Fondazione - Policlinico *"S. Matteo"*
Dipartimento di Cardiochirurgia
Università degli Studi di Pavia
ITALIA

ECMO: MANAGEMENT AND COMPLICATIONS

Antonella Degani

Bergamo 15-16 Dicembre 2007

Corso ECMO SICCH

ECMO

We need ECMO!

ECMO CIRCUIT

- Minimize contact areas
- Avoid stagnant flow areas
- Measure:
  - Venous line pressure – before pump (40–60 mmHg)
  - Pressure before Oxygenator (press. drop 40–100 mmHg)
  - Pressure after Oxygenator (160–200 mmHg)

ECMO SUPPORT

- ABGs are obtained once connected to ECMO
- Repeated after adjustments in FiO_2 and gas sweep
- $PaCO_2$ achieved 40-45 mmHg and pO_2 > 150 mmHg
- ACT150 – 180 sec, checked every 20 min, then every hour
- PT , PTT , INR

ECMO CIRCUIT MANAGEMENT

- Safety checks, alarm control checked every 2h
- Pre/Post membrane pressure
- Emogasanalysis if possibile on line
- Check oxygen venous saturation : $sVO_2 > 70\%$
- Patient temperature is tightly controlled – when above 36 degrees heater cooler is put on standby

ECMO MANAGEMENT

- ABG oxygenator every 4 h
- ABG to patient every 2 hours
- O_2 persist low at high FiO_2, and Hct is > 35%, flow is increased and an arterial ECMO line ABG is performed
- pCO_2 changes gas sweep is adjusted
- Check diuresis: hemofylter (100-150 ml /h), dyalisis

BLENDER

Check the gas pipe connection, when you are out of the operating room

PROS and CONS ROTA FLOW

- No external drive heating
- Never change centrifugal pump
- No clots

- The battery life is measured in volt not in percentage
- The pump says “sig”…: Add ultrasonic cream

COMPLICATIONS

- Quadrox Oxygenator: None
- Affinity Oxygenator: plasma leakeage
- Maxima Oxygenator: plasma leakeage
- Sci Med : bleeding of the patient

QUESTIONS

If you reach the maximum duration time of the oxygenator

- Should you change it immediately?
- Should you wait the failure of the oxygenator?
- Should you consider other parameters: platlets loss, infiammatory response….?

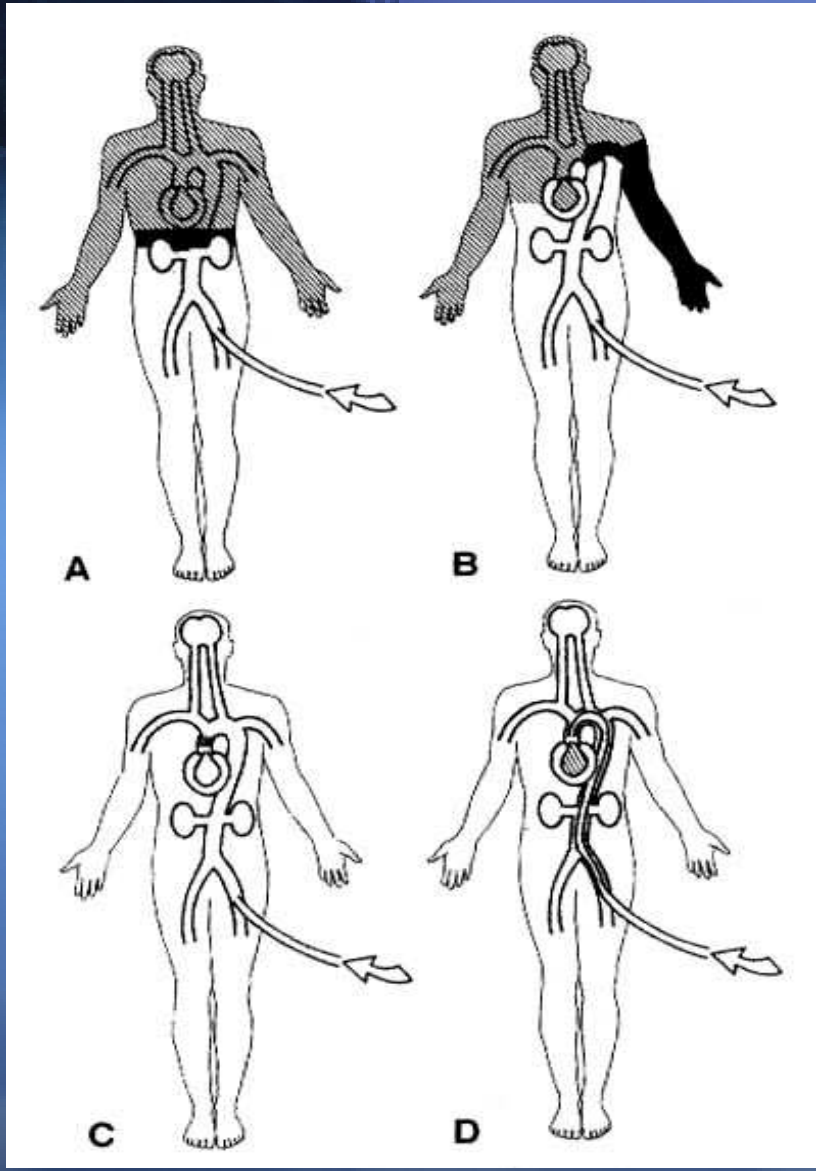
DIFFERENCES BETWEEN V-A AND V-V ECMO

Hemodynamics	V-A	V-V
Systemic perfusion	Circuit flow and cardiac output	Cardiac output
Art. BP	Pulse is damped	Pulse is full
CVP	Accurate guide to volume status	Not helpful
PA Pressure	Decrease in proportion to ECC flow	Not affected by flow

DIFFERENCE BETWEEN V-A AND V-V ECMO

Gas exchange	V-A	V-V
Arterial oxygenation	Sat controlled by ECC flow	80-95% sat common for maximum flow
CO2 removal	Depends of gas sweep and surface area of membrane	Same as VA
Decrease ventilator setting	Rapidly	Slowly

DRAWING BLOOD

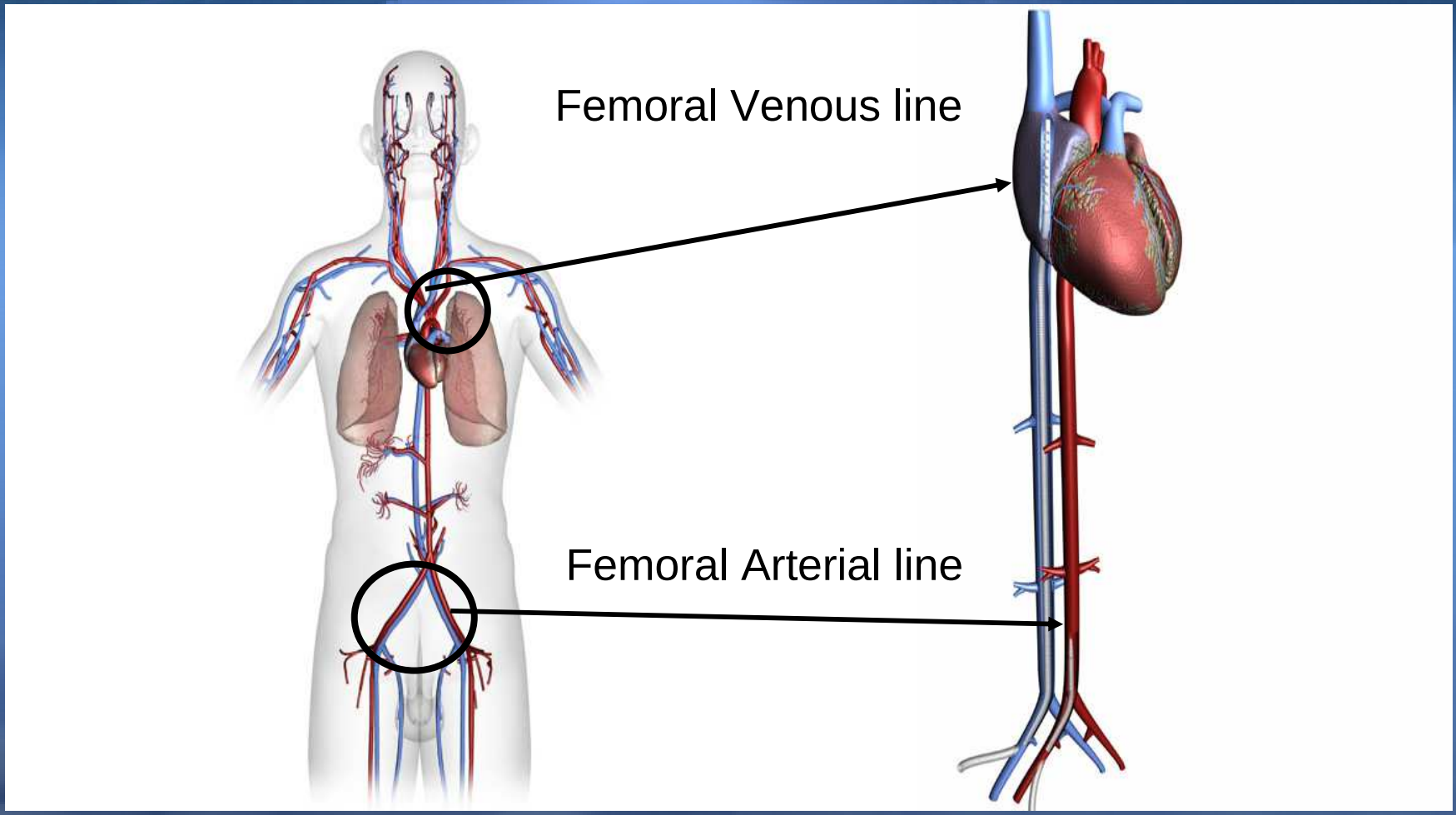


Hensley: “The practice of cardiac anesthesia”

Low flow (A) and moderate return flows (B) delivered to the femoral artery.

High return flows (C and D) to the femoral artery and the aortic root

ECMO
FEMORO-FEMORAL



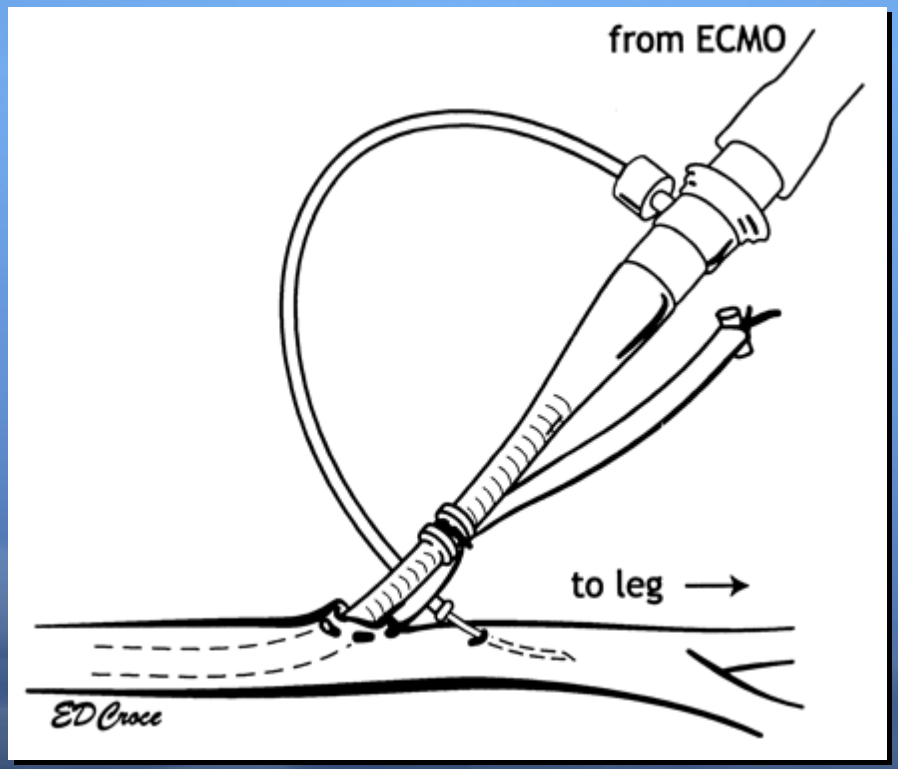
CANNULAE

- Heparin cannulae
- Percutaneos introduction (when possibile) with dilatator (diam 10F to 22F)
- Art. cann. size 17F/19F ,
- Vent. cann. size 19F/21F
- TEE

COMPLICATIONS

- Leg ischemia

7F/9F Catheter connected with luer of the arterial cannula

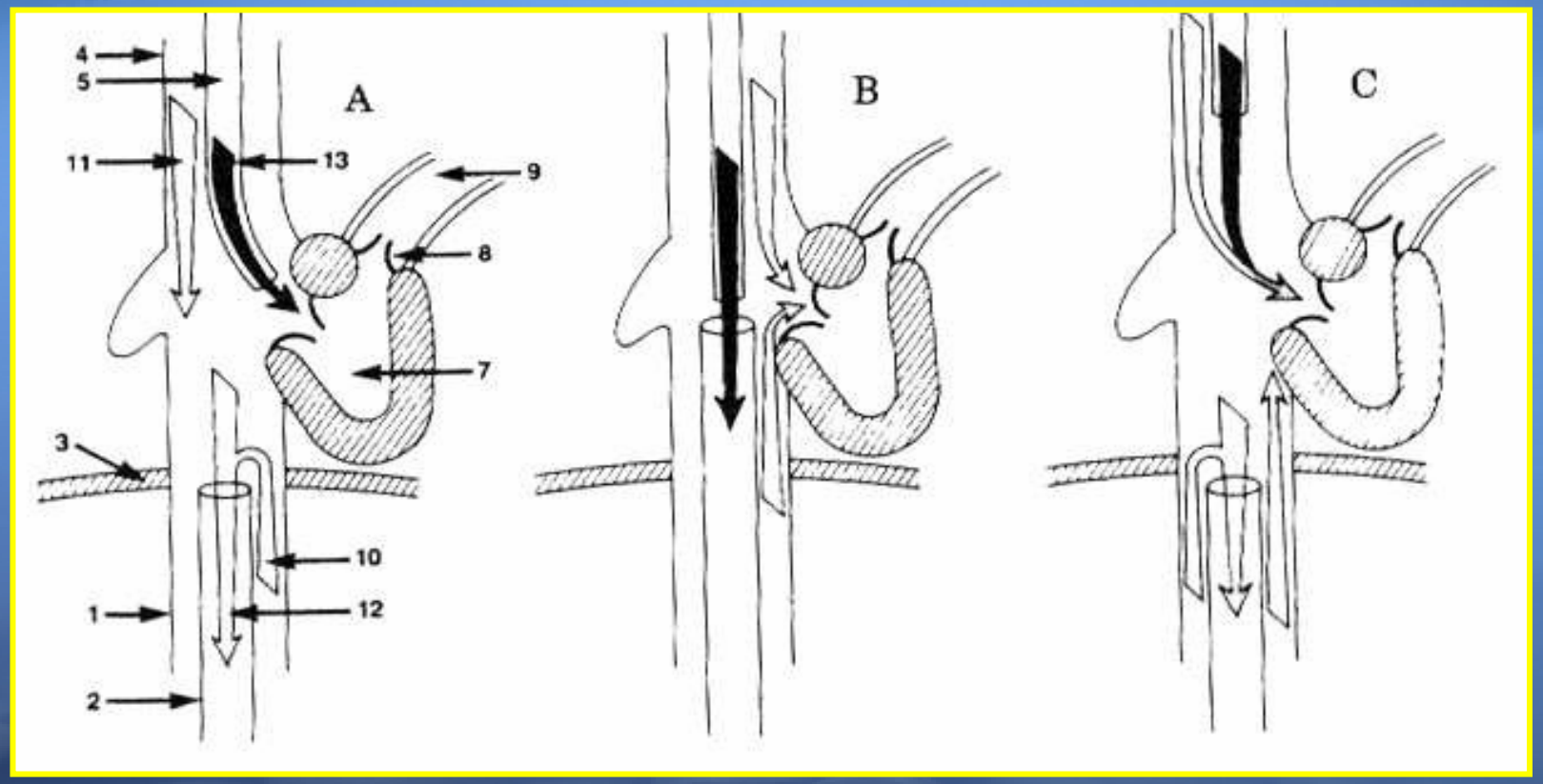


COMPLICATIONS

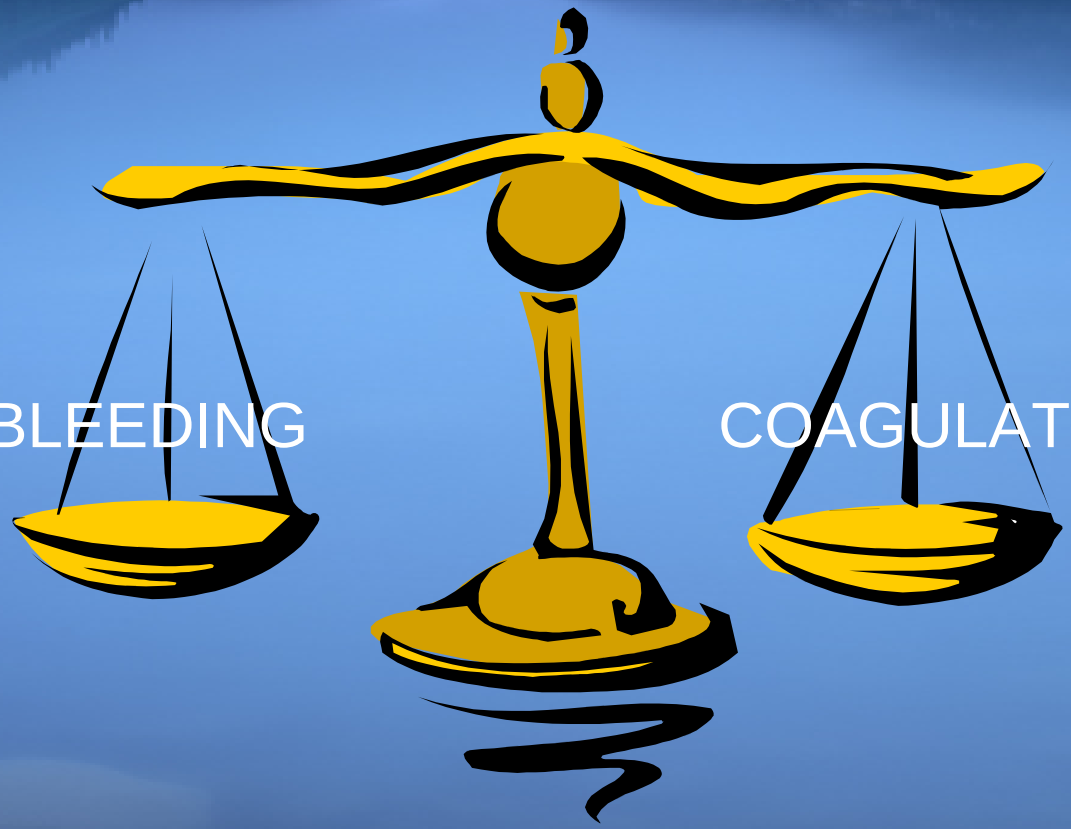
- Loss of venous return
  a) Increase the volume
  b) Flow overshoot
  c) Check Venous Cannula position
  d) Check circuit integrity, kink, clamp

COMPLICATIONS

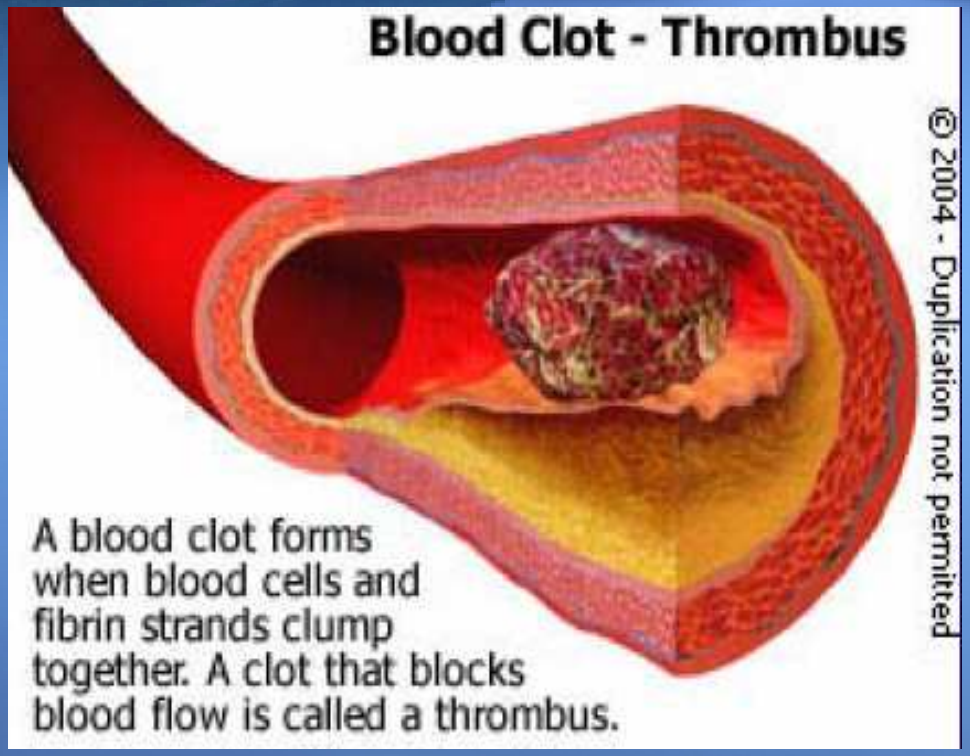
- Cannulae positioning in V-V ECMO



ANTICOAGULATION



THROMBOEMBOLISM



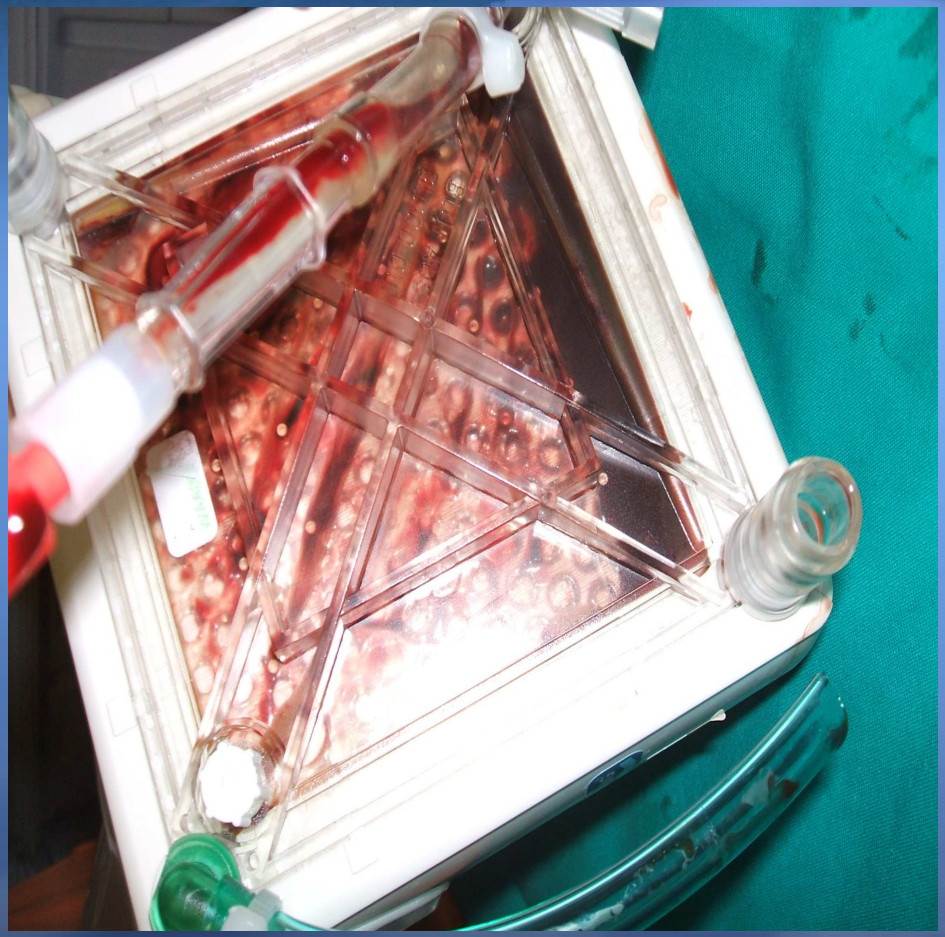
Visible thrombus in blood pump or cannula:

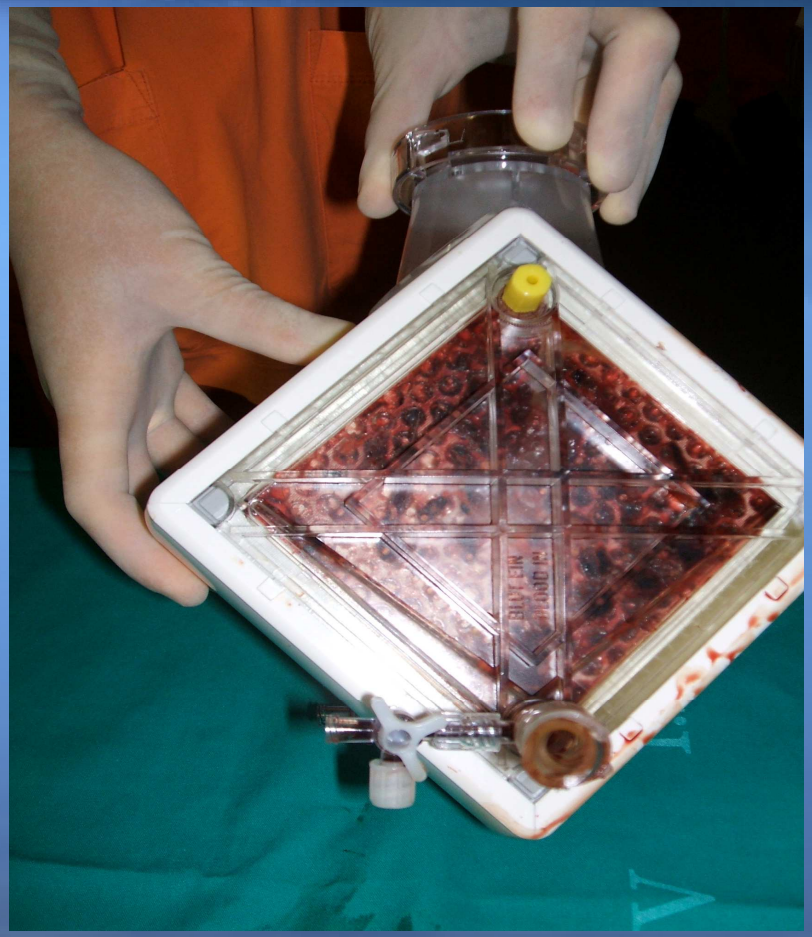
- Neurologic changes
- Seizures
- Hemiparesis
- Paralysis
- Hepatic or renal dysfunction

ANTICOAGULATION MONITORING

FLOW	ACT
Flow >2,5l/min	160-180 sec
Flow 2-2,5l/min	180-200 sec
Flow <2 l/min	>250 sec

CLOTTING OF OXYGENATOR





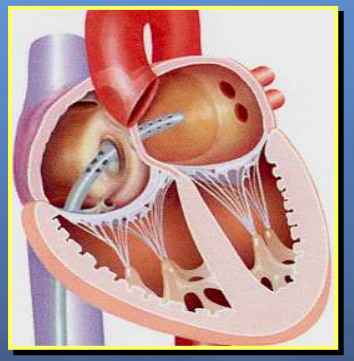
ANTICOAGULATION MONITORING

- Check every day circuit/oxy
- Flow > 2 L/min
- Continue infusion of heparin (15-30 U/kg/die)
- ATIII >80%
- TEG
- TEE

LEFT ATRIAL DRAINAGE

Left atrial drainage cannula 14F

Central ecmo



COMPLICATIONS

- Insufficient left atrial drainage :

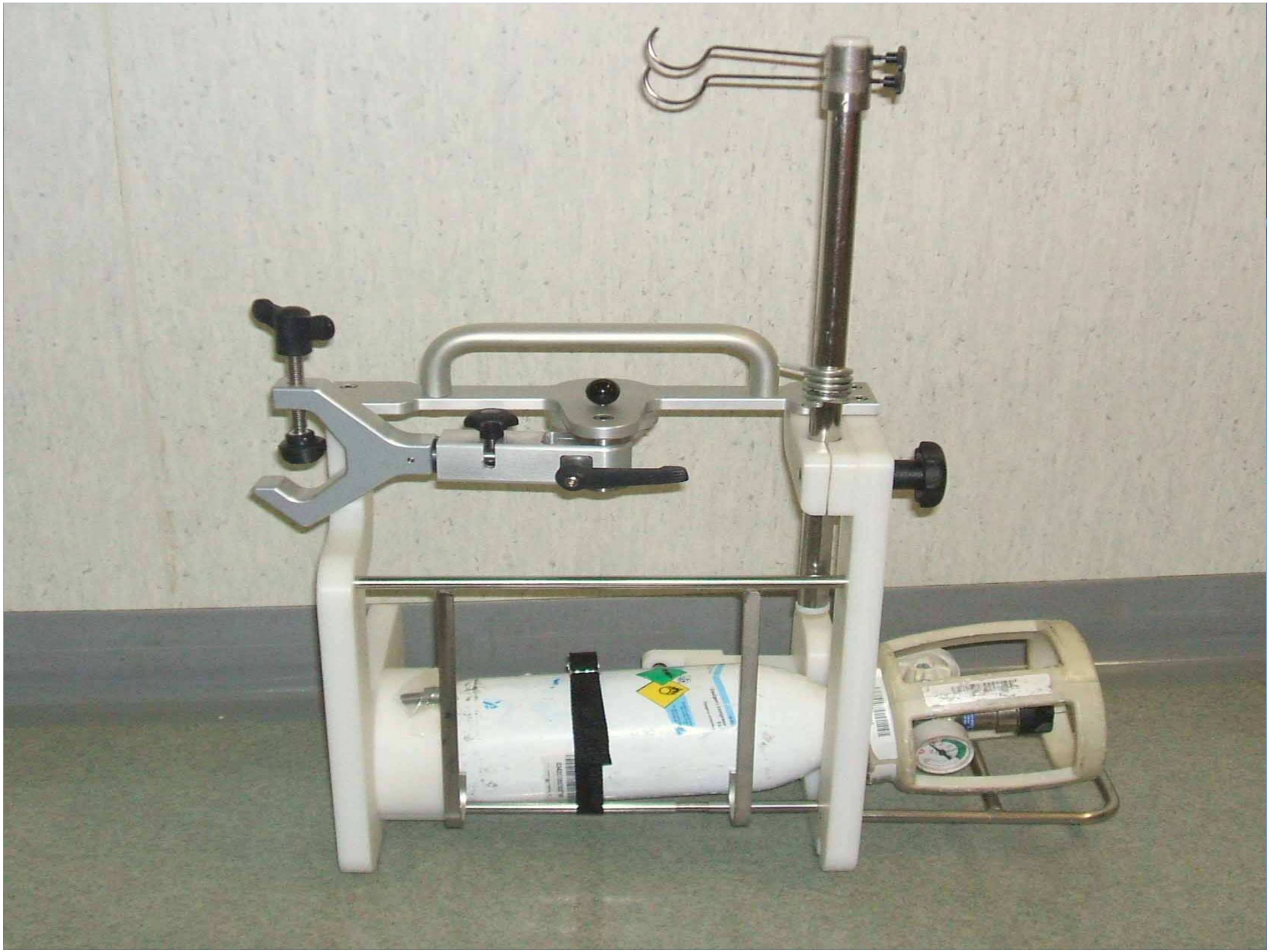
  Change the luer connection to ¼” connection

- Air into the left atrial drainge

  Pay attention to cannula position, close the chest

PUMP	WEIGHT	HANDINESS	SET UP	COST
Biomedicus	☹	☺	☺	☺
Rotaflow	☺	☺	☺	☺
Levitronix	☺☺	☺	☺	☹☹
Lifebridge	☺☺	☺☺	☺	☹☹


SET X
CANN. TOR.
RAGON



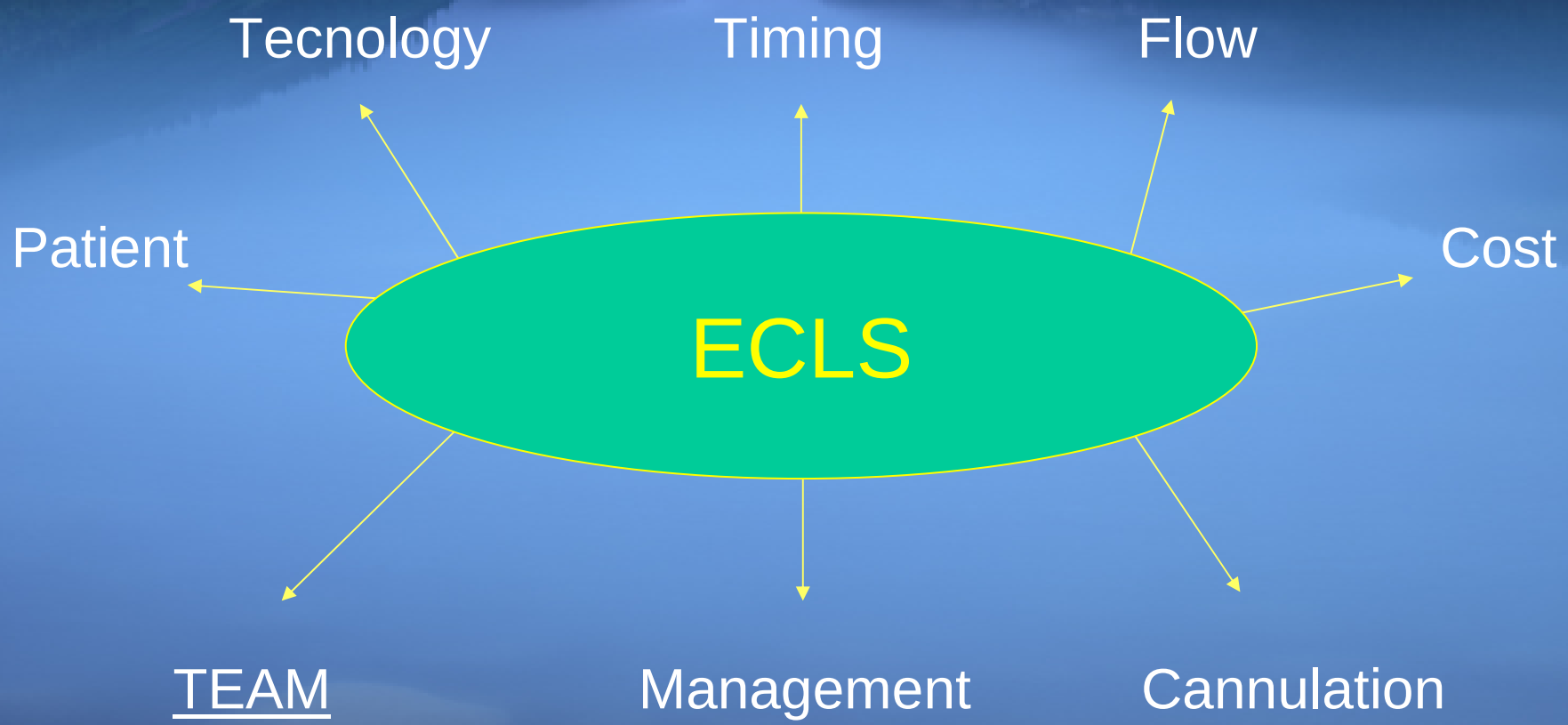
PAVIA EXPERIENCE

Assistance	Total	Average age	Average time	Total time
ECMO VENO-ARTERIOSO	161	55,99±13,67	3,69±2,27	594
ECMO VENO-VENOSO	14	49,29±7,61	11,07±6,66	155
PASSAGGIO VAD DX-ECMO	10	60,40±6,52	6,50±3,9	65
PASSAGGIO VAD SX-ECMO	2	60,50±16,50	3,00±1,00	6
VAD BIVENTRICOLARE	2	51,00±4,00	4,00±1,00	8
VAD DESTRO	24	58,13±10,24	4,92±2,65	118
VAD SINISTRO	3	55,67±11,78	2,33±1,78	7

PAVIA EXPERIENCE

Oxygenator	Total	Average Life	Oxy/ECMO change rate
Polimetilpentene	97	4,71 ±3,41	0,04
Polipropilene	116	4,13 ±2,57	0,89

CONCLUSIONS



Thank you…….