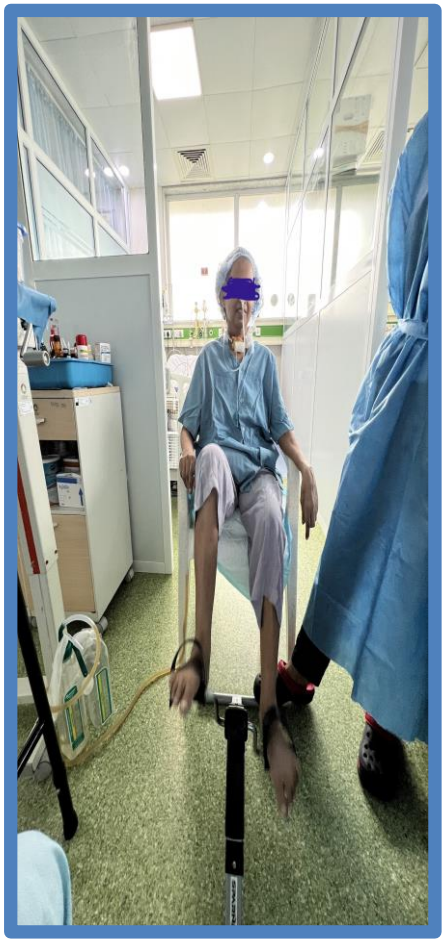


VV ECMO as a BRIDGE to Lung transplant – Our Experience









THANK YOU for LISTENING TO MY PRESENTATION