

Hemodynamic Stability

Hemodynamic stability refers to the maintenance of adequate blood circulation and perfusion pressure to vital organs, particularly the brain, heart, and kidneys. It is a critical parameter during **perioperative care**, **critical illness**, and **trauma resuscitation**.

Key Parameters

Hemodynamic status is typically assessed by monitoring:

- **Blood pressure (BP)**: systolic, diastolic, mean arterial pressure (MAP)
- **Heart rate (HR) and rhythm**
- **Cardiac output (CO) and stroke volume (SV)**
- **Central venous pressure (CVP)**
- **Peripheral perfusion**: capillary refill, skin temperature, lactate
- **Urine output**: indirect marker of renal perfusion

Definitions

- **Stable**: Adequate BP (MAP \geq 65 mmHg), normal HR, good perfusion signs
- **Unstable**: Hypotension (MAP < 60–65 mmHg), tachycardia or bradycardia, signs of hypoperfusion (oliguria, confusion, mottling)

Causes of Instability

- **Hypovolemia**: hemorrhage, dehydration
- **Cardiogenic**: myocardial infarction, arrhythmias
- **Distributive**: sepsis, anaphylaxis
- **Obstructive**: tension pneumothorax, cardiac tamponade, pulmonary embolism

Clinical Importance

- Guides fluid therapy, vasopressor/inotrope use, and monitoring strategies
- Essential for safe anesthesia and surgical outcomes
- Unstable hemodynamics increase risk of **organ failure**, **stroke**, or **death**

Management Strategies

- **Fluids**: crystalloids, colloids, blood products
- **Vasopressors**: norepinephrine, phenylephrine, vasopressin
- **Inotropes**: dobutamine, epinephrine
- **Monitoring**: invasive BP, arterial line, echocardiography, advanced hemodynamic devices (e.g. PiCCO, FloTrac)

Example: Craniotomy and Hemodynamics

In neurosurgical patients:

- Sudden increases in BP may raise **intracranial pressure (ICP)**
- Scalp block or adequate analgesia helps maintain stability during craniotomy
- Hypotension should be avoided to preserve cerebral perfusion pressure ($CPP = MAP - ICP$)

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