ICR-ICH-027

Neurocritical care

Updated 21 Jun 2026

CRITICAL CARE ORDER SET

Intracranial Bleeding

ED-to-ICU management of spontaneous intracerebral hemorrhage. Move fast on the first hour — secure the airway, lower the pressure, reverse the coagulopathy, and call neurosurgery — then characterize the clot, watch for expansion, and control ICP. Adapt every threshold to your protocol and the individual patient.

PATIENT	MRN	LAST KNOWN WELL	GCS / ICH SCORE
ALLERGIES	ANTICOAGULANT / ANTIPLATELET	ORDERING CLINICIAN	ATTENDING

01 First-hour checklist, admission & baseline studies

HOUR-1 Assess airway and need for intubation · establish **last known well** · screen for anticoagulant use needing reversal · calculate GCS and examine pupils · lower the blood pressure · reverse coagulopathy · call neurosurgery.

RAPID CHECKLIST

- [ ] Assess airway and intubation need (see Section 4)
- [ ] Document last known well; ask about anticoagulant / antiplatelet use requiring reversal
- [ ] Calculate **GCS** and examine both pupils

LOCATION / MONITORING

- [ ] Admit / transfer to **Neurocritical care / ICU**

- [ ] Continuous cardiac monitoring; noninvasive BP **q5–15 min** until stable, then per unit protocol
- [ ] Arterial line for continuous BP and frequent ABGs
- [ ] Neuro checks **q1 h** (or more frequently per neurosurgery); document ICP / CPP targets if monitor placed

IMAGING

- [ ] **CT head without contrast STAT** — assess hematoma volume, location, intraventricular extension
- [ ] Repeat CT head per neurosurgery (e.g., **6–24 h**, or with neurologic change)

LABORATORY STUDIES — STAT

- [ ] CBC with differential **and platelet count**
- [ ] Coagulation — PT/INR, aPTT, fibrinogen
- [ ] **Thrombin time** if dabigatran suspected
- [ ] Serum osmolality if osmotic therapy planned
- [ ] ABG if intubated / respiratory compromise
- [ ] CMP (Na, creatinine, liver tests)
- [ ] Type & screen (type & cross if large bleed)
- [ ] **Anti-factor Xa level** if Xa-inhibitor suspected (apixaban / rivaroxaban)
- [ ] Troponin, CK if clinically indicated
- [ ] Serum ethanol / tox screen if clinically indicated

02 Hematoma characterization & severity scores

> **COMMUNICATION** These tools standardize description and risk-stratify — the **ICH Score is a communication aid, not a definitive prognostic predictor**.

HEMATOMA VOLUME — ABC/2 METHOD

- [ ] Estimate volume for parenchymal blood: **A × B × C ÷ 2** — **A** = greatest diameter, **B** = diameter perpendicular to A, **C** = number of slices showing blood × slice thickness (cm)

LOCATION SIGNIFICANCE

- [ ] **Basal ganglia / thalamus / cerebellum / pons** → suggests hypertensive hemorrhage
- [ ] **Lobar** → suggests cerebral amyloid angiopathy or arteriovenous malformation

- [ ] **Intraventricular** → may require external ventricular drain
- [ ] **Infratentorial** → worse prognosis

ICH Score · total 0–6	
GCS 3–4	2
GCS 5–12	1
GCS 13–15	0
Volume ≥ 30 mL	1
Volume < 30 mL	0
Intraventricular hemorrhage	1
Infratentorial origin	1
Age > 80 years	1

Expansion risk · > 3 = 83% accuracy	
Blend sign present	1
Blend sign absent	0
Any hypodensity present	2
Any hypodensity absent	0
Onset → NCCT < 2.5 h	2
Onset ≥ 2.5 h / unknown	0

Spot sign — contrast extravasation (if CTA done) indicates active bleeding. **Blend sign** — hypo + hyperdense mix > 18 HU difference.

03 Neurologic & hemodynamic targets

BLOOD PRESSURE

SBP **130–160 mmHg** (spontaneous ICH, no LVO). MAP per neurosurgery (e.g., 65–80) and CPP goal (CPP = MAP – ICP).

ICP / CPP (IF MONITORED)

ICP **< 20–22 mmHg**; CPP **60–70 mmHg** (individualize).

SERUM SODIUM (IF HYPEROSMOLAR)

Target **145–155 mEq/L**; upper safety limit **160 mEq/L**.

POSITIONING

Head of bed **30°**, neck neutral, avoid jugular compression.

04 Airway, breathing, ventilation

WATCH Reassess the airway continuously — the hematoma may keep expanding and threaten consciousness and airway, especially in **posterior fossa bleeds**. Frequent early neuro exams catch deterioration in time to act.

AIRWAY PROTECTION

- [ ] Intubate any patient unable to protect the airway, rapidly declining consciousness, or **GCS ≤ 8** — also for refractory agitation or need for hyperventilation
- [ ] RSI with etomidate / propofol + rocuronium or succinylcholine per local protocol

VENTILATOR TARGETS

- [ ] **PaO_2 > 80 mmHg**, **SpO_2 > 94%**
- [ ] **$PaCO_2$ 35–40 mmHg**
- [ ] Avoid prophylactic hyperventilation; reserve **$PaCO_2$ ~30–35 mmHg** only for acute deterioration as a bridge to definitive intervention

05 Blood pressure management

TARGETS Mild–moderate ICH with SBP 150–220 → lower to **SBP 130–150 mmHg**. Severe ICH with SBP > 220 → target less defined; avoid severe hypertension, use clinical judgement. Start immediately, reach goal within the first 1–2 hours, then step down to SBP 140–160 watching for neurologic deterioration.

A · BP LOWERING

Nicardipine

- [ ] Start **5 mg/h IV**, titrate **2.5 mg/h q5–15 min**, max **15 mg/h**
- [ ] Hold / reduce if SBP < 120 or MAP < 65 / hypoperfusion

Clevidipine

- [ ] Start **1–2 mg/h IV**, double q2–5 min; usual **4–12 mg/h**, max **20 mg/h**
- [ ] Avoid in egg / soy allergy, severe lipid disorders

Labetalol

- [ ] **10–20 mg IV** over 2 min, repeat q10 min; max cumulative **300 mg** or infusion **0.5–8 mg/min**
- [ ] Avoid in bradycardia, heart block, decompensated HF, severe asthma

Hydralazine · reserve

- [ ] **5–10 mg IV q20 min PRN**; not first-line — variable response, may raise ICP

B · BP SUPPORT — MAINTAIN CPP

- [ ] **Norepinephrine** start **0.02–0.05 mcg/kg/min IV**, titrate q2–5 min; range **0.02–0.5 mcg/kg/min** to MAP ≥ 65–70 or CPP target
- [ ] Vasopressin adjunct or phenylephrine as secondary options per local practice

06 Reversal of anticoagulants / antiplatelets

REVERSE Reverse any coagulopathy (drug-induced or **INR > 1.3**) immediately. Match the agent to the drug taken.

A · Warfarin / vitamin-K antagonist (elevated INR)

- [ ] **4-factor PCC** (weight + INR based) — INR 2–4: `25 units/kg` (max 2500) · INR 4–6: `35 units/kg` (max 3500) · INR > 6: `50 units/kg` (max 5000); use FFP if PCC unavailable
- [ ] **Vitamin K 10 mg IV** in 50–100 mL NS over 30 min (co-administer with PCC)

B · Direct oral anticoagulants

FACTOR XA INHIBITORS — APIXABAN, RIVAROXABAN, EDOXABAN

- [ ] **Andexanet alfa** (protocolized by agent / last dose) — low-dose: `400 mg IV bolus + 4 mg/min ×120 min`; higher-dose for larger recent doses. Weigh thrombotic risk (esp. ischemic stroke)
- [ ] If andexanet unavailable — **4-factor PCC 50 units/kg IV** (max 5000); incomplete reversal

DABIGATRAN

- [ ] **Idarucizumab 5 g IV** total — two consecutive `2.5 g / 50 mL` infusions
- [ ] **Activated charcoal 50 g** if last dose within 2 h; if idarucizumab unavailable consider FEIBA / 4F-PCC (poorly validated); hemodialysis (nephrology) in renal failure

C · Heparin & low-molecular-weight heparin

- [ ] Stop heparin infusion; **protamine `1 mg / 100 units`** heparin given in last 2–3 h, max `50 mg IV` over 10 min
- [ ] Enoxaparin within 8 h — protamine `1 mg / 1 mg` enoxaparin (or per 100 units dalteparin); 8–12 h — `0.5 mg / 1 mg`; reversal incomplete

D · Antiplatelet agents

PATCH **Routine platelet transfusion is not recommended** — in a randomized trial it was associated with worse outcomes. Reserve for patients going to emergent neurosurgery (surgical patients were excluded from that trial) or profound thrombocytopenia.

- [ ] **DDAVP 0.3–0.4 mcg/kg IV** over 15–30 min ×1 (may repeat in 12–24 h if ongoing bleeding)

- [ ] Platelet transfusion only if surgical candidate or profound thrombocytopenia — keep > `100,000/µL` for active bleeding / pre-neurosurgery

E · Non–drug coagulopathy / thrombocytopenia

- [ ] Platelets to > `100,000/µL`; FFP or PCC for markedly prolonged INR not due to warfarin, if indicated
- [ ] Cryoprecipitate to fibrinogen > `150–200 mg/dL`

07 ICP management & hyperosmolar therapy

NON-PHARMACOLOGIC

- [ ] Head of bed > `30°`, midline neutral neck; avoid tight cervical collars / lines near the neck that impede venous drainage; avoid extreme hip flexion; minimize stimulation; treat pain and agitation
- [ ] Light sedation as needed for comfort in intubated patients (e.g., midazolam); antipyretics if T > 38 °C
- [ ] Isotonic fluids only; **keep serum Na > 135 mEq/L**; repeat CT head for neurologic decline or ICP signs → STAT neurosurgical consult if surgical indicators

PICK ONE Give hyperosmolar therapy via **central line** when clinical or radiographic signs of raised ICP appear — choose one primary agent, don't run mannitol and hypertonic saline together without a clear plan.

Hypertonic saline

- [ ] **3% NaCl infusion** start `0.5–1 mL/kg/h IV`; titrate to Na 145–155 and ICP goal — Na rise ≤ `8–10 mEq/L per 24 h`
- [ ] **3% NaCl bolus** for acute spikes — `250 mL` or `2 mL/kg IV` over 10–20 min
- [ ] **23.4% NaCl** `15–30 mL IV q6h` for elevated intracranial tension
- [ ] Serum Na + osmolality **q4–6h**

Mannitol 20%

- [ ] `0.25–1 g/kg IV` via filter over 10–20 min (start 0.5–0.75 g/kg); repeat **q4–6h PRN**

- [ ] Serum osmolality **q4–6h**; osmolar gap **< ~20–25**, osmolality **< 320 mOsm/kg**; hold if hypotensive / oliguric, ensure MAP and volume status

08 Seizure management & prophylaxis

NO PROPHYLAXIS **Do not give antiseizure medication prophylactically** — treat only actual / suspected seizures. (Prophylaxis is more standard in SAH and some lobar ICH per local protocol.)

WITNESSED / SUSPECTED SEIZURE

- [ ] **Lorazepam 0.1 mg/kg IV** (max 4 mg) over 2 min, may repeat once in 5–10 min
- [ ] Follow with maintenance ASM — **levetiracetam 1000–1500 mg IV load**, then **500–1000 mg q12h** (renal adjust)
- [ ] Alternative — **fosphenytoin 15–20 mg PE/kg IV** at 100–150 mg PE/min, then **4–6 mg PE/kg/day** divided q8–12h; check free/total levels + albumin, watch hypotension / arrhythmia

EEG

- [ ] Continuous / intermittent EEG for coma with unexplained deterioration or suspected nonconvulsive status epilepticus

09 Analgesia, sedation, agitation

PAIN CONTROL

- [ ] Acetaminophen **650–1000 mg PO/NG/PR q6h PRN** (max 3–4 g/day; adjust for liver disease)
- [ ] Fentanyl **25–50 mcg IV q30–60 min PRN**, or infusion titrated to comfort and ICP targets

SEDATION (IF INTUBATED)

- [ ] **Propofol** start **5–20 mcg/kg/min IV**, titrate to RASS / ICP; usual **5–80 mcg/kg/min** (monitor hypotension and propofol infusion syndrome)
- [ ] **Dexmedetomidine** start **0.2–0.3 mcg/kg/h IV**, titrate to **0.2–1.5 mcg/kg/h**; caution in bradycardia / hypotension

- [ ] Neuromuscular blockade only for controlled ventilation and refractory ICP under neurosurgical guidance

10 Temperature, glucose & supportive care

TEMPERATURE & GLUCOSE

- [ ] Normothermia `36–37.5 °C` — acetaminophen, cooling blanket if persistent fever, infectious workup if febrile
- [ ] POC glucose `q1–4 h`; insulin to maintain `140–180 mg/dL`, avoid hypoglycemia

PROPHYLAXIS & FLUIDS

- [ ] DVT — SCDs on admission; pharmacologic (enoxaparin 40 mg SC daily or heparin 5,000 units SC q8–12h) when neurosurgery approves, often `24–48 h` after stable CT
- [ ] Stress ulcer — pantoprazole `40 mg IV/PO daily` (or equivalent)
- [ ] IV fluids — **0.9% NaCl**, avoid hypotonic (0.45% NaCl, D5W); individualize rate, avoid overload and hypotension
- [ ] Daily (or more frequent) CMP; replace K, Mg, Phos per ICU protocol
- [ ] Bowel — docusate + senna PO/NG daily, bisacodyl suppository PRN

11 Surgical interventions & consults

CONSULTS

- [ ] **Neurosurgery STAT**
- [ ] Interventional neuroradiology if aneurysm / AVM suspected
- [ ] Neurology (stroke / epilepsy)
- [ ] Palliative care if poor prognosis / goals-of-care

SURGICAL INDICATIONS — as determined by neurosurgery

- [ ] **Cerebellar ICH ≥ 3 cm** or causing brainstem compression → evacuation
- [ ] **IVH with obstructive hydrocephalus** + neurologic decline → EVD
- [ ] **Hemispheric ICH with mass effect** in patients threatened by herniation or obstructive hydrocephalus
- [ ] Monitor closely for hydrocephalus → EVD + CSF drainage

- [ ] **Decompressive hemicraniectomy** as a lifesaving measure for ongoing deterioration
- [ ] Consider **minimally invasive parafascicular surgery (MIPS)** for lobar ICH `30–80 mL` with GCS 5–14 (emerging evidence); role of minimally invasive surgery still being defined

12 Nursing, safety & documentation

- [ ] Neuro checks + pupil assessment **q1 h** (or per neurosurgery)
- [ ] Foley catheter if clinically indicated
- [ ] Daily sedation awakening trial if neurologically safe
- [ ] Strict I/O; daily weights
- [ ] Restraints per hospital policy if needed for safety
- [ ] Early mobilization and PT / OT when stable