Refractory cardiogenic shock

Moderators: María de los Ángeles Rodríguez Esteban, Juan Carlos Ruiz Rodríguez

Wednesday, May 15, 2024

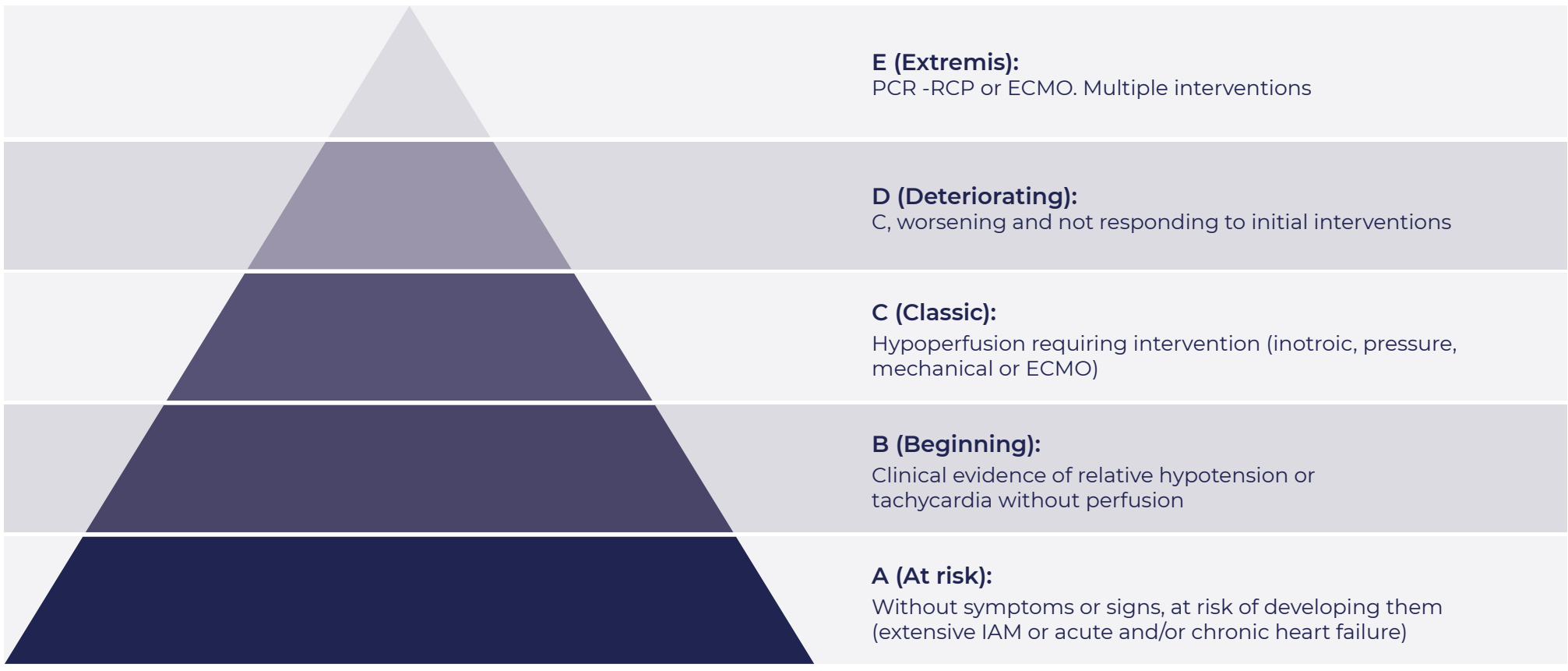
1. WHEN DO WE HAVE A REFRACTORY SHOCK?

Celina Llanos Jorge

DEFINITION OF REFRACTORY SHOCK

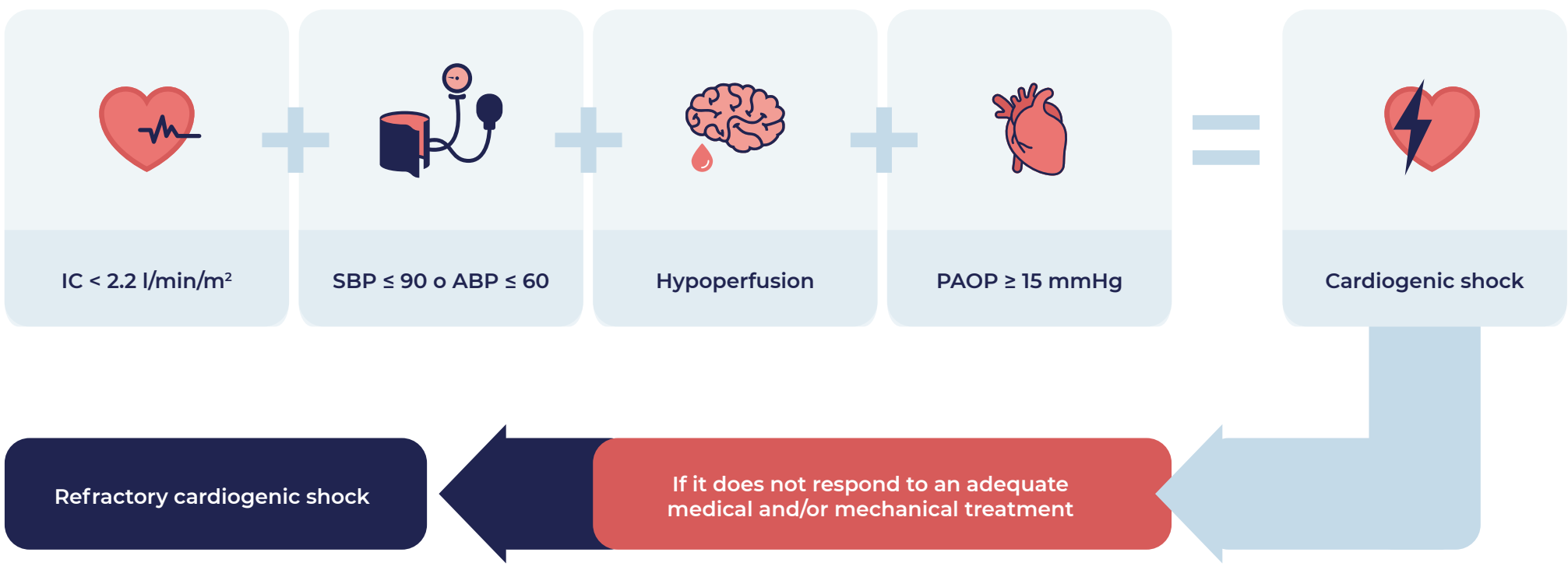
Clinical syndrome caused by an unbalance between the tissue requirement for oxygen and the ability of the cardiovascular system to meet that requirement, due to an acute cardiac dysfunction[1]. This a complex syndrome leading to the occurrence of tissue and organ hypoperfusion.

CLASSIFICATION OF CARDIOGENIC SHOCK[2]



DEFINITION OF REFRACTORY CARDIOGENIC SHOCK

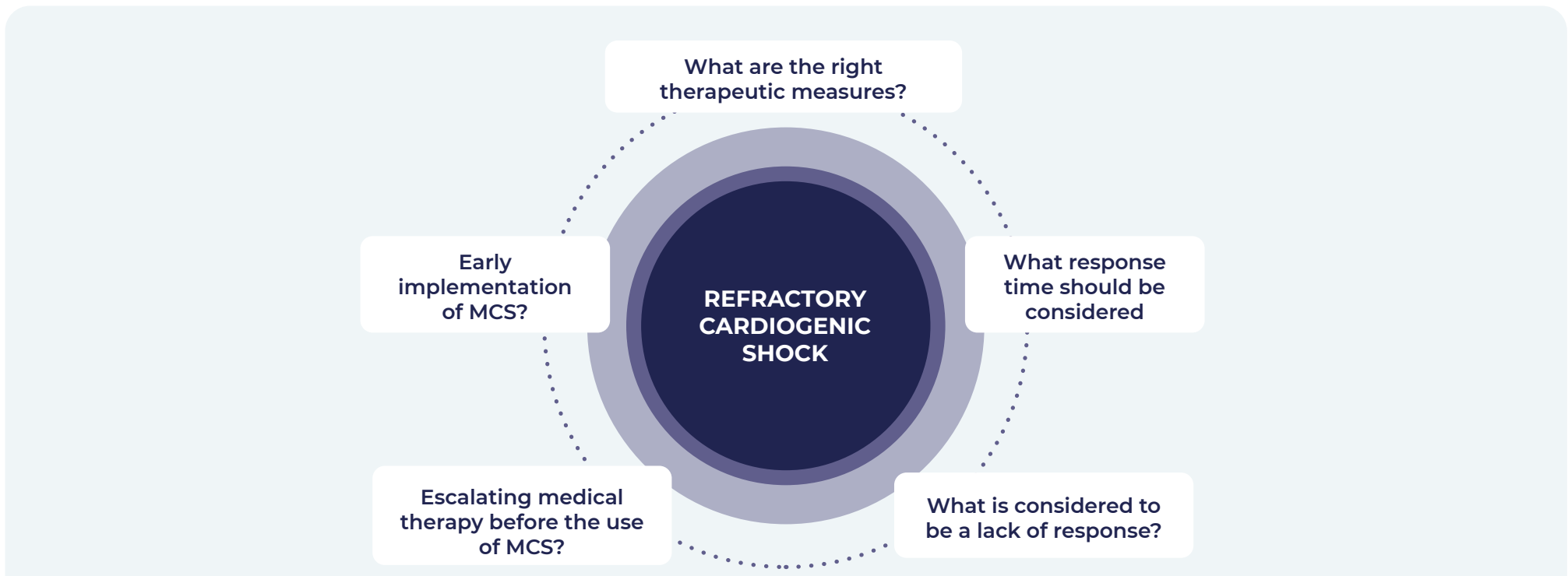
It is characterized by the persistence of hypoperfusion despite a proper therapeutic approach[3].



There is no consensus as to the definition or diagnostic criteria, and even the criteria used to define the population with refractory cardiogenic shock vary between clinical trials[4]. Anyway, it should be understood as a continuous, and an early approach is key to avoid progression.

Zapata et al. 2024[1]	Hypoperfusion + multiorgan failure despite the etiological treatment and adequate support
Sarma et al. 2024[3]	Hemometabolic shock: multiorgan failure + acidosis, refractory to stabilization measures
Naidu et al. 2022[5]	• SCAI D (Deteriorating): C stage, but with more decline, due to lack or response • SCAI E (Extremis): need to quickly escalate support up to very high levels, with no response

SCAI: Society for Cardiovascular Angiography and Intervention



MCS: Mechanical Circulatory Support.

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2. DIAGNOSTIC APPROACH AND HEMODYNAMIC MANAGEMENT OF SHOCK WITH ECHOCARDIOGRAPHY

Ana Ochagavía Calvo

In order to properly diagnose shock, it is essential to consider aspects related to it physiology and hemodynamic monitoring. This will allow us to answer clinical questions and be able to make the right decisions.

Echocardiography is a useful tool in the assessment of the cardiovascular function of critical patients. It is a non-invasive or minimally invasive technique, for bedside application, providing real-time anatomical data. Its main indication in the ICU (40% of cases) is the assessment of the cardiocirculatory function in patients in shock[6].

A basic level of knowledge in echocardiography should allow the etiological diagnosis of typical cases-severe left ventricular failure, severe right ventricular failure, cardiac tamponade, massive valve insufficiency, or hypovolemia.

Current recommendations suggest a more advanced performance and interpretation of echocardiography when the treatment response is Insufficient or when there is a need to delve deeper into the pathophysiology[7].

When faced with a patient with cardiogenic shock, it is essential to ask ourselves what the relevant parameters are and choose hemodynamic monitoring accordingly[1]. Echocardiography allows to assess a great deal of parameters.

RELEVANT UTILITY PARAMETERS

Cardiac output (CO)

Pulmonary artery occluded pressure (PAOP)

- Semiquantitative estimation

Assessing volume responsiveness (leg elevation)

- Variation in aortic peak flow velocity
- Diastolic blood pressure
- Vena cava variation
- Kissing walls

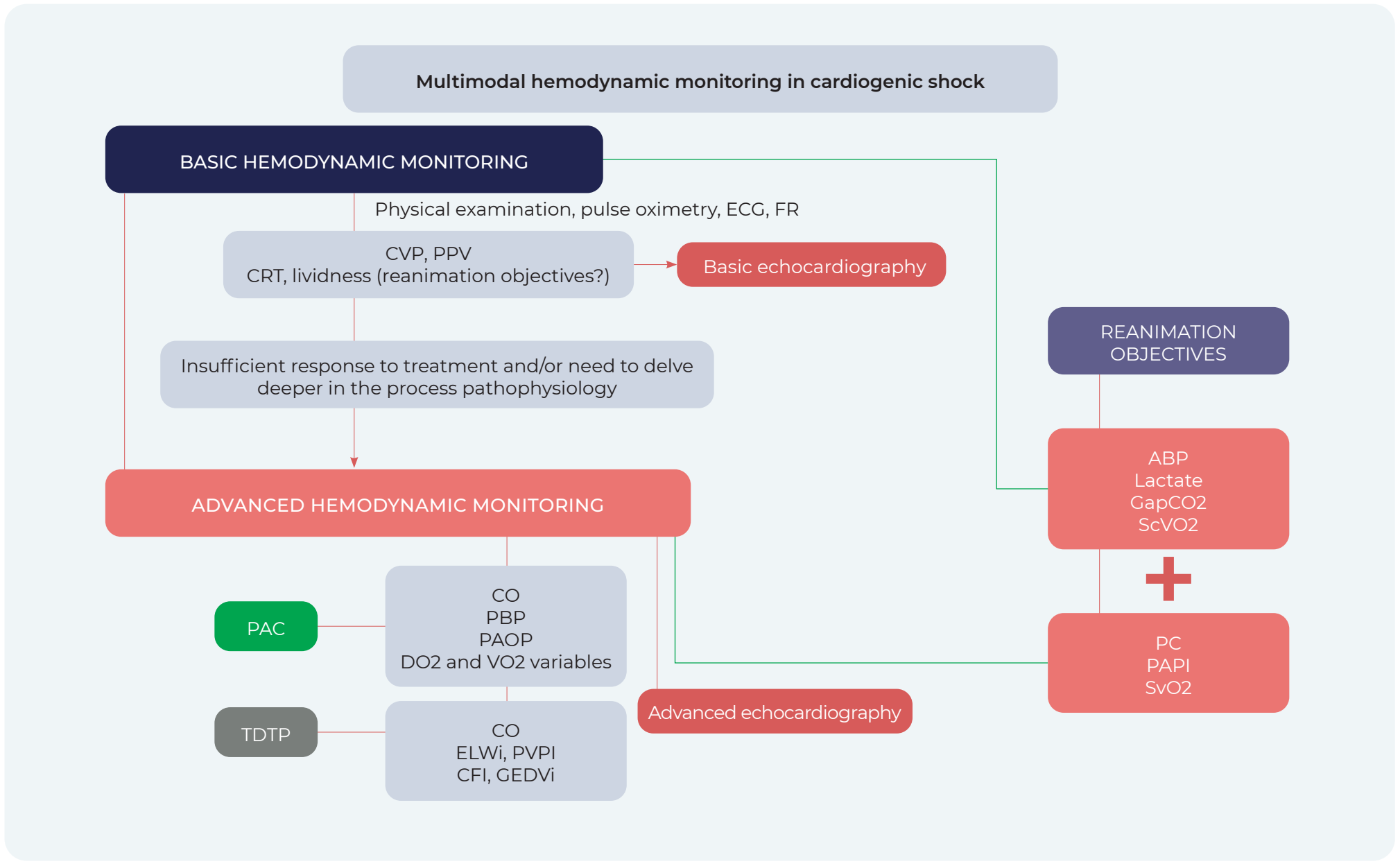
Cardiac power

Pulmonary Artery Pulsatility Index (PAPI)

LIMITATIONS OF ECHOCARDIOGRAPHY

- There is interobserver variability:
  - An adequate training is necessary
  - Different skill levels: basic and advanced
- It is not a continuous hemodynamic monitoring tool

HEMODYNAMIC MONITORING ALGORITHM OF CARDIOGENIC SHOCK:



Multimodal monitoring in cardiogenic shock[8]

PAC: pulmonary artery catheterization. CP: Cardiac power DO_2: Oxygen delivery. ELWi: extravascular lung water index. $GapCO_2$: pCO_2 veno-arterial difference. CO: cardiac output. CFI: cardiac function index. PAPI: pulmonary artery pulsatility index. PVPI: pulmonary vascular permeability index. ABP: average blood pressure. PBP: pulmonary blood pressure. PAOP: pulmonary artery occlusion pressure. CVP: central venous pressure. $ScVO_2$: central venous O_2 saturation. SvO_2: mixed venous O_2 saturation. TPTD: transpulmonary thermodilution. CRT: capillary refill time. VO_2: O_2 consumption. PPV: pulse pressure variation. GEDVi: global end-diastolic volume index.

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3. MEDICAL MANAGEMENT OF REFRACTORY SHOCK

Luis Martín Villén

Refractory cardiogenic shock is a condition with different etiologies and a changing process that evolves over time. Consequently, its management is complex and it depends on the origin and stage. Furthermore, treatment must be applied based on clinical and hemodynamic parameters.

The intervention of cardiac intensive medicine specialists is essential, and it has an impact on mortality[9].

These are the main therapeutic interventions in cardiogenic shock:

1. Revascularization

- Over 50% of cardiogenic shocks occur in the context of acute coronary syndrome. Therefore, coronary revascularization is a fundamental element.
- The evolution of mortality in cardiogenic shock is time-dependent.

2. Antithrombotic treatment

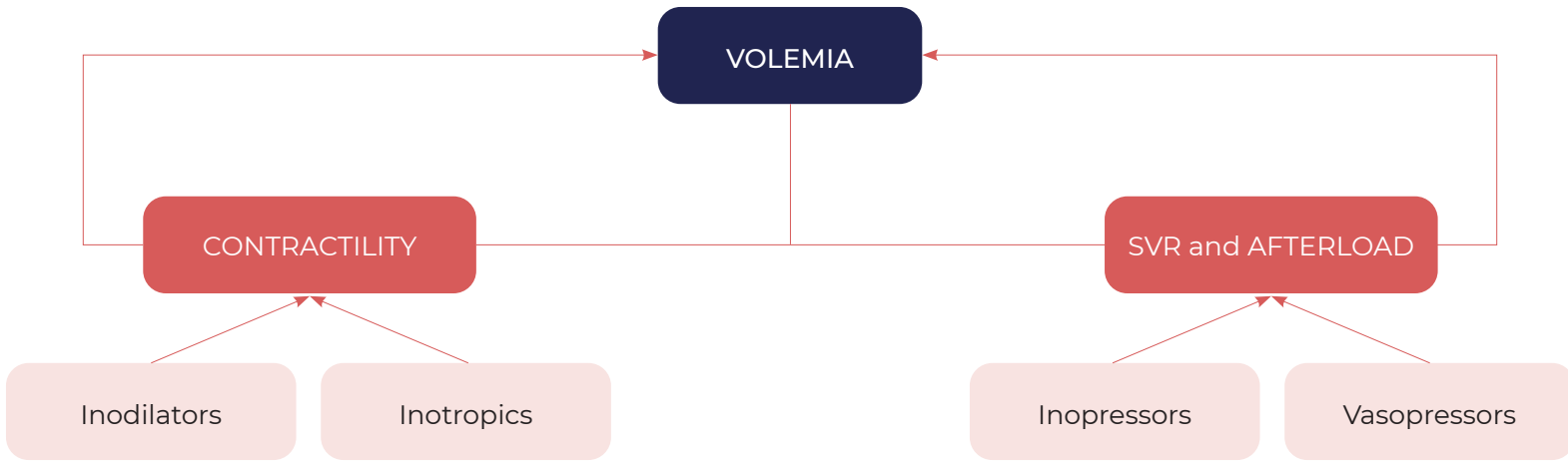
- Intestinal absorption of antiplatelet drugs may be diminished or be insufficient in patients with cardiogenic shock10. Therefore, the risk-benefit ratio of that treatment should be assessed in order to choose the antithrombotic strategy.

3. Management of arrhythmias

- The question arises whether they are the cause or consequence of shock before approaching its treatment[10,11].

4. Fluid therapy and vasoactive drugs

- Based on the stage of myocardial damage and the observed parameters[12].



- Management using *fluid challenge* must be performed once the patient is properly categorized and standardized and not systematically[13].

5. Volume depletion by diuretics

- Pharmacologic therapy applied through a stepped algorithm better preserves kidney function, and it is associated with less adverse events than ultrafiltration[14].
- Using hemofiltration exclusively in these cases of established acute kidney failure[15,16].

6. Vasoactive drugs

- This is the basic support treatment for cardiogenic shock, although more evidence is required[17,18]. It includes vasopressors and inotropes.
- The goal should be ABP < 65 mmHg / SBP > 90 mmHg[19].
- There is no evidence of superiority for any of the inotropic drugs.
- Levosimendan could be useful in beta-blocked patients and with SCAI C or lower. The evidence supporting its use comes from older studies not including high-severity patients[20].
- A stepper approach is necessary when using vasoactive drugs, following the right algorithms[21,22].

7. Respiratory support

- The effects of mechanical ventilation, both beneficial and deleterious, need to be known to optimize their use[23].

8. Temperature control

9. Analgesia and sedation

CSL Behring

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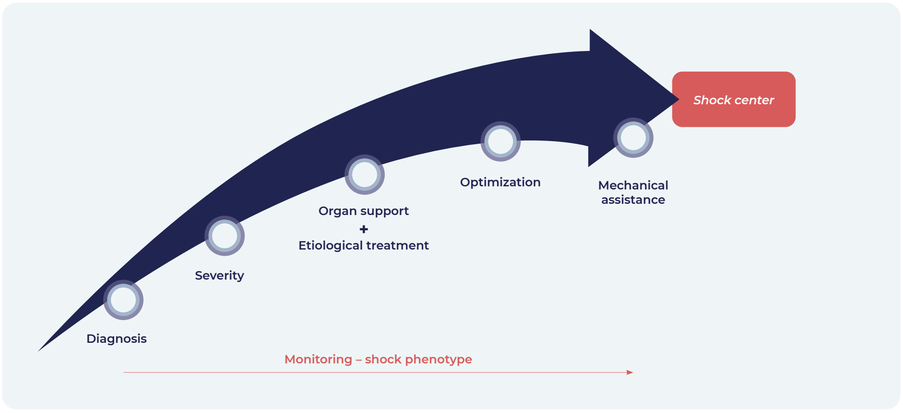
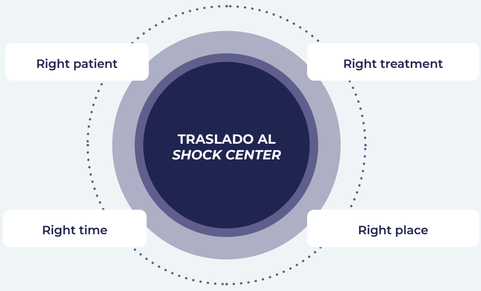
4. WHEN SHOULD I REFER MY PATIENT TO A SHOCKCENTER

María Paz Fuset Cabanes

The therapeutic strategy in cases of cardiogenic shock is the following:



Even though patients should be transferred in the last step of that strategy, they may also have to be transferred in previous steps because no more treatments can be provided at our hospital. Anyway, when managing shock, the following is essential:



Factors to be considered when referring cardiogenic shock patients to a *shock center.*

Determination of severity in two ways:

- **SCAI:** in stages A and B the patients can be optimized; in stage C as well, but mechanical intervention may be necessary, and we may not have it available.
- **VIS (Vasoactive-Inotropic Score):** higher scores are related to a higher mortality[24], and in surgical patients, besides, with the incidence of acute kidney damage, the duration of mechanical ventilation and the duration of hospital stay, among others[25]. **It is recommended to transfer patients with a score ≥ 21 to a center where they can access all potentially necessary interventions**[25].

When choosing candidate patients to mechanical circulatory support it is important to critically assess available publications and to take into account that they are endorsed by the brands marketing each device[26].

RELEVANT ASPECTS:

- Creating *shock teams* to make multidisciplinary agreed decisions.
- Creating interhospital networks and obtaining institutional support.
- Developing interhospital transfer protocols.
- Registering and studying potential improvements.
- Reclaiming the role of intensivists in the following aspects:

Diagnosis

Stratification

- SCAI
- Baseline VIS
- Monitoring according to severity

Start of organ support

Planning of etiological treatment

Reevaluation

- VIS
- Lactate
- Multiorgan failure

Definition of the therapeutic strategy

Contact with other specialties and/or centers

Transfer planning

In summary, patients should be referred in the following cases:

1. Impossibility of patient optimization within 6-12 hours

2. Need for a specific treatment:

- Etiological
- For complications
- For poor evolution

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