

Percutaneous Mechanical - Circulatory Support (pMCS)

Aims of pMCS:

- Resuscitate patients in cardiogenic shock
- Stabilizing measure: angiography and prompt revascularization/treatment of the underlying cause
- Reduce infarct size: unloading the LV and influencing cardiac remodeling

Indications:

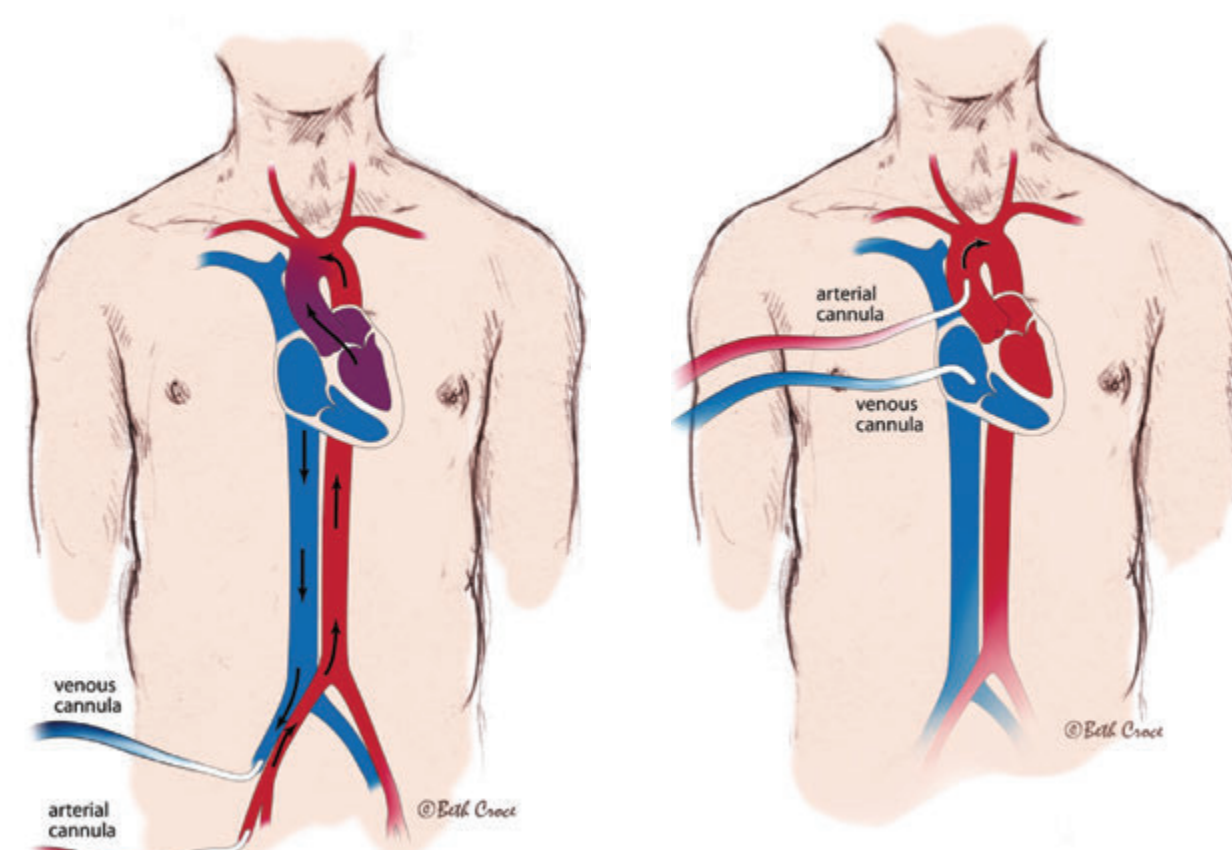
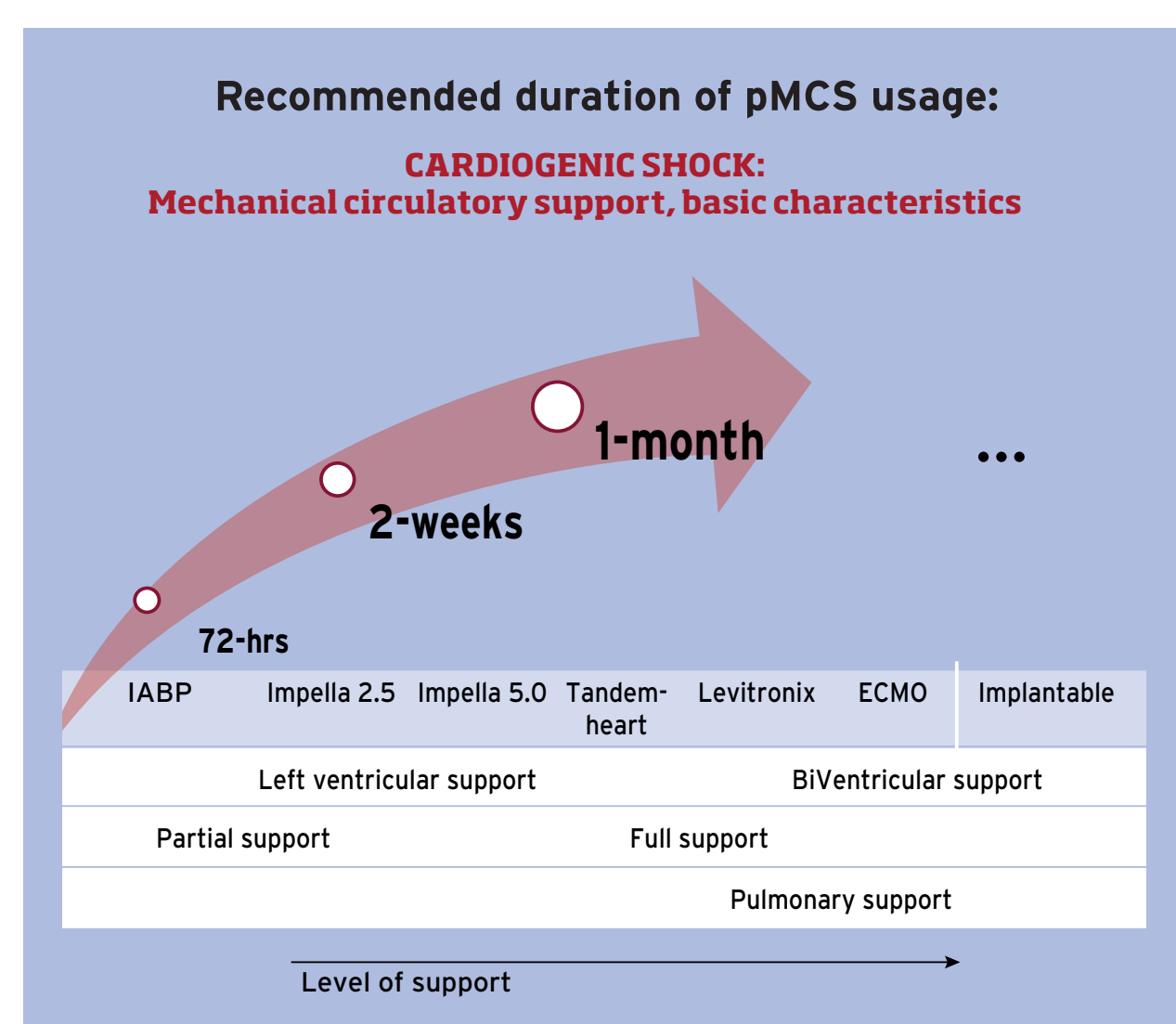
- Complications of STEMI/NSTE-ACS
- Severe heart failure
- Acute cardiac allograft failure
- Post-transplant RV failure
- Failure to wean from bypass after cardiac surgery
- Refractory arrhythmias
- Prophylactic use for high risk PCI
- High risk ablation of ventricular tachycardia
- High risk percutaneous valve interventions

Contraindications:

- All devices: Irreversible neurological disease, severe peripheral vascular diseases and contraindication to anticoagulation
- IABP: Moderate to severe aortic insufficiency, aortic dissection and abdominal aortic aneurysm
- Impella: LV thrombus, moderate to severe aortic stenosis, moderate to severe aortic insufficiency and mechanical aortic valve
- TandemHeart: Ventricular septal defect and moderate to severe aortic insufficiency

Complications:

- All devices: Bleeding, vascular injury, infection and neurologic injury
- IABP: Thrombocytopenia, thrombosis, obstruction of arterial flow and air embolism.
- Impella: Hemolysis, pump migration, aortic insufficiency, and cardiac tamponade.
- TandemHeart: Cannula migration, cardiac tamponade, thromboembolism and interatrial shunt development.
- VA ECMO: Oxygenator failure, upper body hypoxia, LV dilatation and peripheral ischemia.



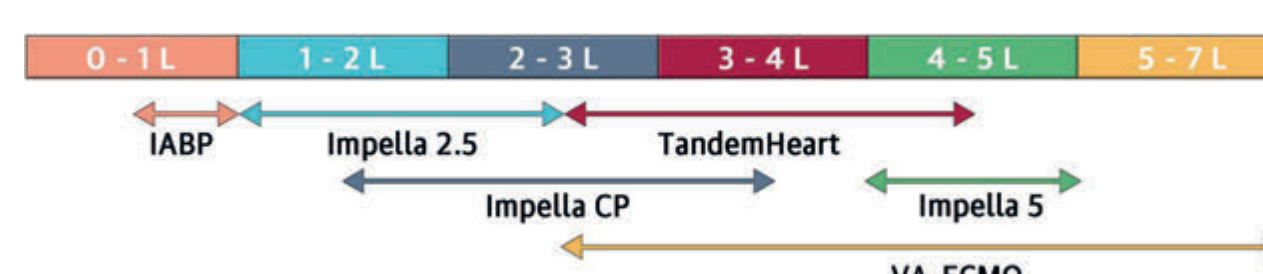
Peripheral VA ECMO

- Cannulae are inserted into the right femoral artery and the right common femoral vein
- Backflow cannula used to prevent limb ischemia
- Oxygenated blood returns to aorta → lung gets little O2 blood → may exacerbate lung ischemia
- Lower body receives better perfusion
- Possible poor perfusion of coronaries and cerebral vessels.

Central VA ECMO

- The arterial cannula is placed into the ascending aorta and the venous cannula placed in the right atrium
- No preferential perfusion to the lower body
- No possibility of hypoxic perfusion of cerebral vessels.
- Can use very large cannulae
- Needs sternotomy and tissue dissection
- Can predispose to severe bleeding.

Comparison of pMCS devices and their impact on cardiac flow



Main Features of pMCS:

Intra-aortic Balloon Pump (IABP):

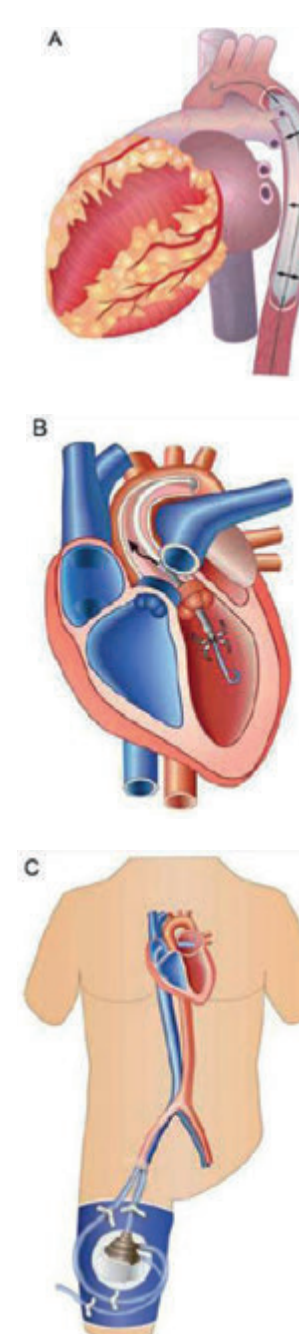
- Increases diastolic BP and reduces afterload
- Most benefit in patients who has ongoing myocardial ischemia
- Routine IABP use doesn't provide an overall benefit

Impella®:

- Intra-cardiac micro-axial rotatory flow pump
- Blood from LV to ascending aorta
- Depends on adequate right heart function
- Short-term use (up to 5 days)

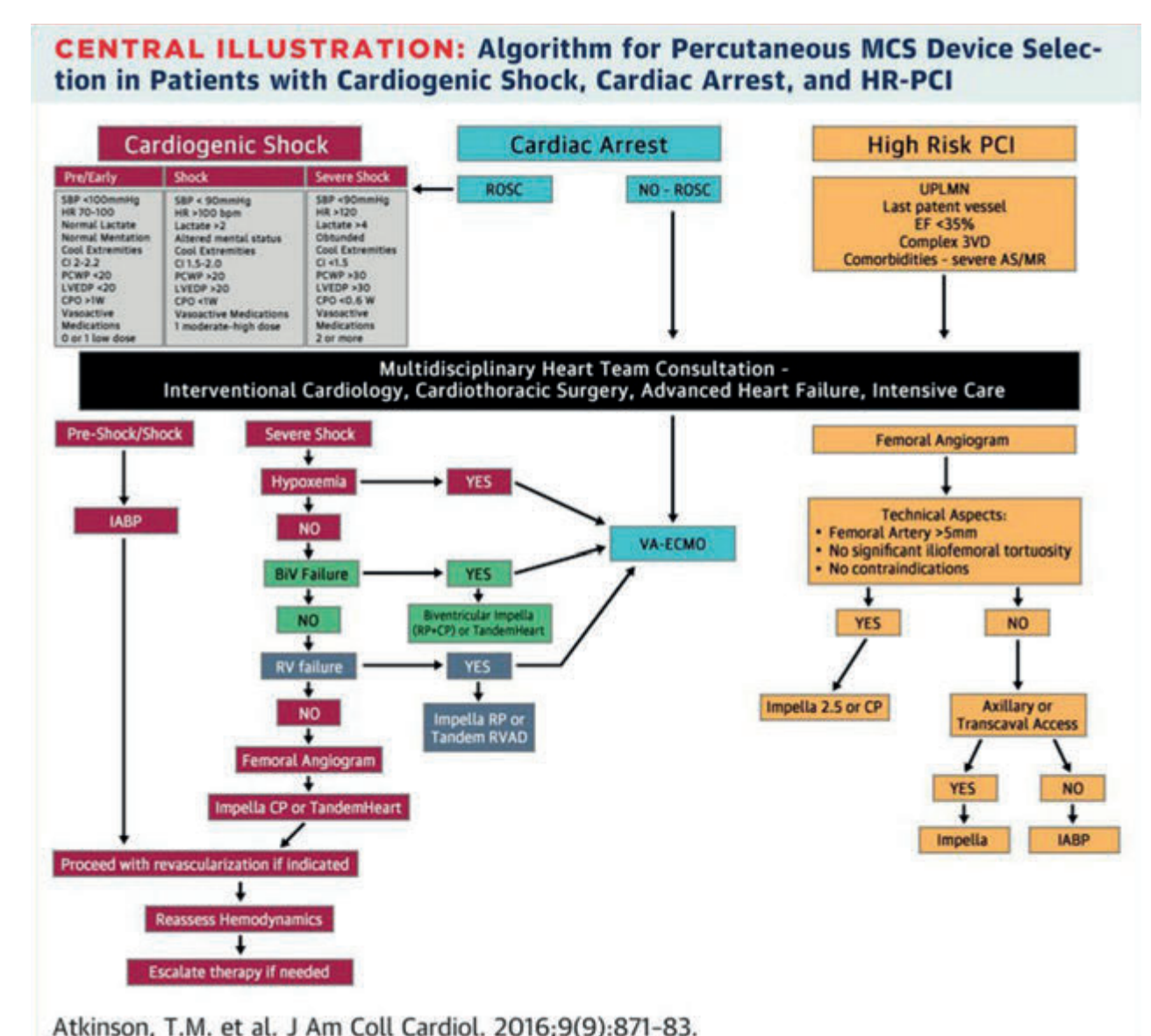
TandemHeart®:

- Extracorporeal centrifugal pump (LA to femoral)
- Superior hemodynamic support compared with IABP (up to 4L/min)
- Technically challenging (requires trans-septal puncture)
- Reduces incidence of hemolysis and thrombo-emboli
- Depends on adequate right heart function
- Longer duration (up to 18 days)



Veno-Arterial ECMO (VA ECMO):

- Extracorporeal centrifugal pump and an oxygenator
- Provides cardiac or cardio-pulmonary support
- Percutaneous and rapid access
- Less reliable on right ventricular function than other pMCS devices
- Cheaper than Impella® and TandemHeart®
- Using it with IABP or Impella® may reduce afterload
- Stable flow rates up to 8 L/min can be used up to 2-4 weeks.



Recommendations:

- Routine use of IABP in patients with cardiogenic shock is not recommended (III/A)
- IABP insertion should be considered for patients with hemodynamic instability /cardiogenic shock due to mechanical complications (IIa/C)
- pMCS provides superior hemodynamic support compared with IABP and pharmacology
- Patients with cardiogenic shock carry an extremely high risk. Early placement of an appropriate pMCS may be considered in those who fail to stabilize/improve
- In the setting of a profound cardiogenic shock, IABP is less likely to provide benefit than continuous flow pumps (including Impella® and TandemHeart®). ECMO may also provide benefit, particularly where gas exchange is impaired
- Acute decompensated heart failure patients may benefit from early use of pMCS when they deteriorate
- Insufficient data to support (or refute) routine use of pMCS as adjunct for revascularization in the setting of an extensive myocardial infarction.

REFERENCES:

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