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Cardiogenic Shock

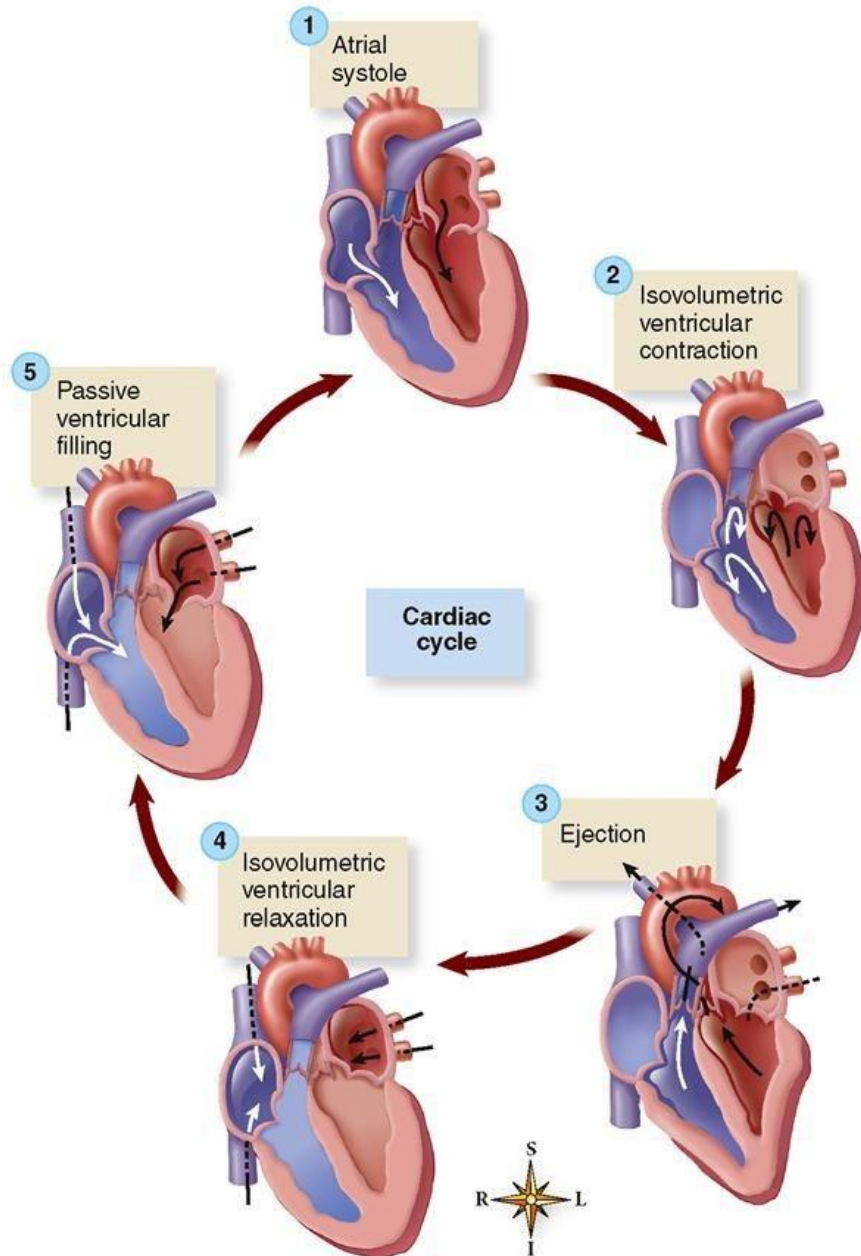
NURSING CARE MANAGEMENT



Bandung 8 maret 2020

Siklus jantung

- Kegagalan fungsi jantung untuk mensuplai darah ke seluruh jaringan tubuh, menjadi penyebab terjadinya shock



Definisi syok kardiogenik

- Tekanan darah sistolik < 90 mmHg, volume cairan cukup namun disertai tanda-tanda hipoperfusi baik ***secara klinis*** maupun ***laboratorium***. *ESC HF Guideline 2017*

Table 1. Pragmatic and Clinical Trial Definitions of CS

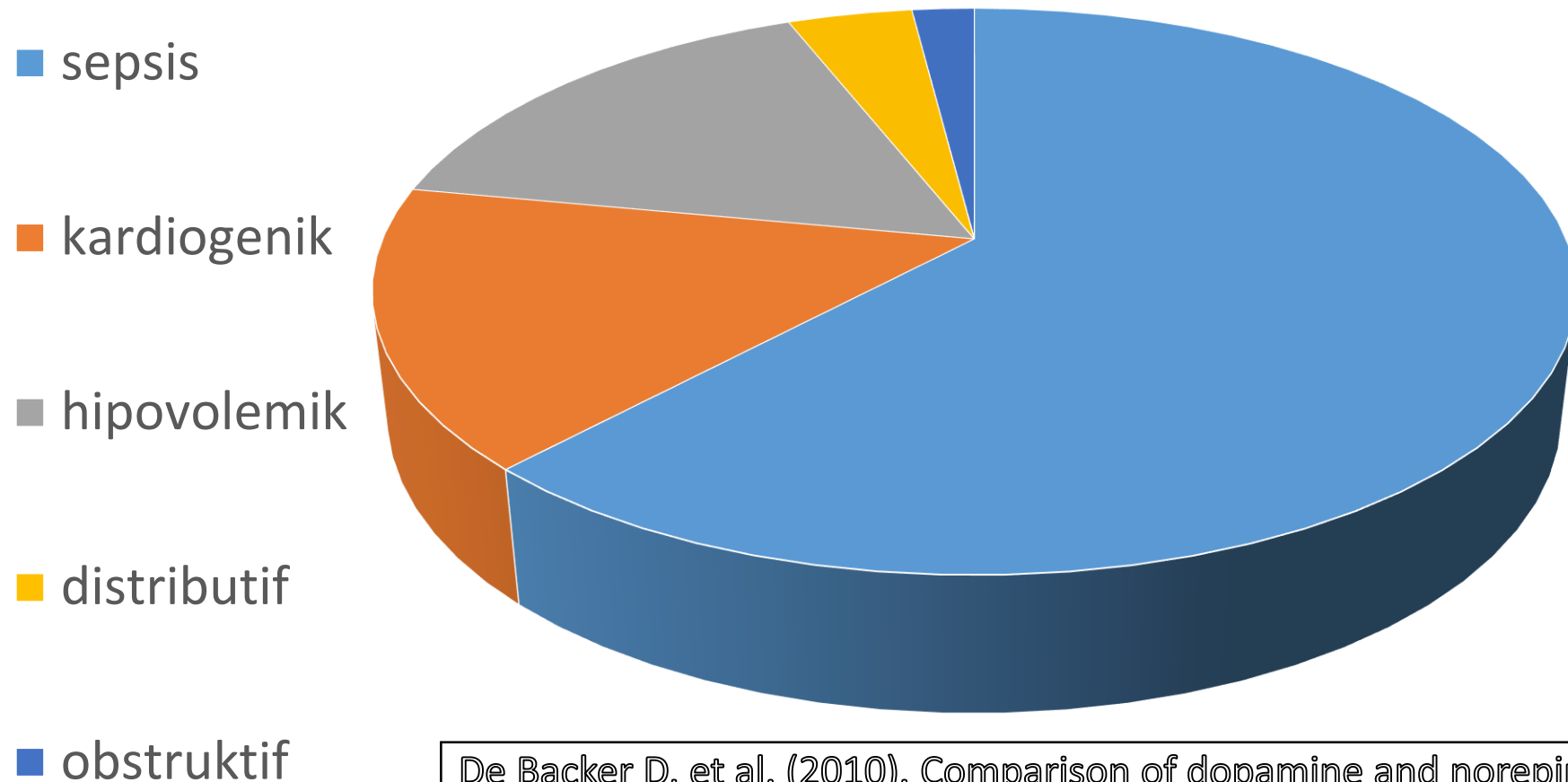
Clinical Definition	SHOCK Trial ^{9*}	IABP-SHOCK II [†]	ESC HF Guidelines ¹⁵
Cardiac disorder that results in both clinical and biochemical evidence of tissue hypoperfusion	Clinical criteria: SBP <90 mmHg for ≥30 min OR Support to maintain SBP ≥90 mmHg AND End-organ hypoperfusion (urine output <30 mL/h or cool extremities) Hemodynamic criteria: CI of $\leq 2.2 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$ AND PCWP ≥15 mmHg	Clinical criteria: SBP <90 mmHg for ≥30 min OR Catecholamines to maintain SBP >90 mmHg AND Clinical pulmonary congestion AND Impaired end-organ perfusion (altered mental status, cold/clammy skin and extremities, urine output <30 mL/h, or lactate >2.0 mmol/L)	SBP <90 mmHg with adequate volume and clinical or laboratory signs of hypoperfusion Clinical hypoperfusion: Cold extremities, oliguria, mental confusion, dizziness, narrow pulse pressure Laboratory hypoperfusion: Metabolic acidosis, elevated serum lactate, elevated serum creatinine

CI indicates cardiac index; CS, cardiogenic shock; ESC, European Society of Cardiology; HF, heart failure; IABP-SHOCK II, Intraaortic Balloon Pump in Cardiogenic Shock II; LV, left ventricular; MI, myocardial infarction; PCWP, pulmonary capillary wedge pressure; SBP, systolic blood pressure; and SHOCK, Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock.

*In setting of MI complicated by predominantly LV dysfunction.

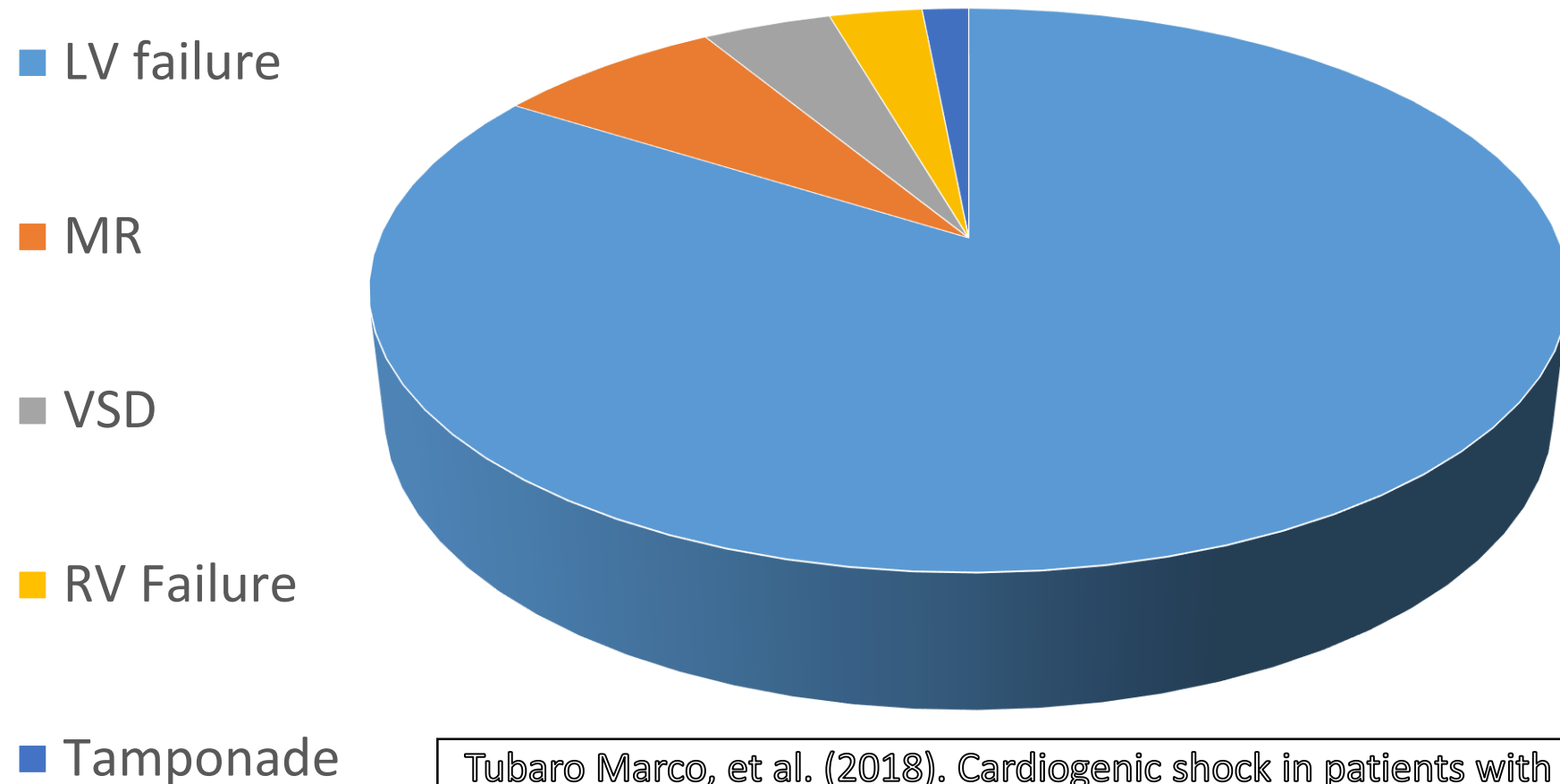
†In setting of acute MI.

Epidemiologi

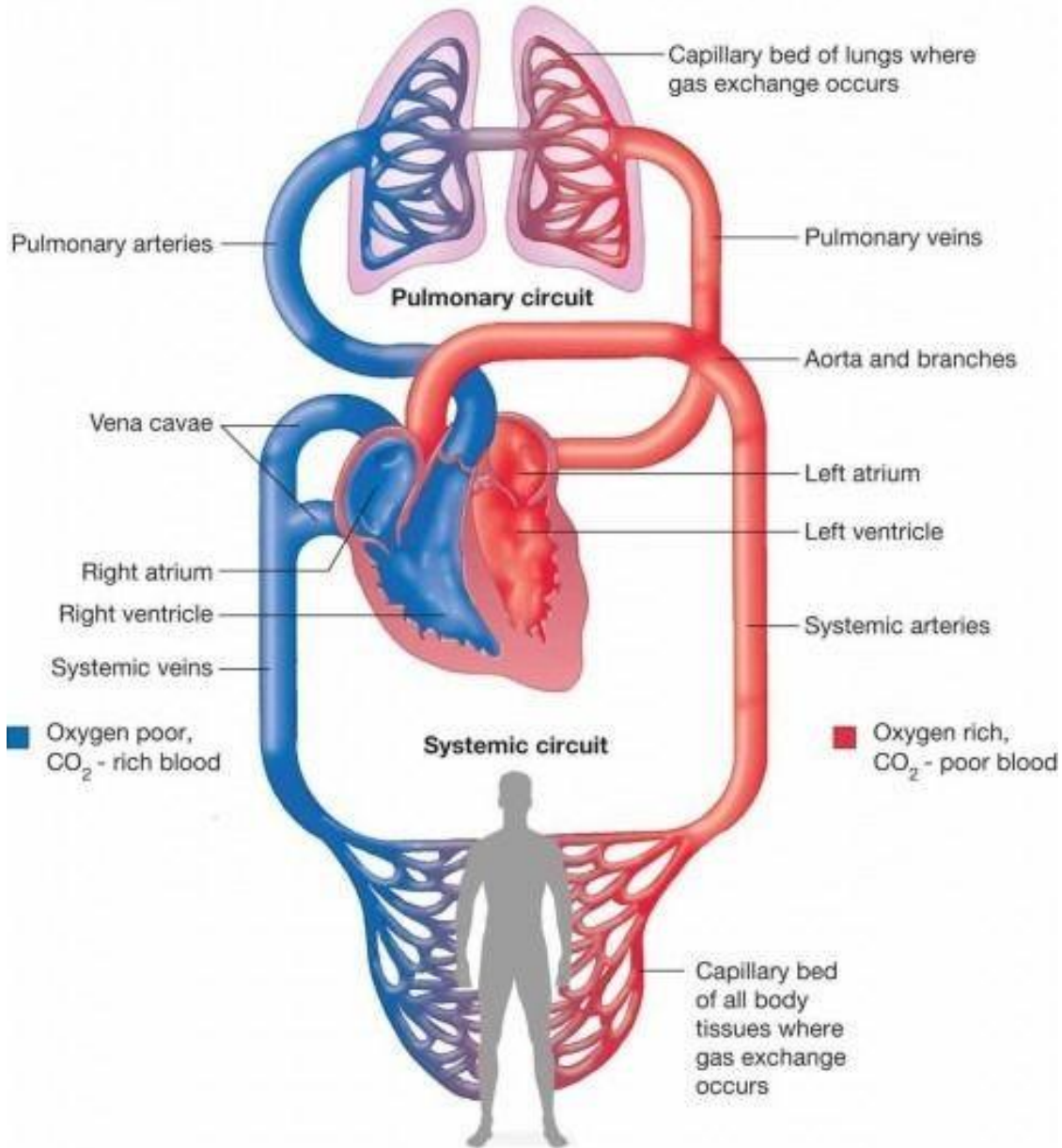


De Backer D, et al. (2010). Comparison of dopamine and norepinephrine in the treatment of shock. N Engl J Med, 362(9), 779-89

Epidemiologi



Tubaro Marco, et al. (2018). Cardiogenic shock in patients with acute coronary syndromes. European society Of cardiology



Hemodinamik

- SV = jumlah darah yang di pompa dalam 1 x kontraksi ventrikel kiri
- Curah jantung/CO = Jumlah darah yang dipompa dalam 1 menit
- $CO = SV \times HR$
- $SVR = \frac{(MAP - CVP)}{CO} \times 80$
- $PVR = \frac{(\text{Mean PAP} - CVP)}{CO} \times 80$

HEMO-DYNAMICS

#NurseHacks

Cardiac Index (CI)
 Cardiac Output (CO)
 Central Venous Pressure (CVP)
 Mean Arterial Pressure (MAP)
 Pulmonary Artery Diastolic Pressure (PAD)
 Pulmonary Artery Mean Pressure (PAM)
 Pulmonary Artery Systolic Pressure (PAS)
 Pulmonary Artery Wedge Pressure (PAWP)
 Pulmonary Vascular Resistance (PVR)
 Right Arterial Pressure (RAP)
 Stroke Volume (SV)
 Stroke Volume Index (SVI)
 Systemic Vascular Resistance (SVR)
 Systemic Vascular Resistance Index (SVRI)

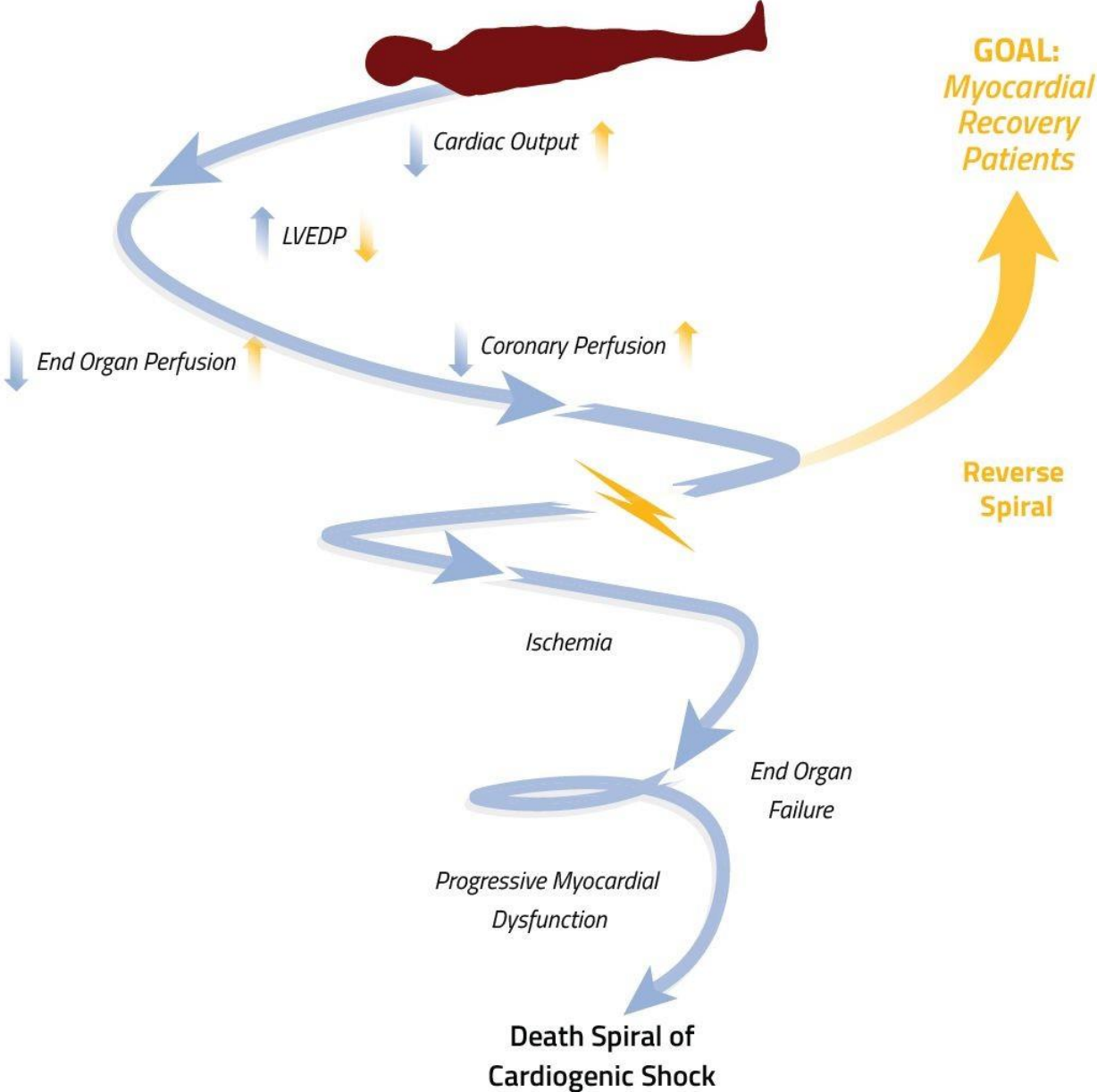
2.5-4 L/min
 4-8 L/min
 2-8 mm/Hg
 70-90 mm/Hg
 6-12 mm/Hg
 10-15 mm/Hg
 20-30 mm/Hg
 8-12 mm/Hg
 150-300 dynes
 2-6 mm/Hg
 60-130 mL
 40-50 mL/m²
 800-1200 dynes
 2000-2400 dynes



Parameter	Equation
Left Ventricular Stroke Work (LVSW)	$SV \times (MAP - PAWP) \times 0.0136$
Left Ventricular Stroke Work Index (LVSWI)	$SVI \times (MAP - PAWP) \times 0.0136$
Right Ventricular Stroke Work (RVSW)	$SV \times (MPAP - RAP) \times 0.0136$
Right Ventricular Stroke Work Index (RVSWI)	$SVI \times (MPAP - RAP) \times 0.0136$
Coronary Artery Perfusion Pressure (CPP)	$Diastolic\ BP - PAWP$
Right Ventricular End-Diastolic Volume (RVEDV)	SV/EF
Right Ventricular End-Systolic Volume (RVESV)	$EDV - SV$
Right Ventricular Ejection Fraction (RVEF)	SV/EDV

Reverse the Cardiogenic Shock Spiral

Impella® Now FDA Approved for Cardiogenic Shock Therapy



Tanda klinis hipoperfusi

- Penurunan status mental
- Pusing
- Ekstremitas terasa dingin
- Oliguri
- Pulse pressure menyempit

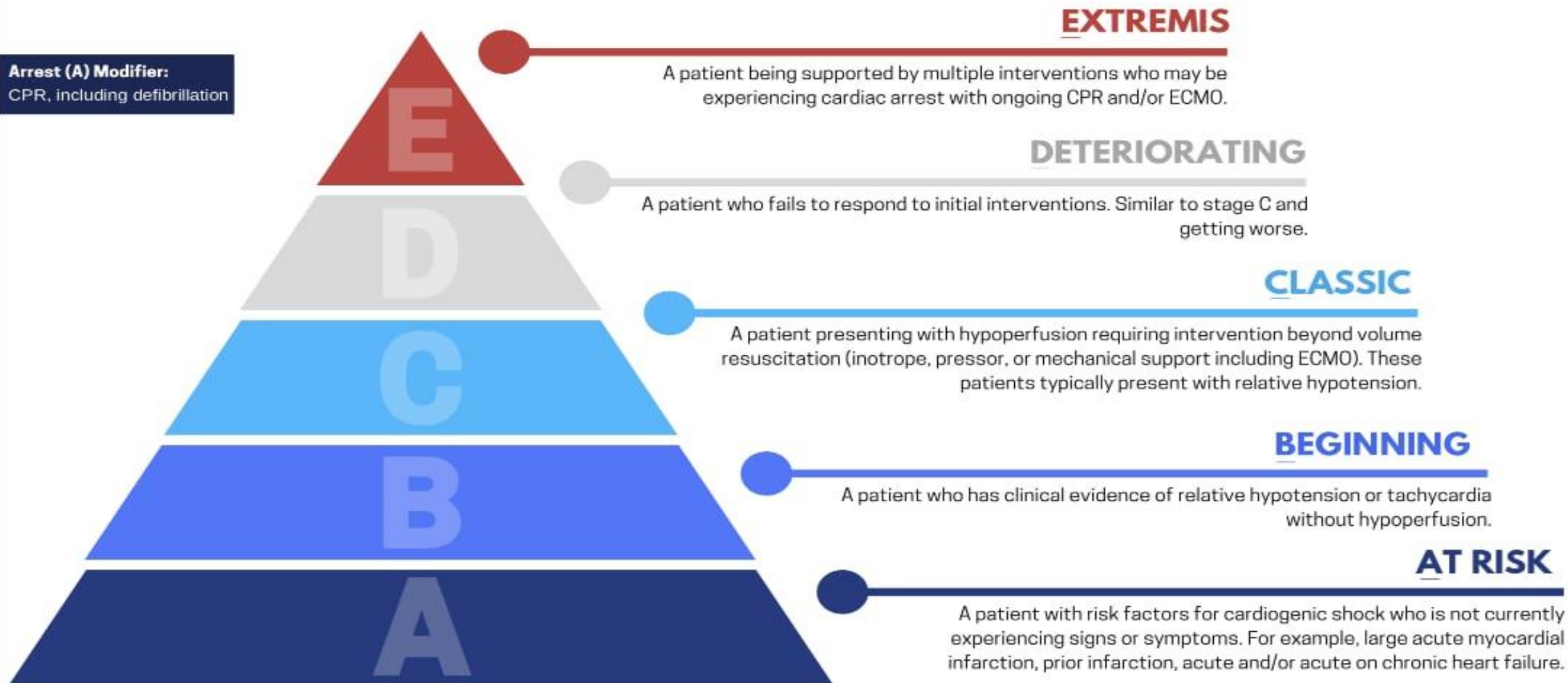
Tanda laboratorium hipoperfusi

- Asidosis metabolic
- Asam laktat meningkat
- Serum kreatinin meningkat

SCAI Stages of Cardiogenic Shock

Adapted from the SCAI Clinical Expert Consensus Statement on the Classification of Cardiogenic Shock
Endorsed by ACC, AHA, SCCM, and STS

Arrest (A) Modifier:
CPR, including defibrillation



Tanda Syock

Early	MAP turun 10 mmHg dari baseline, HR naik
Compensatory	MAP turun 10-15 mmHg dari baseline, Renin naik, ADH naik, vasokonstriksi, pulse pressure turun, HR naik, pH turun, gelisah,
Progressive	MAP turun 20 mmHg dari baseline, hipoksia organ dan jaringan, oliguria, nadi cepat dan lemah, pH turun, perubahan sensori neron
Refractory	Kerusakan sel dan organ, kerusakan multi system organ, pH turun

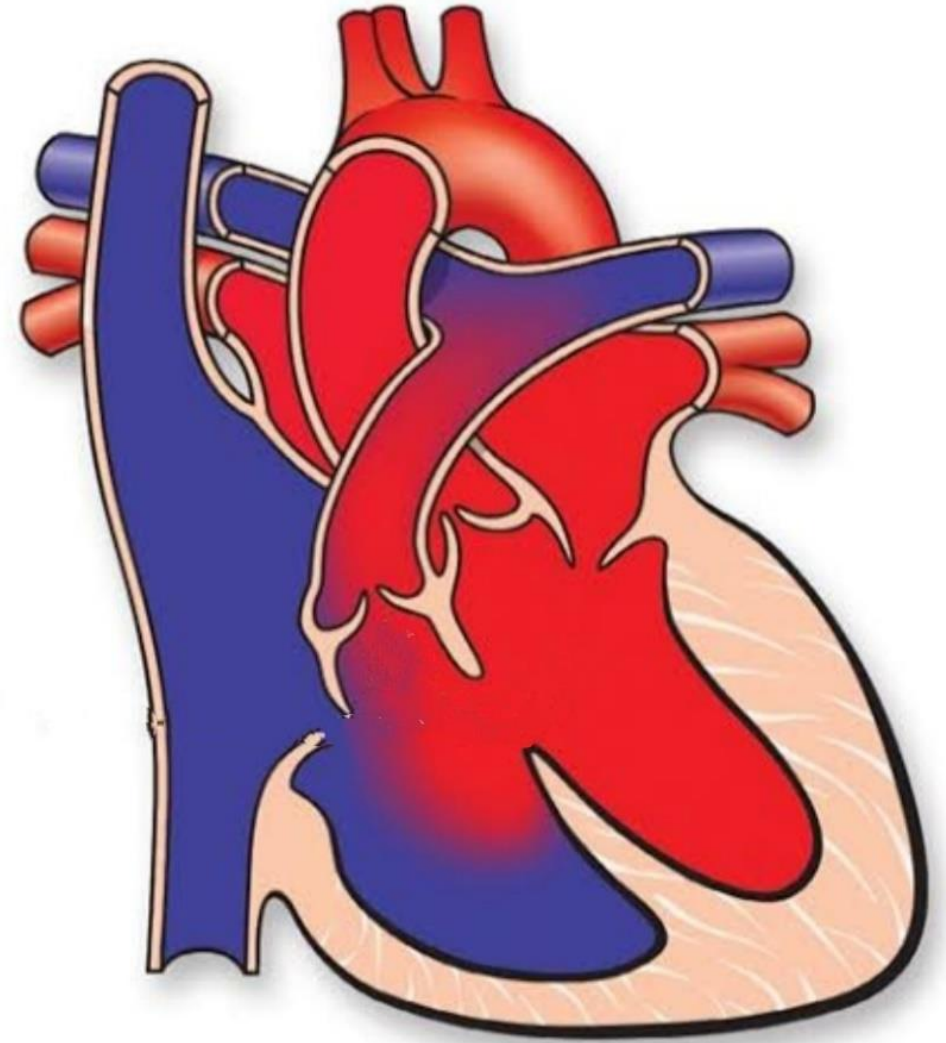
Penyebab

- Myocardial infarct
- Ventricular septal rupture (VSR)
- Mitral regurgitation
- Cardiac Tamponade
- Ruptur dinding ventrikel
- Pasca bedah jantung
- Aritmia

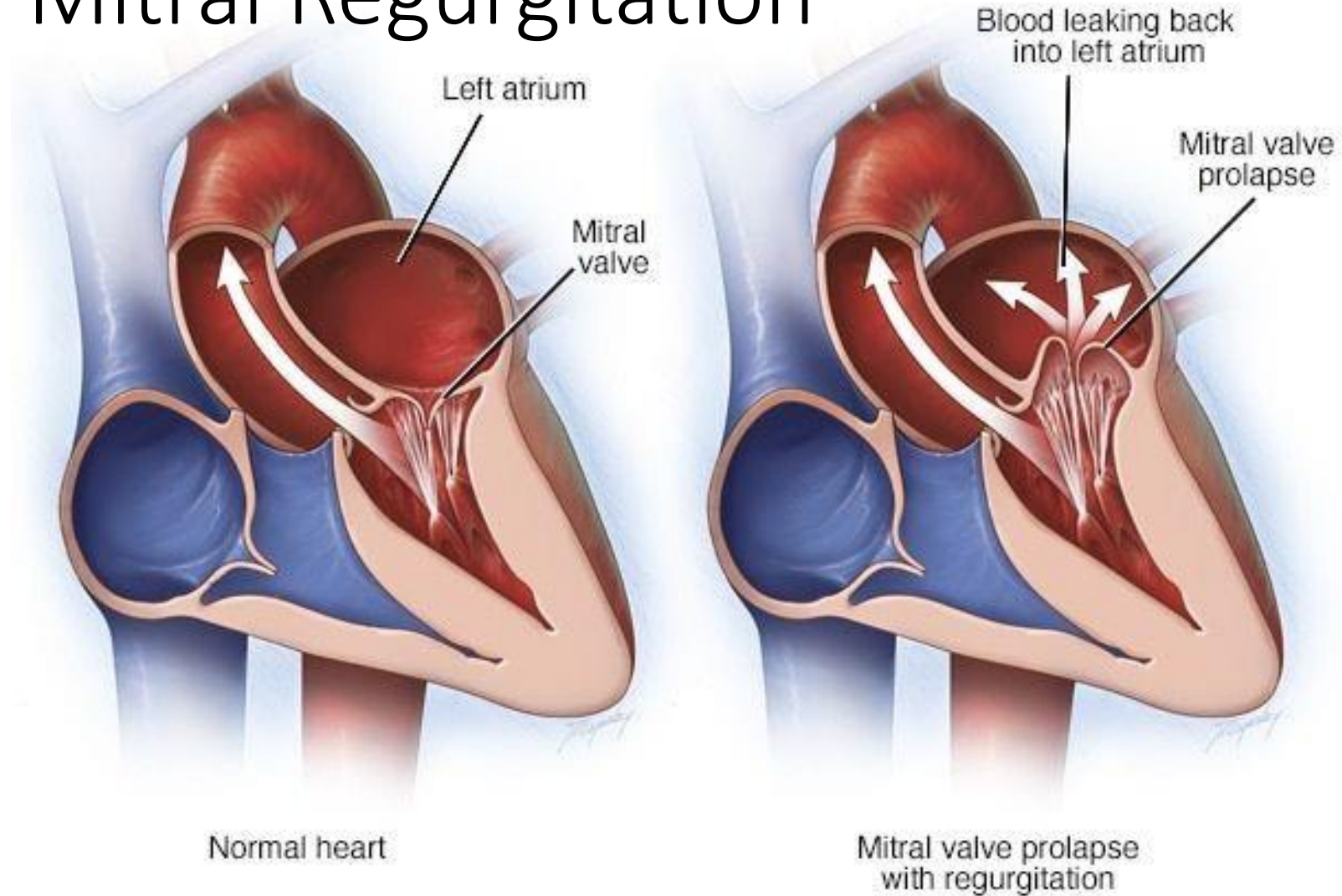
Myocardial infarct



Ventricular Septal Rupture



Mitral Regurgitation



NURSING MNEMONICS & TIPS

CARDIAC TAMPONADE

"THE 3 D'S"

D DISTANT (MUFFLED) HEART SOUNDS

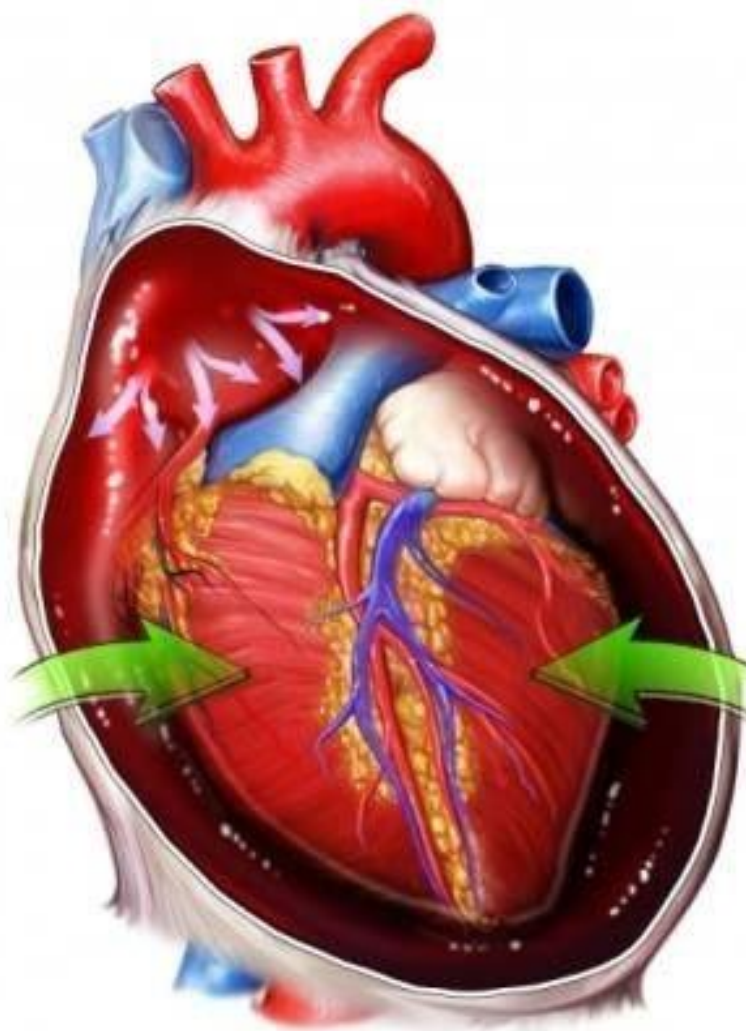
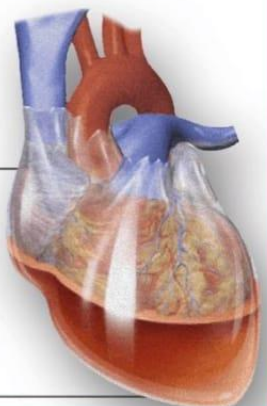
D DISTENDED NECK VEINS

D DECREASED PULSE PRESSURE

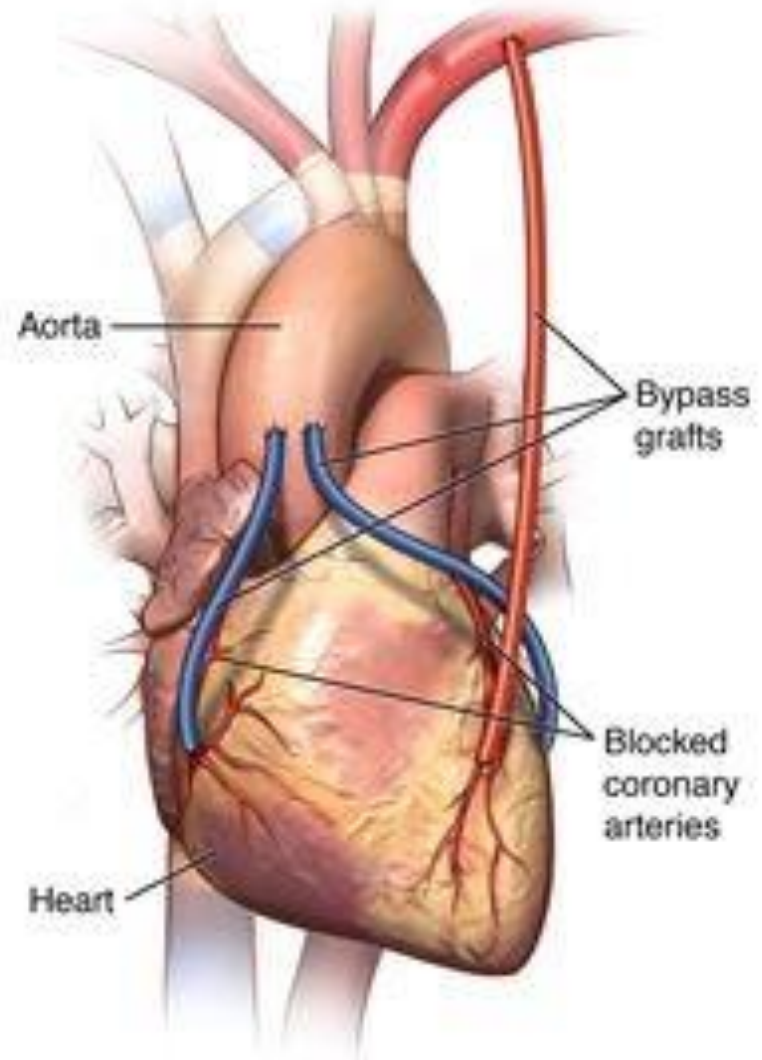
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LEARN MORE: CARDIAC TAMPONADE

In cardiac tamponade, blood or fluid collects in the pericardium, the sac surrounding the heart. Pericardial fluid may accumulate slowly without causing any noticeable symptoms until a large amount accumulates. However, a rapidly developing effusion can stretch the pericardium to its maximum size and, because of increased pericardial pressure, reduce venous return to the heart and decrease CO. It often has three characteristic signs that the physician will recognize during a physical exam. These signs are commonly referred to as "Beck's Triad" or The 3 D's.

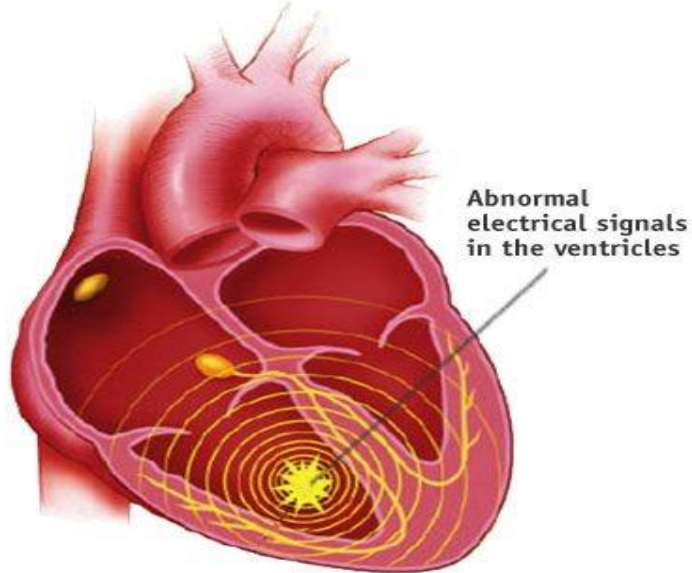


Coronary artery bypass graft (CABG)



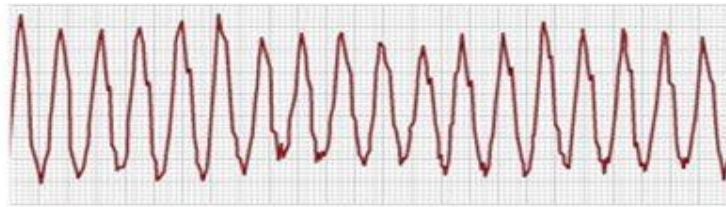
CABG

- Paling sering karena kebocoran conduit sehingga terjadi perdarahan masif

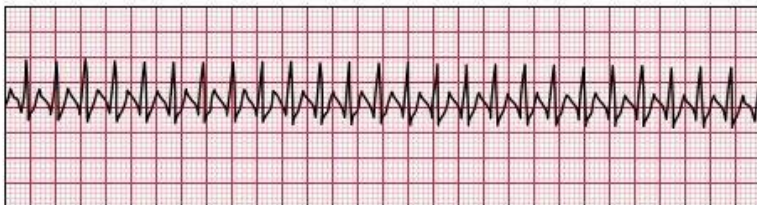
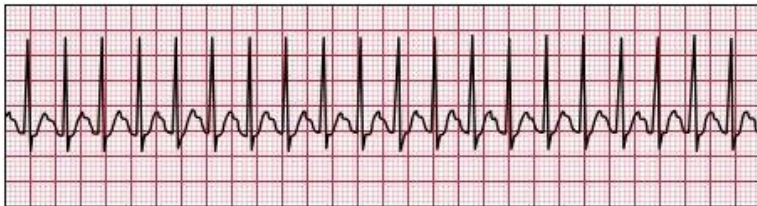


Abnormal electrical signals in the ventricles

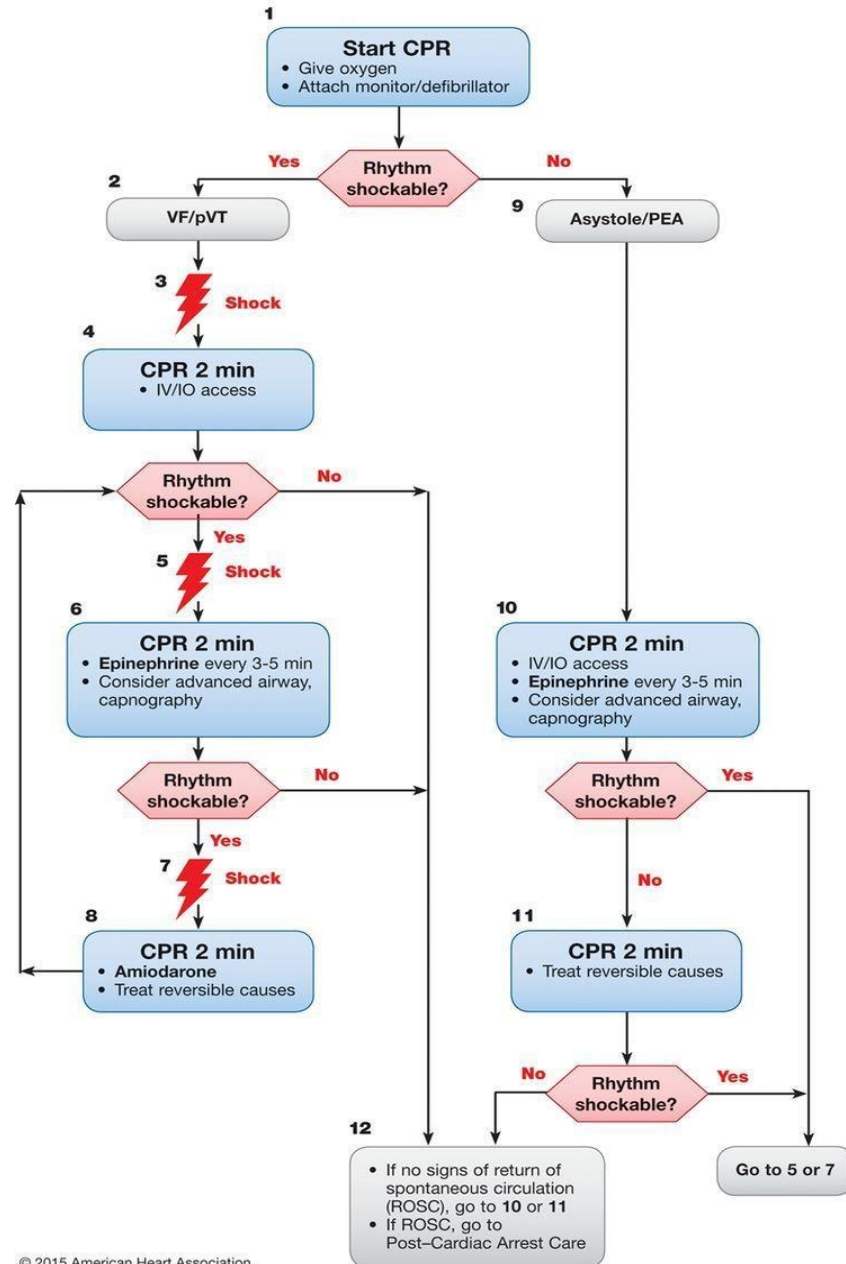
Ventricular Tachcardia ECG



Supraventricular Tach



Adult Cardiac Arrest Algorithm—2015 Update

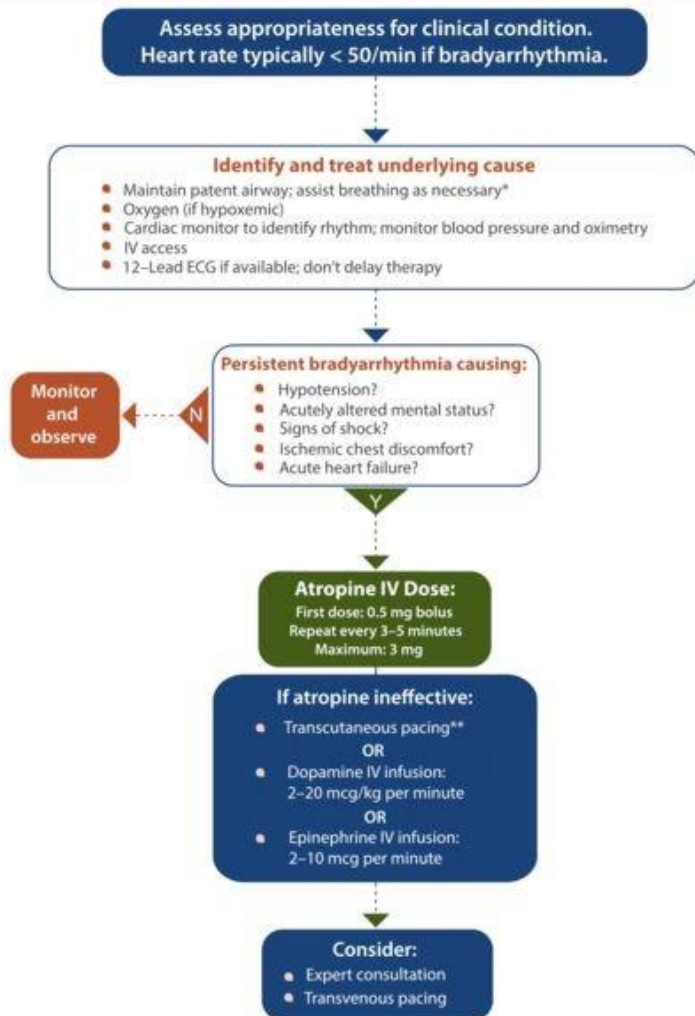


CPR Quality
• Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil. • Minimize interruptions in compressions. • Avoid excessive ventilation. • Rotate compressor every 2 minutes, or sooner if fatigued. • If no advanced airway, 30:2 compression-ventilation ratio. • Quantitative waveform capnography – If PETCO₂ <10 mm Hg, attempt to improve CPR quality. • Intra-arterial pressure – If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.
Shock Energy for Defibrillation
• Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered. • Monophasic: 360 J
Drug Therapy
• Epinephrine IV/IO dose: 1 mg every 3-5 minutes • Amiodarone IV/IO dose: First dose: 300 mg bolus. Second dose: 150 mg.
Advanced Airway
• Endotracheal intubation or supraglottic advanced airway • Waveform capnography or capnometry to confirm and monitor ET tube placement • Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions
Return of Spontaneous Circulation (ROSC)
• Pulse and blood pressure • Abrupt sustained increase in PETCO₂ (typically ≥40 mm Hg) • Spontaneous arterial pressure waves with intra-arterial monitoring
Reversible Causes
• Hypovolemia • Hypoxia • Hydrogen ion (acidosis) • Hypo-/hyperkalemia • Hypothermia • Tension pneumothorax • Tamponade, cardiac • Toxins • Thrombosis, pulmonary • Thrombosis, coronary

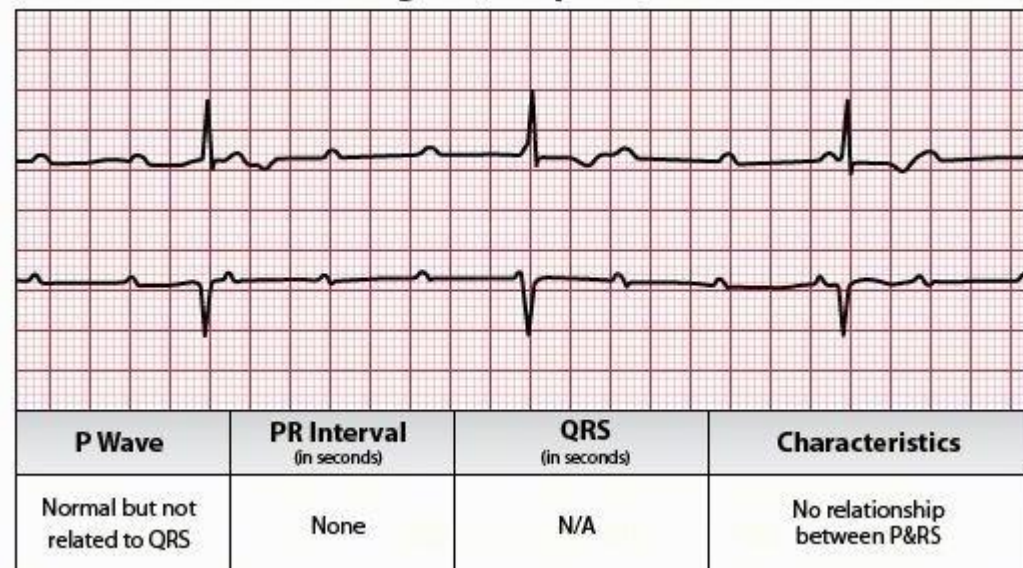
Bradycardia With a Pulse Algorithm

ACLS Training Center

ACLS Online Since 1998



Third Degree (complete) AV Block



* Dongen VJ, Wenzel Y, Knacker K, Gerlach K. Comparison of different airway management strategies to ventilate apneic, nonpreoxygenated patients. Crit Care Med. 2003;31:800-804.

** Link MS, Atkins DL, Fosselman RS, Halperin HR, Saksena RA, White RD, Cudnik AT, Berg MD, Kudenchuk PJ, Kerner RE. Part 6: electrical therapies: automated external defibrillators, defibrillation, cardioversion, and pacing. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010;122(suppl 1):S704-S719. http://circ.ahajournals.org/content/122/suppl_1/S704

Perbedaan parameter hemodinamik pada keadaan syock

Hemodynamic measurements in shock				
Parameter	Normal	Hypovolemic shock	Cardiogenic shock	Septic shock
Right atrial pressure (preload)	Mean of 4 mm Hg	↓	↑	Normal to slight ↓
Pulmonary capillary wedge pressure (preload)	Mean of 9 mm Hg	↓	↑	Normal to slight ↓
Cardiac index (pump function)	2.8-4.2 L/min/m ²	↓	↓↓	↑
Systemic vascular resistance (afterload)	Mean of 1150 dynes*sec/cm ⁵	↑	↑	↓
Mixed venous oxygen saturation	60%-80%	↓	↓	↑

Tatalaksana umum

- Meningkatkan suplai oksigen ke miokardium
- Maksimalkan cardiac output
- Menurunkan beban kerja ventrikel kiri

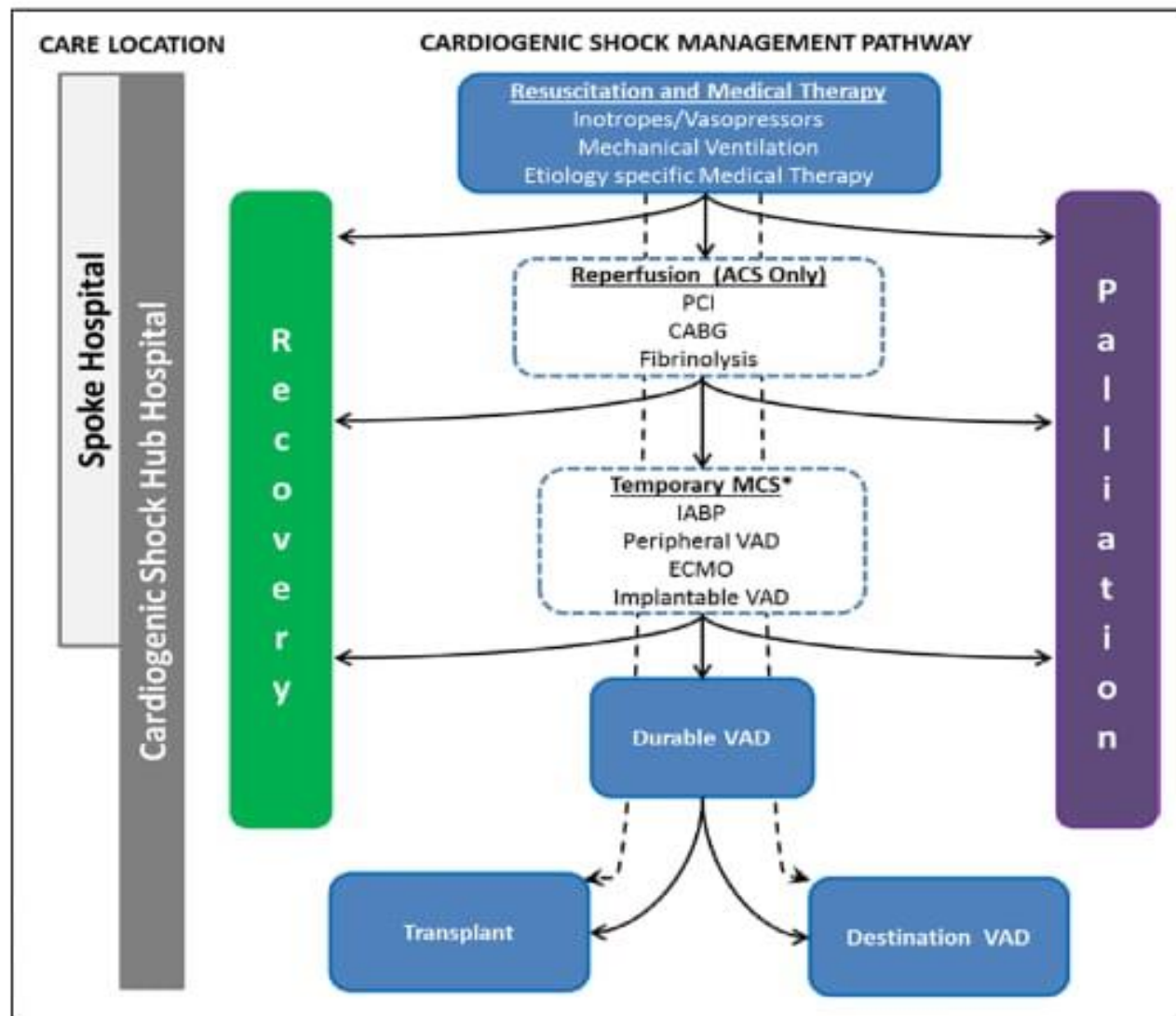
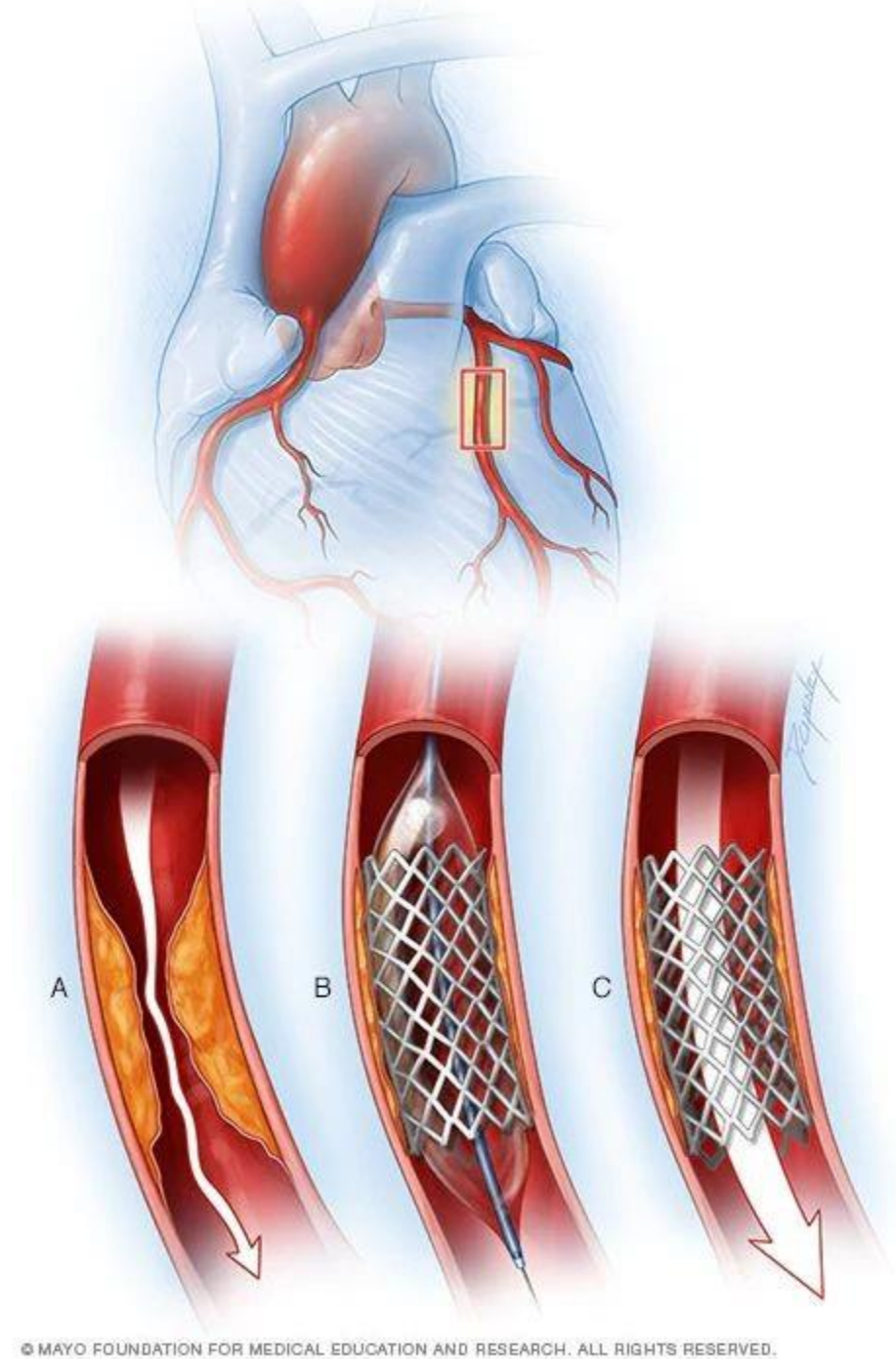


Figure 4. Potential cardiogenic shock care pathway, care location, and care providers.

ACS indicates acute coronary syndrome; CABG, coronary artery bypass graft; ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump; MCS, mechanical circulatory support; PCI, percutaneous coronary intervention; and VAD, ventricular assist device. *Consider temporary MCS before reperfusion in cases of refractory cardiac arrest or shock.

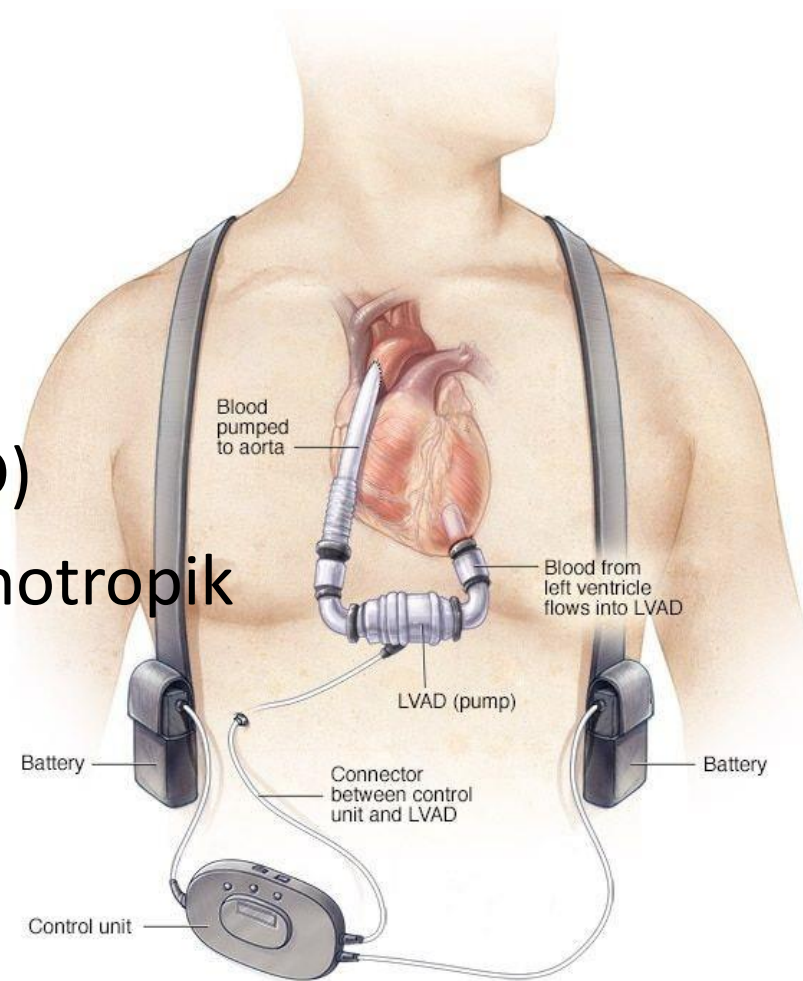
Suplai oksigen ke miokardium

- Ventilasi mekanik
- Fibrinolitik
- PCI



Maksimalkan cardiac output

- Anti aritmia
- Cardioversi
- Pacu jantung (Pace maker)
- Ventricular Assist Device (VAD)
- Titirasi obat inotropik dan kronotropik



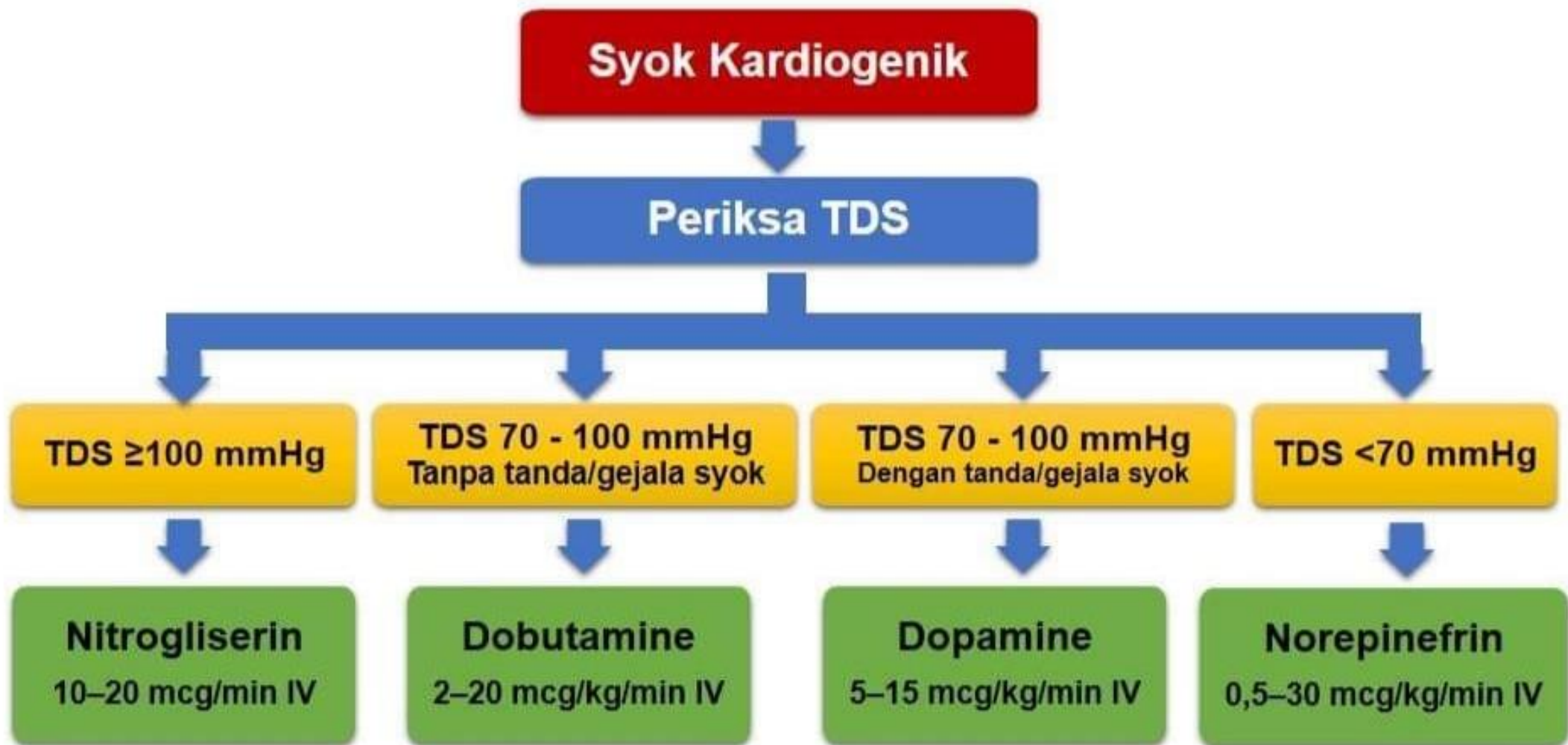
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Table 4. Mechanism of Action and Hemodynamic Effects of Common Vasoactive Medications in CS

Medication	Usual Infusion Dose	Receptor Binding				Hemodynamic Effects
		α_1	β_1	β_2	Dopamine	
Vasopressor/inotropes						
Dopamine	0.5–2 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	–	+	–	+++	$\uparrow\text{CO}$
	5–10 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	+	+++	+	++	$\uparrow\uparrow\text{CO}$, $\uparrow\text{SVR}$
	10–20 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	+++	++	–	++	$\uparrow\uparrow\text{SVR}$, $\uparrow\text{CO}$
Norepinephrine	0.05–0.4 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	++++	++	+	–	$\uparrow\uparrow\text{SVR}$, $\uparrow\text{CO}$
Epinephrine	0.01–0.5 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	++++	++++	+++	–	$\uparrow\uparrow\text{CO}$, $\uparrow\uparrow\text{SVR}$
Phenylephrine	0.1–10 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	+++	–	–	–	$\uparrow\uparrow\text{SVR}$
Vasopressin	0.02–0.04 U/min	Stimulates V_1 receptors in vascular smooth muscle				$\uparrow\uparrow\text{SVR}$, $\leftrightarrow\text{PVR}$
Inodilators						
Dobutamine	2.5–20 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	+	++++	++	–	$\uparrow\uparrow\text{CO}$, $\downarrow\text{SVR}$, $\downarrow\text{PVR}$
Isoproterenol	2.0–20 $\mu\text{g}/\text{min}$	–	++++	+++	–	$\uparrow\uparrow\text{CO}$, $\downarrow\text{SVR}$, $\downarrow\text{PVR}$
Milrinone	0.125–0.75 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	PD-3 inhibitor				$\uparrow\text{CO}$, $\downarrow\text{SVR}$, $\downarrow\text{PVR}$
Enoximone	2–10 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	PD-3 inhibitor				$\uparrow\text{CO}$, $\downarrow\text{SVR}$, $\downarrow\text{PVR}$
Levosimendan	0.05–0.2 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$	Myofilament Ca^{2+} sensitizer, PD-3 inhibitor				$\uparrow\text{CO}$, $\downarrow\text{SVR}$, $\downarrow\text{PVR}$

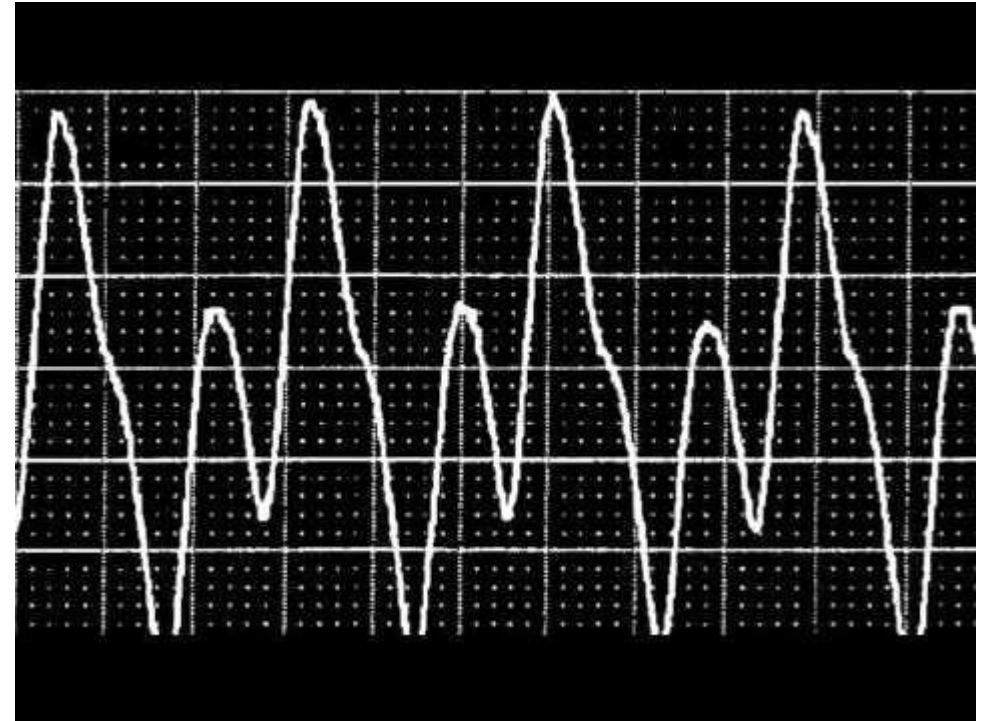
CO indicates cardiac output; CS, cardiogenic shock; PD-3, phosphodiesterase-3; PVR, pulmonary vascular resistance; and SVR, systemic vascular resistance.



Suh, Gil Joon (2018). *Essentials of Shock Management, A Scenario-Based Approach*. Singapore: Springer

Menurunkan beban kerja ventrikel kiri

- Vasodilator
- Intra Aortic Balloon Pump (IABP)



Tatalaksana keperawatan

- Rekam dan monitor EKG 12 lead (identifikasi aritmia atau MCI)
- Foto thoraks (identifikasi edema paru dan hipertropi jantung)
- Periksa cardiac marker (CK, CKMB, Troponin)
- Identifikasi penyebab (akibat aritmia, volume atau pompa jantung)
- Kolaborasi obat inotropic, vasopressor, kronotropik, vasodilator)
- Kolaborasi anti aritmia (obat dan terapi listrik (cardioversi/defibrilasi)
- Monitoring IABP
- Kolaborasi Reperfusi (PCI, fibrinolitik)

Terima kasih