ICR-PED-015

Pulmonary · critical care

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CRITICAL CARE ORDER SET

Pulmonary Edema

ICU management of acute pulmonary edema. Support oxygenation first — early NIV for cardiogenic edema — then diurese, offload with vasodilators when the pressure tolerates it, and support the failing pump. Classify cardiogenic vs noncardiogenic early and treat the underlying cause. Adapt every dose to your institutional protocol and the patient in front of you.

PATIENT	MRN	WEIGHT (KG)	TYPE — CARDIOGENIC / NON
ALLERGIES	**DRY WEIGHT / LVEF**	**ORDERING CLINICIAN**	**DATE / TIME**

01 Admission & level of care

- [ ] Admit / remain in **ICU** — critical care, ventilator-capable bed
- [ ] Diagnosis: **acute pulmonary edema** — specify: [ ] cardiogenic [ ] noncardiogenic [ ] mixed
- [ ] Code status: [ ] Full code [ ] DNR [ ] DNI [ ] Other: _____

02 Monitoring & nursing

- [ ] Continuous cardiac monitoring (telemetry)
- [ ] Continuous pulse oximetry

- [ ] Noninvasive BP at least **q15 min** until stable, then per ICU protocol
- [ ] Strict intake & output; record **q1 h**
- [ ] Daily weights (bed scale if needed)

LINES & CATHETERS

- [ ] Foley catheter for close urine output monitoring — insert now; reassess need daily
- [ ] Arterial line for continuous BP (if unstable or on vasopressors)
- [ ] Central venous access (vasopressors, multiple infusions, or poor peripheral access)

03 Oxygenation & ventilation

TARGET SpO_2 **92–96%** (adjust for COPD / hypercapnia). Early NIV is first-line for cardiogenic edema and often averts intubation.

OXYGEN DELIVERY

- [ ] Nasal cannula: **1–6 L/min**
- [ ] Simple mask: **6–10 L/min**
- [ ] Non-rebreather mask: **10–15 L/min**
- [ ] High-flow nasal cannula: **up to 40–60 L/min**, FiO_2 **0.4–1.0**

NONINVASIVE VENTILATION — IF NO CONTRAINDICATIONS (ESP. CARDIOGENIC)

- [ ] BiPAP: IPAP **10–20 cm H_2O**, EPAP **5–10 cm H_2O**, FiO_2 titrate to SpO_2 goal

OR

- [ ] CPAP: **8–12 cm H_2O**, FiO_2 titrate to SpO_2 goal
- [ ] ABG / VBG now, then per clinical status

CONSIDER EARLY INTUBATION IF

- [ ] Inability to protect airway
- [ ] Refractory hypoxemia (PaO_2 < 60 mmHg on high FiO_2 / NIV)
- [ ] Worsening hypercapnia or pH < 7.25
- [ ] Hemodynamic instability with respiratory fatigue

IF INTUBATED

- [ ] Lung-protective ventilation; initial V_t **~6–8 mL/kg IBW**
- [ ] Initial PEEP **5–10 cm H_2O**; adjust per oxygenation / hemodynamics

- [ ] FiO_2 `0.4–1.0` to maintain SpO_2 goal
- [ ] Daily SBT readiness checklist

04 Hemodynamic management

VITAL SIGN TARGETS — MODIFY PER PATIENT

- [ ] MAP ≥ `65 mmHg`
- [ ] SBP target: `___ – ___ mmHg`

CARDIAC ASSESSMENT

- [ ] **STAT 12-lead EKG**; continuous ECG monitoring for ischemia / arrhythmia
- [ ] Point-of-care ultrasound (if available): lungs + cardiac + IVC
- [ ] Echocardiogram (TTE) — LV/RV function, valves, filling pressures

05 Diuretics — first-line for volume overload / cardiogenic edema

- [ ] Check BMP, Mg, phosphate prior to or with first dose

Loop diuretic — furosemide

- [ ] **Furosemide `20–80 mg IV`** bolus (higher end if chronic loop use / severe congestion). If on home PO furosemide, give ≥ equivalent IV dose (e.g., 1–2× home PO dose)

IF INADEQUATE DIURESIS — URINE OUTPUT < 100–150 ML/H AFTER 1–2 H

- [ ] Repeat furosemide `40–80 mg IV`

OR

- [ ] Furosemide infusion `5–20 mg/h IV` (after loading bolus)

Alternative loop diuretics

- [ ] Bumetanide `0.5–2 mg IV`
- [ ] Torsemide `10–40 mg IV`

Diuretic augmentation — if diuretic resistance

- [ ] Metolazone `2.5–5 mg PO` (30–60 min before loop)

- [ ] Chlorothiazide **500–1000 mg IV**

ELECTROLYTE REPLACEMENT & DAILY LABS

- [ ] Replete **K^+ ≥ 4.0 mEq/L** and **Mg^{2+} ≥ 2.0 mg/dL** per protocol
- [ ] Daily labs: BMP, Mg, phosphate

06 Vasodilators — hypertensive cardiogenic edema with adequate BP

INDICATION SBP **> 140–160 mmHg AND** no hypotension or cardiogenic shock.

NITROGLYCERIN

- [ ] SL nitroglycerin **0.4 mg q5 min × up to 3 doses** PRN severe dyspnea / hypertension
- [ ] IV nitroglycerin infusion — start **5–20 mcg/min**, titrate by 5–20 mcg/min q3–5 min to symptom relief & target BP (range 10–200 mcg/min)

NITROPRUSSIDE — EXPERIENCED STAFF & INVASIVE MONITORING

- [ ] IV nitroprusside — start **0.3–0.5 mcg/kg/min**, titrate by 0.5 mcg/kg/min q5–10 min up to 3–5 mcg/kg/min (avoid in severe renal / hepatic failure; watch cyanide toxicity)

07 Vasopressors / inotropes — hypotension or cardiogenic shock

IF MAP < 65 MMHG DESPITE VOLUME OPTIMIZATION

- [ ] **Norepinephrine infusion** — start **0.01–0.05 mcg/kg/min**, titrate to MAP goal (up to 0.5–1 mcg/kg/min per protocol)

LOW CARDIAC OUTPUT STATE / CARDIOGENIC SHOCK — PER ECHO / HEMODYNAMICS

- [ ] **Dobutamine infusion** — start **2.5–5 mcg/kg/min**, titrate by 2.5 mcg/kg/min up to 10–20 mcg/kg/min as tolerated
- [ ] Consider milrinone **0.125–0.375 mcg/kg/min** per cardiology / ICU attending
- [ ] Consider arterial line and advanced hemodynamic monitoring

08 Fluid management

- [ ] Fluid restriction: total fluids (IV + PO) **1000–1500 mL/day**; adjust by weight, Na, congestion
- [ ] Avoid maintenance IV fluids unless clearly indicated
- [ ] Stop / minimize hypotonic fluids and excessive IV medications / flushes

DAILY NET FLUID BALANCE GOAL

- [ ] Negative **500–1000 mL/day** · [ ] Other: ____

ESCALATE DIURESIS IF

- [ ] Weight increases ≥ 1 kg/day
- [ ] Persistent crackles or edema
- [ ] Rising BNP with evidence of volume overload

09 Workup & diagnostics

- [ ] **Chest x-ray (portable) now**; repeat as clinically indicated

LABORATORY STUDIES

- [ ] CBC with differential
- [ ] LFTs
- [ ] BNP or NT-proBNP
- [ ] ABG / VBG
- [ ] BMP, Mg, phosphate
- [ ] Coagulation (PT/INR, aPTT) if indicated
- [ ] Cardiac biomarkers (troponin ± CK-MB)
- [ ] Lactate (if shock suspected)

CARDIAC EVALUATION

- [ ] 12-lead EKG now; repeat if chest pain or rhythm change
- [ ] Transthoracic echocardiogram (order STAT / urgent)

INFECTIOUS WORKUP — IF PNEUMONIA / SEPSIS SUSPECTED

- [ ] Blood cultures × 2
- [ ] Respiratory viral panel
- [ ] Sputum Gram stain / culture
- [ ] Procalcitonin (per institutional practice)

OTHER / ETIOLOGIC WORKUP AS INDICATED

- [ ] D-dimer ± CT pulmonary angiography for PE suspicion
- [ ] Autoimmune / vasculitis labs (if noncardiogenic / inflammatory cause suspected)

10 Etiology-specific therapies

Cardiogenic edema / acute decompensated HF

CONTINUE / INITIATE CHRONIC HF THERAPIES AS HEMODYNAMICS ALLOW

- [ ] ACEi (lisinopril 2.5–10 mg PO daily) / ARB (losartan 25–100 mg PO daily) / ARNI (sacubitril-valsartan 24/26–97/103 mg PO BID)
- [ ] Beta-blocker (metoprolol succinate 12.5–200 mg PO daily as tolerated)
- [ ] MRA (spironolactone 12.5–25 mg PO daily)
- [ ] SGLT2 inhibitor (dapagliflozin or empagliflozin 10 mg PO daily)

CARDIOLOGY CONSULT FOR

- [ ] Refractory pulmonary edema · ACS / ischemia · advanced HF therapies (IABP, Impella, ECMO, transplant, LVAD)

Noncardiogenic edema / ARDS — sepsis, aspiration, TRALI, negative pressure, high altitude

TREAT UNDERLYING CAUSE

- [ ] Broad-spectrum antibiotics per local antibiogram — e.g., piperacillin–tazobactam 3.375–4.5 g IV q6–8h ± vancomycin 15–20 mg/kg IV q8–12h (renal-adjust)
- [ ] Aspiration precautions; consider bronchoscopy if indicated
- [ ] Transfusion reaction management if TRALI / TACO suspected

ARDS STRATEGY — IF MEETS CRITERIA

- [ ] Low tidal volume (4–6 mL/kg IBW)
- [ ] Higher PEEP per ARDSNet / local protocol
- [ ] Prone positioning ≥ 16 h/day for moderate–severe ARDS
- [ ] Conservative fluid strategy

Specific etiologies / situations

- [ ] Hypertensive emergency — IV antihypertensives (nicardipine 2.5–15 mg/h, or labetalol 10–20 mg IV q10 min / infusion 0.5–2 mg/min)
- [ ] ACS protocol — aspirin 162–325 mg PO/chew, P2Y12 inhibitor, anticoagulation, statin, emergent cath as indicated

- [ ] Renal failure / diuretic resistance — nephrology consult; consider urgent hemodialysis or ultrafiltration

11 Symptom control & adjuncts

ANALGESIA / ANXIOLYSIS — AVOID OVERSEDATION

- [ ] Low-dose opioid for severe dyspnea — morphine 1–2 mg IV q2–4h PRN or hydromorphone 0.2–0.4 mg IV q3–4h PRN
- [ ] Short-acting anxiolytic — lorazepam 0.5–1 mg IV/PO q4–6h PRN

> **CAUTION** Avoid routine morphine for acute HF — reserve for selected cases; monitor BP and respiration.

DVT PROPHYLAXIS — UNLESS CONTRAINDICATED

- [ ] Enoxaparin `40 mg SC daily` (renal-adjusted 30 mg SC daily)
- [ ] UFH `5000 units SC q8–12h`
- [ ] Mechanical prophylaxis: SCDs

STRESS ULCER PROPHYLAXIS — IF INTUBATED, COAGULOPATHIC, OR HIGH RISK

- [ ] PPI (pantoprazole 40 mg IV/PO daily) or H_2 blocker (famotidine 20 mg IV/PO q12h, renal-adjusted)

12 Daily reassessment & de-escalation

- [ ] Reassess respiratory status and need for NIV / ventilator daily
- [ ] Reassess hemodynamics, diuretic dose, and fluid balance daily

TITRATE / WEAN

- [ ] Oxygen
- [ ] NIV settings
- [ ] Vasopressors / inotropes

EVALUATE FOR STEP-DOWN ONCE

- [ ] Off vasopressors ≥ 24 h
- [ ] Stable on ≤ 4 L/min NC or equivalent

- [ ] No acute interventions anticipated

EDUCATIONAL USE ONLY

Not a substitute for clinical judgement. Verify doses, allergies, renal function, and contraindications. Adapt all agents, targets, and thresholds to your institutional protocols, formulary, and the individual patient.

Spreading knowledge
Improving outcomes