ICR-CS-017

Cardiology · critical care

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CRITICAL CARE ORDER SET

Cardiogenic Shock

ICU management of cardiogenic shock. Establish invasive monitoring, define the hemodynamic profile by echo ± PAC, and restore perfusion with norepinephrine and an inotrope rather than reflexive fluids. Identify and treat the cause — emergent revascularization for ACS — and escalate early to mechanical circulatory support for shock refractory to optimized vasoactives. Adapt every dose to your institutional protocol and the patient in front of you.

PATIENT	MRN	WEIGHT (KG)	SCAI STAGE
ALLERGIES	**ETIOLOGY / LVEF**	**ORDERING CLINICIAN**	**DATE / TIME**

01 Monitoring & access

LEVEL OF CARE / DISPOSITION

- [ ] **ICU level of care**
- [ ] Continuous cardiac monitoring and pulse oximetry
- [ ] **Arterial line** for invasive BP — site: radial (preferred) or femoral
- [ ] **Central venous catheter** (e.g., right IJ) — for vasopressors / inotropes, CVP / $ScvO_2$

Hemodynamic monitoring — if available

- [ ] Consider **pulmonary artery catheter** if unclear volume status, mixed shock picture, or complex valvular / RV pathology

TARGET PARAMETERS — MODIFY PER PATIENT

MAP ≥ 65 mmHg

CI ≥ 2.2 L/min/m²

PCWP **~15–18 mmHg** (if PAC)

$ScvO_2$ ≥ **60–70%**

VITAL SIGNS & ASSESSMENTS

- [ ] Vital signs (incl. MAP) **q15 min** until stable, then **q1 h**
- [ ] Strict I/O; urinary catheter with hourly output
- [ ] Neuro checks (if not sedated / paralyzed) **q1–2 h**

02 Diagnostics / initial evaluation

LABORATORY STUDIES — STAT, THEN Q4–6 H AS INDICATED

- [ ] CBC with differential
- [ ] VBG or ABG with **lactate**
- [ ] BNP or NT-proBNP
- [ ] Type & screen ± crossmatch
- [ ] Blood cultures × 2 (if concern for sepsis-triggered shock)
- [ ] CMP (incl. Mg, PO_4)
- [ ] Troponin, CK-MB
- [ ] Coagulation: PT/INR, aPTT, fibrinogen
- [ ] Serum glucose; HbA1c (once)
- [ ] D-dimer if PE in the differential

IMAGING / BEDSIDE TESTS

- [ ] **12-lead ECG** (repeat with any change in status)
- [ ] Portable chest x-ray
- [ ] **Urgent TTE** — LV/RV function, valvular lesions, pericardial effusion, IVC, estimated filling pressures
- [ ] Consider CT pulmonary angiography if PE suspected and stable enough
- [ ] Consider coronary angiography / cath lab activation if acute MI suspected and patient appropriate

03 Airway, breathing & oxygenation

TARGET Goal SpO_2 **≥ 92%** (modify in chronic hypercapnia). Device — NC vs HFNC vs NIPPV vs mechanical ventilation by distress / pulmonary edema.

NONINVASIVE VENTILATION — ACUTE CARDIOGENIC PULMONARY EDEMA, NO CONTRAINDICATION

BiPAP initial settings — example

IPAP **10–14** cm H_2O | EPAP **5–8** cm H_2O | FiO_2 → SpO_2 ≥ 92%

INTUBATION & MECHANICAL VENTILATION — IF NEEDED

- [ ] Indications: refractory hypoxemia, exhaustion, AMS, shock severity

Rapid sequence induction

- [ ] Etomidate **0.2–0.3 mg/kg IV** once (hemodynamically more stable)

OR

- [ ] Ketamine **0.5–1 mg/kg IV** once (caution in catecholamine-depleted states)
- [ ] Rocuronium **1–1.2 mg/kg IV** once

Post-intubation — volume A/C, initial

V_t **6–8 mL/kg PBW** | RR **16–22/min** (to pH / CO_2)

PEEP **5–10 cm H_2O** (oxygenation vs preload) | FiO_2 start 1.0, titrate down

04 Hemodynamic targets

MAP ≥ **65 mmHg** (higher in chronic HTN)

SBP ≥ **90 mmHg** (unless individualized)

Urine output ≥ **0.5 mL/kg/h**

Lactate clearance over time

AVOID Tachycardia > 120/min where possible.

05 Fluid management

CAUTION **Avoid reflexive large-volume boluses.**

IF NO CLEAR OVERLOAD & FILLING PRESSURES UNKNOWN

- [ ] **Diagnostic bolus: 250 mL** balanced crystalloid (LR / Plasma-Lyte) IV over 15–30 min while monitoring MAP, CVP (if available), lung exam, ultrasound IVC / LV
- [ ] Repeat × 1 if clear improvement and no signs of pulmonary congestion

IF CLINICAL / ECHO EVIDENCE OF OVERLOAD

- [ ] **No bolus** — proceed directly to vasoactive agents and diuretics

MAINTENANCE

- [ ] Minimal maintenance fluids — e.g., D5 ½NS or Plasma-Lyte at **`25–50 mL/h`**, adjusted for drug carriers and PO intake

06 Vasoactive medications

Orders presume central access; titrate to MAP, perfusion, and side effects.

1 Norepinephrine · first-line vasopressor with hypotension

- [ ] Start **`0.02–0.05 mcg/kg/min`** IV infusion
- [ ] Titrate by **`0.02–0.05 mcg/kg/min`** q5–10 min; usual range 0.02–0.5 (higher in refractory shock)
- [ ] Goal MAP ≥ 65 mmHg and adequate perfusion; central preferred, may start peripheral while obtaining access

2 Vasopressin · adjunct in refractory hypotension

- [ ] Fixed-dose **`0.03 units/min`** IV continuous (do not titrate by BP; adjust catecholamines instead)
- [ ] Avoid > 0.04 units/min (ischemia risk)

3 Epinephrine · alt vasopressor / inotrope — watch arrhythmias, lactate

- [ ] Start **`0.01–0.03 mcg/kg/min`**; titrate by 0.01–0.03 q5–10 min; usual range 0.01–0.3
- [ ] Consider mainly for marked LV dysfunction with hypotension & bradycardia, or 2nd-line when NE ± inotrope insufficient

07 Inotropic support

Select by BP, arrhythmia risk, and suspected RV vs LV predominance.

Dobutamine · classic inotrope for low-output state

- [ ] Start **`2.5–5 mcg/kg/min`**; titrate by 2.5 q10–20 min; typical 2.5–20

CAUTION Severe hypotension (MAP < 60–65) without adequate vasopressor support · rapid AF or VT propensity.

Milrinone · PDE-3 inhibitor — beta-blockade, RV failure; watch BP & kidneys

- [ ] Generally **omit loading dose** in shock (hypotension risk)
- [ ] Start infusion **`0.125–0.25 mcg/kg/min`**; titrate by 0.1–0.125 q1–2 h; max ~0.75

RENAL ADJUSTMENT

- [ ] CrCl 30–50: consider 0.125–0.25 max · CrCl < 30: lower end, slower titration

08 Vasodilator therapy — only when BP allows

WHEN Afterload reduction needed (hypertensive cardiogenic pulmonary edema, acute MR) **and MAP adequate** (e.g., ≥ 70–75 mmHg, individualized).

Nitroprusside

- [ ] Start **`0.3–0.5 mcg/kg/min`**; titrate by 0.2–0.5 q5–10 min
- [ ] Usual max 10 mcg/kg/min in short bursts; chronic high doses risk cyanide / thiocyanate toxicity — require invasive BP & tight ICU monitoring

Nitroglycerin · esp. ischemia & pulmonary edema with preserved BP

- [ ] Start **`5–10 mcg/min`**; titrate by 5–10 q5–10 min; usual range 10–200
- [ ] Monitor BP, headache, tolerance

09 Diuretics — for volume overload / pulmonary edema

Furosemide · or bumetanide per local practice

- [ ] If diuretic-naïve: **furosemide `20–40 mg IV`** bolus once
- [ ] If on chronic oral loop: IV dose ~1–2× total oral daily dose (e.g., 40–80 mg IV)
- [ ] May repeat q4–6 h, or infusion **`5–10 mg/h`**, titrate by 5 mg/h to 40 mg/h as needed

- [ ] Add thiazide (metolazone **2.5–5 mg PO**) if diuretic resistance and BP tolerates

10 Antiplatelet / anticoagulation

Tailor to etiology (ACS, LV thrombus, devices).

Suspected / confirmed ACS (NSTEMI / STEMI) — verify with cardiology & cath lab protocol

ASPIRIN

- [ ] Load **162–325 mg PO** chewed once (if not prehospital); maintenance 81 mg PO daily

P2Y₁₂ INHIBITOR

- [ ] Ticagrelor **180 mg PO** once, then 90 mg BID

OR

- [ ] Clopidogrel **600 mg PO** once, then 75 mg daily

ANTICOAGULATION — UFH INFUSION

- [ ] Bolus **60–70 units/kg IV** (max ~4000–5000); infusion **12–15 units/kg/h**; titrate to aPTT / anti-Xa per protocol

Prophylactic anticoagulation — if not full-dose

- [ ] Enoxaparin **40 mg SC daily** or UFH **5000 units SC q8–12 h** (adjust for BMI, renal function, bleeding risk)

11 Disease-specific / definitive therapies

Acute MI–related cardiogenic shock

- [ ] **Consult cardiology STAT**; coronary angiography ± PCI emergently
- [ ] Avoid routine IV beta-blockers in the acute shock phase
- [ ] Start high-intensity statin when feasible — atorvastatin **80 mg PO daily**

Mechanical circulatory support — consider early

- [ ] Immediate cardiology / cardiothoracic surgery / heart failure consultation

OPTIONS

- [ ] Intra-aortic balloon pump (IABP)
- [ ] Impella device
- [ ] TandemHeart
- [ ] Veno-arterial ECMO

INDICATIONS

- [ ] Persistent shock with ongoing hypoperfusion despite adequate vasoactive optimization; potential bridge to recovery, PCI, surgery, transplant, or LVAD

Specific etiologies

- [ ] **Acute severe MR / VSD post-MI:** afterload reduction (if BP tolerates), mechanical support, emergent surgical consult
- [ ] **RV infarction:** maintain adequate preload (cautious volume), avoid excessive PEEP & nitrates, consider dobutamine / milrinone; careful vasopressors

12 Sedation, analgesia & delirium — intubated patients

Analgesia first

- [ ] Fentanyl `25–50 mcg IV q15 min PRN` pain / dyspnea, or infusion `25–100 mcg/h`; titrate to behavioral pain score

Sedation

- [ ] Propofol start `5–10 mcg/kg/min`; titrate by 5–10 q5–10 min; usual 5–50

MONITOR BP, triglycerides, PRIS risk with high dose > 50–70 mcg/kg/min for prolonged periods.

- [ ] Alt / adjunct: dexmedetomidine `0.2–0.7 mcg/kg/h` (avoid large bolus; watch bradycardia / hypotension)

Delirium prevention & management

- [ ] Daily sedation interruption as tolerated; nonpharmacologic measures
- [ ] Antipsychotics PRN (e.g., haloperidol `1–2 mg IV q4–6 h PRN`) depending on QTc and other risks

13 Glycemic control

- [ ] Insulin sliding scale or infusion per ICU protocol; typical target `140–180 mg/dL`

- [ ] POC glucose **q1–2 h** on infusion or **q4–6 h** on subcutaneous

14 Electrolyte management

TARGETS **K^+ ≥ 4.0 mEq/L** in shock / arrhythmia risk · **Mg^{2+} ≥ 2.0 mg/dL**.

- [ ] **Potassium:** KCl **10–20 mEq IV** over 1 h, repeat as needed; or oral 20–40 mEq PO if gut function and stable
- [ ] **Magnesium:** magnesium sulfate **2 g IV** over 1 h; may repeat; higher (4–6 g) for torsades / VT scenarios

15 Code status & communication

DOCUMENT DISCUSSION WITH PATIENT / SURROGATE

- [ ] Code status (full code vs DNR / DNI, etc.)
- [ ] Goals of care — possible MCS, ICU course, potential for recovery vs chronic advanced HF
- [ ] Engage palliative care early in very high-risk or recurrent shock cases