Cardiogenic Shock. What is new in treatment?

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DEFINITION

- ✓ Cardiogenic shock is a clinical condition of inadequate tissue perfusion due to cardiac dysfunction.

- ✓ Clinical criteria includes:

  hypotension (a systolic blood pressure < 90mmHg) for least 30 minutes or the need of supportive measure to maintain blood pressure > 90mmHg, end organ hypoperfusion, cardiac index at least 2,2 l/minute

Etiology

- ✓ Myocardial infarction
- ✓ Valvular dysfunction
- ✓ Cardiac arrhythmias
- ✓ Myocardiopathies
- ✓ Mechanical complications

Introduction

- ✓ The in hospital mortality for acute myocardial infarction (AMI) is currently around 7%.
- ✓ Death is related predominantly to the development cardiogenic shock, which affect 5-10% of all causes of AMI and has a mortality rate of 50 to 90% (2).
- ✓ Cardiogenic shock is an emergency, requiring immediate resuscitative therapy before shock irreversibly damage vital organs.

Introduction

- ✓ The key to a good outcome in patients with cardiogenic shock is an organized approach, with rapid diagnosis and prompt initiation of pharmacological therapy to maintain blood pressure and cardiac output.

- ✓ All patients require admission to an intensive care setting, which may involve emergent transfer to the cardiac catheterization suite.

Resuscitation, ventilation and pharmacological intervention.

- ✓ Initial management include fluid resuscitation to correct hypovolemia and hypotension.
- ✓ Central venous and arterial line are required.
- ✓ Oxygenation and airway protection are critical; intubation and mechanical ventilation are commonly required.
- ✓ Therapy with aspirin and heparin should be given as routinely recommended for myocardial infarction

Hemodynamic management

- ✓ Individualized PA catheter use is recommended for severly hypotensive myocardial infarction patients (4). Clinical assessment with echocardiography is a reasonable alternative.

- ✓ Pharmacological treatment includes inotrops and vasopressors, which should be used in the lowest possible doses, higher vasopressors doses are associated with poorer survival (5).

Hemodynamic management

- ✓ Inotropic agents, have a central role in a treatment because the initiating event involves contractile failure.

- ✓ Still use of inotropics and vasopressor agents is always required to maintain coronary and systemic perfusion until an IABP is placed or until shock resolves. American Heart Association guidelines recommend Norepinephrine for more severe hypotension, because of high potency (6).

Hemodynamic management

- ✓ Dobutamine is the choice inotropic treatment (4).
- ✓ Pharmacological treatments that warrant further investigation includes: Vasopressin, Levosimendan (a calcium sensiting agent that has so far shown little additional value in randomized heart failure trials(6), and or activated protein C, which has been tried in conjunction with mechanical support in AMI patients (7).

Reperfusion

- ✓ The survival benefit of early revascularization in cardiogenic shock, reported in several observational studies, was show convincingly in the randomized shock trial which found a 13% absolute increase in a 1 year survival in patients assigned to early revascularization (9).

- ✓ Thrombolytic therapy is less effective but is indicated when percutaneous coronary intervention PCI is impossible.

Timing of PCI

- ✓ Early revascularization is better in cardiogenic shock presentation 0 to 6 hours after symptoms onset and is was associated with the lowest mortality among cardiogenic shock patients (5,9).

- ✓ *Stenting and glycoprotein IIB IIIa inhibition* were independently associated with improved outcomes in patients undergoing PCI for cardiogenic shock (1).

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Fig. 1

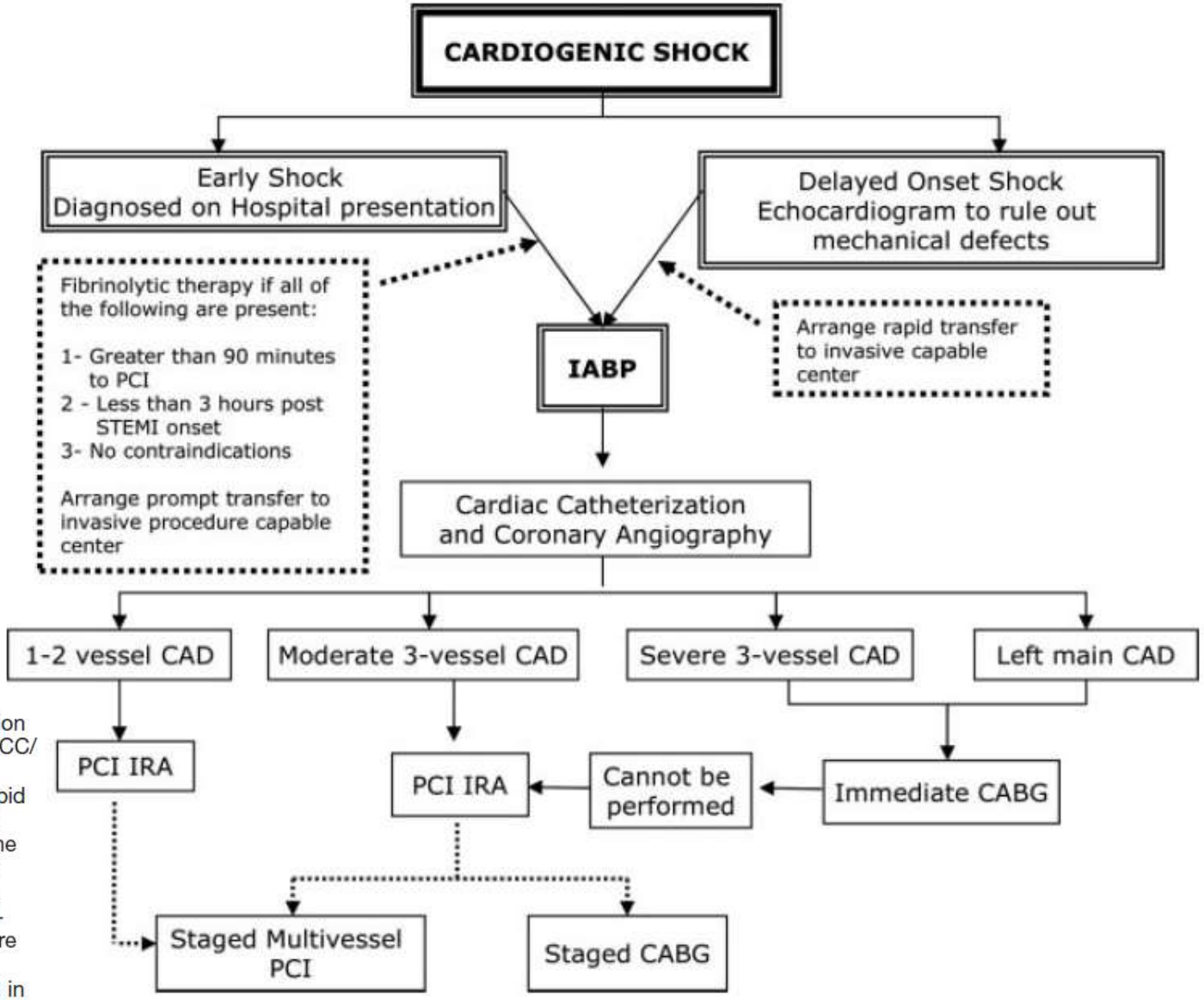


Figure 4. Algorithm for revascularization strategy in cardiogenic shock, from ACC/AHA guidelines.[42,44] Whether shock onset occurs early or late after MI, rapid IABP placement and angiography are recommended. Immediate CABG is the preferred method of revascularization when severe triple-vessel or left main disease is present and should be performed as needed when VSR or severe mitral regurgitation exists. PCI of the infarct-related artery is recommended in the case of single- or double-vessel disease or moderate triple-vessel disease and when CABG is not possible for patients with more extensive disease. CAD indicates coronary artery disease; IRA, infarct-related artery.

World Federation of Societies of Anaesthesiologists

Revascularization approach; surgery or PCI

- ✓ Revascularization in the *SHOCK TRIAL* could be percutaneously or surgical.
- ✓ The survival was similar despite a higher prevalence of triple vessels or left main disease and diabetes mellitus in patients underwent CABG compared with PCI survival (1,9).

The SHOCK TRIAL

- ✓ New England Journal Of Medicine 1999;341:625-634

- ✓ Hochman JS, Sleeper IA ,Web JG et al. Early revascularization in acute myocardial infarction complicated by cardiogenic shock SHOCK Investigators. Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock. (SHOCK TRIAL)

The SHOCK TRIAL

- ✓ Results from this trial supported the superiority of a strategy that combines early revascularization with medical management in patients with cardiogenic shock.

- ✓ In the study, patients were assigned to receive either optimal medical management, including IABP and thrombolytic therapy or cardiac catheterization followed by revascularization using PTCA or CABG (9).

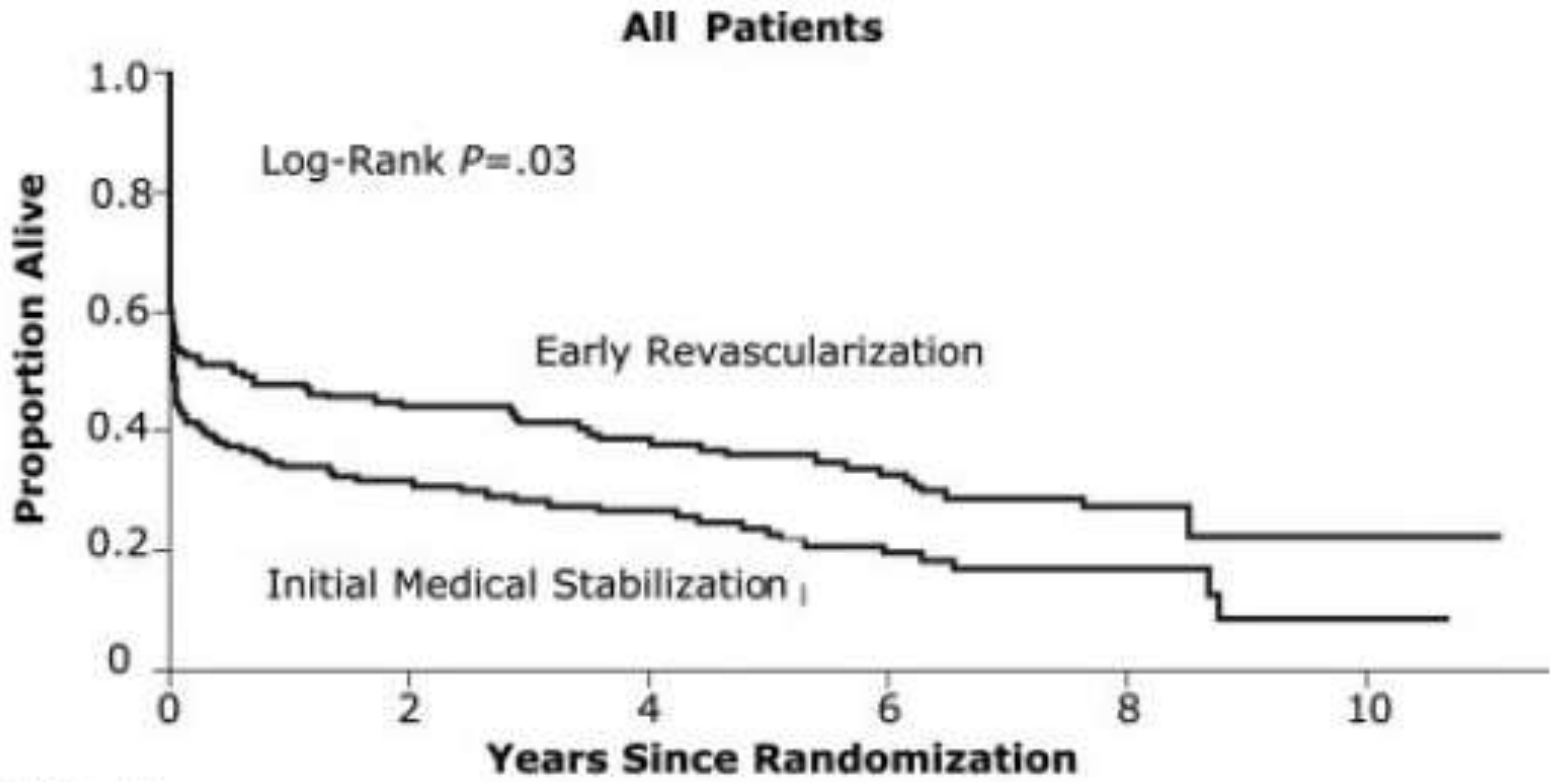
The SHOCK TRIAL

- ✓ The mortality rate at 30 days was 46.7% in the early intervention group and 56% in patients treated with optimal medical management. Although these 30 days results did not reach statistical significance, the mortality rate at 6 month was significantly lower in the early interventional group (50.3 % versus 63.1% (9).

The SHOCK TRIAL

- ✓ The survival rate at 1 year, was 46.7% for patients in the early revascularization group and 33.6% in the conservative management group.

The SHOCK TRIAL



No. at Risk						
ERV	152	56	42	33	18	3
IMS	150	38	29	18	9	2

Mechanical support in patients with cardiogenic shock

- ✓ Although early reperfusion of the coronary system is the corner stone of management of cardiogenic shock, this will not always provide full resolution for such a grave situation. Additional time may be needed after restoration of blood flow to the injured myocardium to recover from stunning (3).

Mechanical support in patients with cardiogenic shock

- ✓ Thus methods for mechanical support of the myocardium, that maintain normal systemic perfusion, may improve the outcome of patients with cardiogenic shock complicated AMI.

Surgical implanted devices (VADS)

- ✓ Were initially designed to support patients in hemodynamic collapse.
- ✓ They are used in several clinical situation e.g.: cardiogenic shock, cardiopulmonary arrest (3).
- ✓ Despite advances in surgically implanted VAD technology, the current available, still have drawbacks. They need extensive surgery and anesthesia .

Surgical implanted devices (VADS)

- ✓ *IABP* Can be considered short term VAD. It is effective in a stabilization of patients decreasing afterload and increasing coronary perfusion pressure.
- ✓ IABP II study (12) showed that in randomized assigned 600 patients with cardiogenic shock, complicating AMI to IABP use or not, the use of IABP did not significantly reduce 30 day mortality in patients with planned early PCI.
- ✓ The ESC guidelines for the management of STEMI IN 2012, have changed the level of recommendation for IABP use in cardiogenic shock from class I in the class IIb (12).

Percutaneous ventricular devices (pVADs)

- ✓ In contrast to IABP this devices can compensate for the loss of myocardial pump function, normalizing cardiac output and thus allowing physiologic perfusion of vital organs.
- ✓ In cases of cardiogenic shock, pVADs are mainly used as a bridge to recovery (12).
- ✓ Two main currently available pVADs are: Tandem Heart and Impella Recover 2.

Fig.3: *Tandem Heart Ventricular assist device*

- ✓ a percutaneous left atrial to femoral arterial ventricular assisted device. The initial trials comparing Tandem Heart with IABP, for cardiogenic shock, showed a favorable hemodynamic influence (1,3).

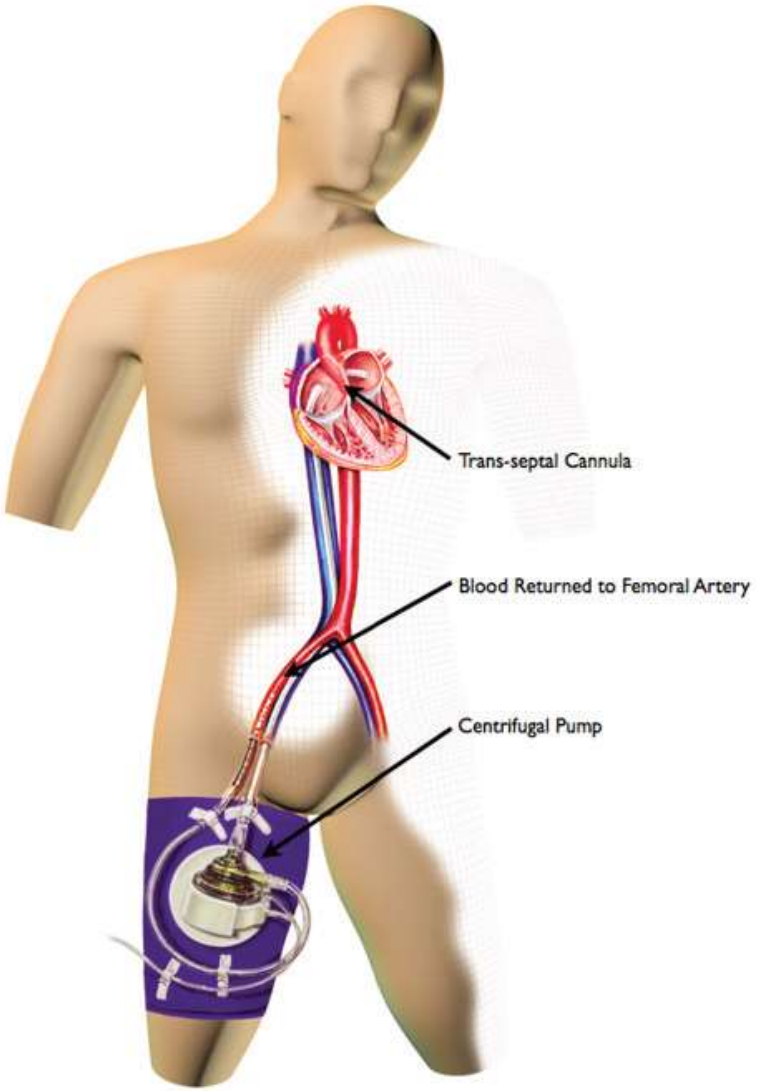
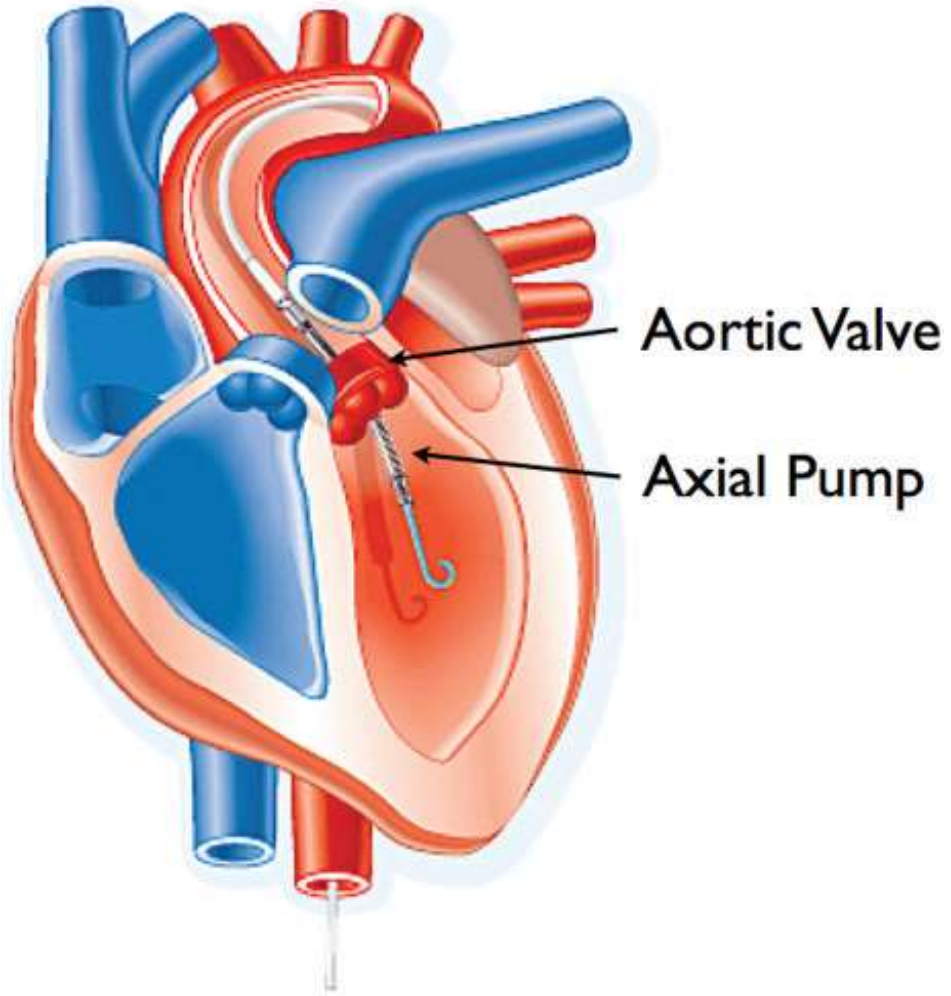


Fig. 4: *Impella Recover 2 System*

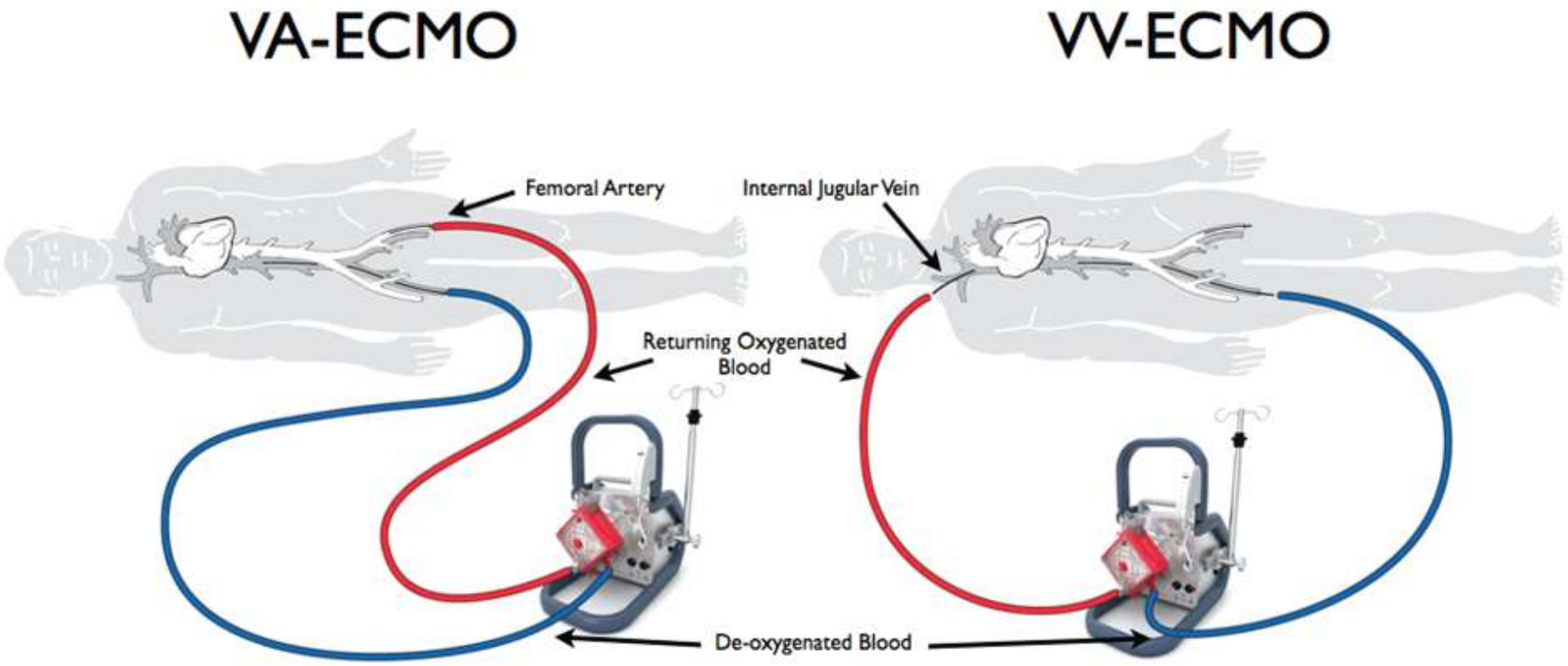


- ✓ a percutaneous transvalvular VAD

Percutaneous Extracorporeal Membrane Oxygenation (ECMO)

- ✓ Provide a temporary circulatory support in patient who present with severe hemodynamic instability associated with multi organ failure.
- ✓ ECMO support could improve survival. In a recent retrospective reviews of patients who suffer AMI associated with cardiogenic shock and early ECMO initiation yielded better outcome (13)

Fig. 5


VA-ECMO
VV-ECMO
Femoral Artery
Internal Jugular Vein
Returning Oxygenated Blood
De-oxygenated Blood

Summary of VAD use in cardiogenic shock

- ✓ In 2007, Garatti and colleagues (2) revised 17 major studies of LVAD support (surgical and percutaneous) for cardiogenic shock complicating AMI. They found a mean weaning and survival rate of 58.8% and 40% respectively.

- ✓ VAD support did not show survival improvement in patients with cardiogenic shock complicating AMI, compared with early reperfusion alone or in combination with IABP (13).

Summary of VAD use in cardiogenic shock

- ✓ Data from Society of Thoracic Surgeons National Cardiac Database, suggest that these devices could save approximately 60% of patients with persistent shock after CABG.

- ✓ Recently ESC guidelines recommended VADs as class IIb (level of evidence C) for use in patients with STEMI and cardiogenic shock not responding to standard treatment including IABP and as bridge to transplantation.

Conclusions

- ✓ Cardiogenic shock is a treatable illness with reasonable chance to full recovery.
- ✓ It is important to recognize that although patients with cardiogenic shock are at very high risk for early death, great potential exist for salvage. Early invasive approach can increase short and long term survival and can result in good quality of life.

Conclusions

- ✓ Revascularization is associated with some benefit at every level of risk. Taken together these survival and quality of life data should prompt consideration of aggressive early care, for even highly unstable patients and additional clinical trials of new pharmacological and mechanical therapies (4).