**POSTCARDIOTOMY LOW CARDIAC OUTPUT MANAGEMENT**

**ENVIRONMENT**
- INTENSIVE CARE UNIT

**RESPONSIBLE STAFF**
- ICU PHYSICIANS
- NURSE STAFF

**OBJECTIVE**
- POSTCARDIOTOMY PATIENT WITH LOW CARDIAC OUTPUT

**GENERAL HEMODYNAMIC MONITORIZATION**
- CONTINUOUS EKG
- INVASIVE ARTERIAL BLOOD PRESSURE MONITORIZATION
- CENTRAL VENOUS PRESSURE
- FLUID BALANCE

**LOW RISK PATIENT**
- Severe systolic disfunction
- Moderate-severe pulmonary hypertension
- Chronic cardiomyopathy Surgery
- Combined heart surgery (valvular+CABG)
- Mitral or Mitral-Aortic valve surgery
- Intraoperative complications

**HIGH RISK PATIENT**
- CONTINUOUS INVASIVE CARDIAC OUTPUT MONITORING (SWAN GANZ CATHETER)

**HEMODYNAMIC GOALS**
- MAP ≥ 70 mmHg (Individualize)
- SBP ≥ 90 mmHg
- PAWP 10-15 mmHg
- CVP 8-12 mmHg
- CI 2.2 L/min/m²
- Lactic acid < 2 mmol/L
- SVR 800-1600 dyn.sec/cm⁵
- SvO₂ ≥ 65% or ScvO₂ ≥ 70%
- Urine output >0.5 ml/kg/h
- SpO₂ >95%

**Abbreviations:**
- CABG: Coronary Artery Bypass Grafting; CI: Cardiac Index; CVP: Central Venous Pressure; EKG: Electrocardiogram; MAP: Mean Arterial Pressure; PAWP: Pulmonary Arterial Wedge Pressure; SBP: Systolic Blood Pressure; SvO₂: Mixed Venous Oxygen Saturation; ScvO₂: Central Venous Oxygen Saturation; SpO₂: Peripheral Capillary Oxygen Saturation; SVR: Systemic Vascular Resistance.
**LOW PRELOAD**
- PAWP < 10 mmHg
- PPV > 13%
- IVC > 50%

**NORMAL PRELOAD**

**HIGH PRELOAD**
- PAWP > 10 mmHg
- PPV < 13%
- IVC < 50%

**PRELOAD OPTIMIZATION**
- VOLUME LOAD

**NORMAL BP**
- MAP 70-80 mmHg

**HIGH BP**
- MAP > 85 mmHg

**LOW BP**
- MAP < 70 mmHg

**DOBUTAMINE**
OR Levosimendan
OR Milrinone

**VASODILATORS + DOBUTAMINE**
OR Levosimendan
OR Milrinone

**DOBUTAMINE + NORADRENALINE**
OR Adrenaline

**PERSISTENCE OF INSTABILITY**

**STABILIZATION**
- **Hemodynamic goals achieved**

**TREATMENT OPTIMIZATION**

**MECHANICAL SUPPORT**
- IABP/CIRCULATORY ASSISTANCE

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* Usually only one inotropic agent is used, but in selected cases, can be necessary the administration of more than one inotropic agent, seeking synergic effect.  
** Hemodynamic goals were presented in the previous chart.

BP: Blood Pressure; IABP: Intra-aortic Balloon Pump; IVC: Inferior Vena Cava; MAP: Mean Arterial Pressure; PAWP: Pulmonary Arterial Wedge Pressure; PPV: Pulse Pressure Variation.
RIGHT VENTRICULAR DISFUNCTION

CONSIDER INICIATION OF ADVANCED HEMODYNAMIC MONITORIZATION
ECHOCARDIOGRAM/CONTINUOUS INVASIVE CARDIAC OUTPUT MONITORING

NORMAL BP
MAP 70-80 mmHg

- INOTROPES: Dobutamine
  Or Levosimendan
  Or Milrinone
+ VASODILATORS: Nitroglycerine
*IF PULMONARY HYPERTENSION:
Inhaled or IV Pulmonary vasodilators

LOW BP
MAP < 70 mmHg

- INOTROPES: Dobutamine
  Or Levosimendan
  Or Milrinone
+ VASOCONSTRICTOR: Noradrenaline
  Or Adrenaline
*IF PULMONARY HYPERTENSION:
Inhaled Pulmonary vasodilators.

PERSISTENCE OF INSTABILITY

TREATMENT OPTIMIZATION

MECHANICAL SUPPORT
IABP/CIRCULATORY ASSISTANCE

STABILIZATION
**Hemodynamic goals achieved

* If right ventricular filling volume is low or PAWP/CVP>1 and CVP <10 mmHg proceed to give volume load. Preload optimization with close monitorization and reevaluate. If PAWP/CVP <1 and rapidly increasing, or CVP >15 without cardiac output increase DO NOT GIVE VOLUME LOAD.
** Hemodynamic goals were presented in the previous chart.

BP: Blood Pressure; CVP: Central Venous Pressure; IABP: Intra-aortic Balloon Pump; IV: Intravenous; MAP: Mean Arterial Pressure; PAWP: Pulmonary Arterial Wedge Pressure.
INOTROPE AGENTS WITHDRAWAL

INICATE PROTOCOL WHEN 30 MIN POST-OP OR 1 HOUR POST-OP IF INOTROPIC AGENTS WERE INITIATED IN THE ICU

PROCEED IF CORRECT HEMODYNAMIC GOALS ARE ACHIEVED

↓ 1 μg/kg/min DOBUTAMINE EVERY HOUR
↓ 0.02 μg/kg/min NORADRENALINE EVERY HOUR

WITHDRAWAL RATE: DECREASE BY HALF

RESTART RATE OF WITHDRAWAL AFTER ONE HOUR OF STABILIZATION

RE_EVALUATE PRELOAD: +/- VOLUME LOAD

CONTINUE WITH SAME WITHDRAWAL RATE

INCREASE TO PREVIOUS VASOACTIVE DOSAGE

OBJECTIVES
CI >2.2 L/min/m²
URINE OUTPUT >0.5 ml/kg/h
GOOD PERFUSION SIGNS
HEMODYNAMIC STABILITY

IF AFTER 3 CYCLES HEMODYNAMIC GOALS ARE NOT ACHIEVED STOP PROTOCOL UNTIL FURTHER PHYSICIAN INDICATIONS