

Emergency Management of Spontaneous Intracerebral Hemorrhage



Madeleine M. Puissant, MD, PhD^{a,b,*}, Jason Hine, MD^{b,c}

KEYWORDS

- Hemorrhagic stroke • Intracerebral hemorrhage (ICH) • Blood pressure
- Anticoagulation reversal • Hematoma expansion • Emergency care

KEY POINTS

- Blood pressure control should be initiated within the first 30 minutes of arrival with intravenous agents that allow smooth careful control.
- Anticoagulation reversal should be provided within the first 30 minutes of arrival—this requires systems for rapid labs, access to reversal agents, and pharmacy participation.
- There is an increased focus on implementing time metrics and bundles of care to elevate ICH care to that of acute ischemic stroke care.
- There is growing support for the role of minimally invasive neurosurgery for select patients at institutions with this expertise.

INTRODUCTION AND EPIDEMIOLOGY

Intracerebral hemorrhage (ICH), bleeding into brain parenchyma, is the most common hemorrhagic stroke and carries significant morbidity and mortality (30%–40%) affecting 80,000 people in the United States each year.^{1–3} Until just a few years ago, guidelines for ICH management and efficacious therapeutic options were sparse, especially in comparison to acute ischemic stroke care. These patients present in critical condition to the emergency department where the initial diagnosis, stabilization, and treatment in a timely fashion is a critical component of patient care, impacting clinical trajectory and patient outcomes. The purpose of this review is to provide an overview and evidence-based strategies for the acute management of ICH in the emergency department.

^a Department of Emergency Medicine, MaineHealth Maine Medical Center, 22 Bramhall Street, Portland, ME 04102, USA; ^b Department of Emergency Medicine, Tufts University School of Medicine, Boston, MA, USA; ^c Department of Emergency Medicine, MaineHealth Maine Medical Center Biddeford, 1 Medical Center Drive, Biddeford, ME 04005, USA

* Corresponding author. Department of Emergency Medicine, MaineHealth Maine Medical Center Portland, ME.

E-mail address: Madeleine.Puissant@MaineHealth.org

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Abbreviations	
AC	anticoagulation
AHA	American Heart Association
ASMs	antiseizure medications
BG	blood glucose
CAA	cerebral amyloid angiopathy
DAPT	dual antiplatelet therapy
DOACS	direct oral anticoagulants
ED	emergency department
EEG	electro encephalography
EIBPL	early intensive blood pressure lowering
EVD	external ventricular drainage
GCS	Glasgow Coma Scale
HE	hematoma expansion
HPI	history of present illness
ICH	intracerebral hemorrhage
ICP	intracranial pressure
IV	intravenous
LMWH	low-molecular weight heparin
PCC	prothrombin complex concentrate
QASC	quality in acute stroke care
SBP	systolic blood pressure

PATHOPHYSIOLOGY

Risk factors for ICH include hypertension; tobacco and alcohol use; chronic liver disease resulting in coagulopathy; dual antiplatelet therapy (DAPT) or anticoagulation use; use of substances including cocaine, heroin, and amphetamine; diabetes; older age and male sex. Hypertension is the most significant modifiable risk factor and the most common cause of spontaneous ICH in patients under 70 years of age.⁴

Location of bleed: Bleeding occurs most commonly in the basal ganglia (50%), cerebral lobes (10%–20%), thalamus (15%), pons and brainstem (10%–20%), and cerebellum (10%).^{3,5} Hypertension and arteriosclerosis as the cause of ICH most commonly leads to deep hemorrhages. Cerebral amyloid angiopathy (CAA), another primary cause of ICH, commonly results in lobar bleeds.⁶

Primary brain injury occurs secondary to parenchyma compression from both the enlarging hematoma and hydrocephalus from compression of ventricles leading to increased intracranial pressure (ICP). Hematoma expansion (HE) most commonly occurs over the first 3 to 12 hours, with one-third of HE occurring within the first 3 hours. Secondary injury including cerebral edema, inflammation, and local tissue toxicity from blood breakdown begins in the first few hours and progresses over days to weeks.^{7,8}

The prognosis of ICH depends on hematoma volume, location of hemorrhage, presence of intraventricular extension of the hemorrhage, patient age and comorbidities, and timeliness of interventions.^{9,10}

Given the critical nature of ICH and its rapid progression, early recognition and a systematic approach to management including prompt neuroimaging, acute blood pressure management, timely reversal of anticoagulation, and neurosurgical evaluation for select patients is key for patient outcomes.

CLINICAL ASSESSMENT

Presentation: Patients presenting with ICH are often difficult to distinguish from other forms of hemorrhagic or ischemic stroke. Signs and symptoms can include: headache,

neck stiffness, emesis, loss of consciousness/coma, seizures, elevated blood pressure, and acute neurologic deficits.

As for all critically ill patients, initial management consists of rapid assessment and stabilization beginning with traditional airway, breathing, and circulation. If there is concern for airway compromise (loss of gag reflex, decreased mentation, and vomiting), patients should be intubated with particular attention paid to maintaining appropriate oxygenation (goal SpO₂ >94%) and stable hemodynamics (especially avoiding hypotension).

Critical pieces of history of present illness (HPI) include time of symptom onset (or time of last known well), use of anticoagulant or antiplatelet medications (and time of last dose), known kidney disease, recent surgical history, and recent stroke or brain trauma.

Rapid intravenous (IV) access should be obtained and relevant laboratory studies including blood glucose (BG) level, complete blood count, kidney function (creatinine [Cr], blood urea nitrogen [BUN], glomerular filtration rate [GFR]), liver function, inflammatory markers (erythrocyte sedimentation rate [ESR], C-reactive protein [CRP]), coagulation studies (prothrombin time [PT], international normalized ratio [INR], activated partial thromboplastin time [aPTT]), cardiac biomarkers (troponin), and urinalysis (including pregnancy test for females <55yo, and tox panel) should be collected. Some laboratory markers indicating increased risk of morbidity/mortality include: thrombocytopenia, evidence of acute kidney injury (elevated Cr or decreased GFR), hyperglycemia, and elevated troponin.¹¹

Neurologic assessment and clinical scoring tools: A careful but focused neurologic examination should be performed and it is useful to document an initial Glasgow Coma Scale (GCS), NIH stroke scale, and ICH score. These scores provide a way to objectively monitor changing clinical status and a way to communicate with consultants the acuity and severity of clinical presentation.

The GCS is a reliable and well-validated tool used to quickly rate the severity of a patient's neurologic injury from an assessment of eye-opening (score range 1–4), best verbal response (score range from 1–5), and best motor response (score range 1–6). Neurologic injury is classified as either mild (scores 13–15), moderate (9–12), and severe (8 or less).¹²

National Institutes of Health Stroke Scale (NIHSS) is useful for assessing specific neurologic deficits and predicting patient outcomes with higher scores correlating to poorer outcomes and increased mortality.^{13–15}

The ICH score was specifically designed and validated to allow standardized communication regarding the severity of ICH and is useful in predicting 30-day mortality—though it was not designed for and should not be used for prognostication. Data points are easily obtained in the initial emergency department (ED) course and include age, GCS score, ICH volume, presence/absence of intraventricular hemorrhage, and infratentorial location.¹⁶

Acute neuroimaging: Obtaining an emergent noncontrast computerized tomography scan is considered the gold standard in quickly detecting size and location of acute hemorrhage, presence of intraventricular extension (IVH), and complications including hydrocephalus. Certain imaging features such as heterogenous densities within the hematoma or irregularities at its margin can indicate expanding hematoma.^{17,18}

Often a CT angiogram (CTA) is reasonable to obtain as first imaging study, if available, as it can provide more detailed information on acute bleeding, provide evaluation for secondary cause of ICH including aneurysm or AV malformation, as well as provide simultaneous evaluation for acute ischemic stroke if both remain on the differential

after initial evaluation.^{19,20} Identification of a “spot sign” on CTA, indicating presence of contrast extravasation, is an independent predictor of HE and poor outcomes and may help guide surgical decision making.^{21–23}

MRI is useful in the sub-acute phase to assess for secondary causes of hemorrhage, but this is unlikely to be obtained in the ED and should not delay acute management or transfer decision making.

ACUTE MANAGEMENT

For the emergency medicine clinician, the goals of early management should be stabilization and prevention of HE. As noted earlier, HE is associated with neurologic deterioration, increased dependency for survivors, and death.¹¹ Objectively, these goals are best accomplished by rapid blood pressure stabilization, anticoagulation reversal, and early consultation with specialty services.

Care coordination across the spectrum of care is ideally done in an anticipatory fashion, before caring for a patient with ICH in the ED. This includes creation of order sets within electronic health records, development of protocols/guidelines for the provision of care, and assurance of buy-in by involved care team members (eg, physicians, advanced practice providers, nurses, pharmacists, respiratory therapists, and others).

Blood pressure management: Emergent, efficient, and smooth blood pressure stabilization while avoiding precipitous drops should be a priority goal in ICH management. For most patients, this entails lowering the blood pressure to specific systolic blood pressure (SBP) targets outlined in the 2022 AHA guidelines, and informed likely by the intensive blood pressure reduction in acute cerebral hemorrhage trial 2 (INTERACT2) and antihypertensive treatment of acute cerebral hemorrhage II (ATACH2) trials.^{24–26}

- Recommended agents: IV agents are preferred for their rapid, titratable, and predictable medication effects. Additionally oral medications may not be safe in this population at high aspiration risk. Common agents include
 - *Nicardipine*: starting dose 5 mg/hr with titration by 2.5 mg/hr every 10 minutes. Max dose 15 mg/hr.
 - *Labetalol*: 5 to 20 mg IV push over 2 minutes, dose adjusted IV pushes (20–80 mg) every 10 to 15 minutes. Max IV push dose 80 mg.
 - *Clevidipine*: 1 to 2 mg/hr with titration by doubling dose every 1.5 minutes. Max dose 21 mg/hr.
- Blood pressure goals: Target blood pressure should be patient-specific with reference to baseline SBP, when available.^{11,27}
 - *Patient with mild to moderate ICH presenting with SBP 150 to 200 mm Hg*: target of 140 mm Hg SBP, with a range of 130 to 150 mm Hg.
 - Allowing SBP to run below 130 mm Hg may be harmful.
 - *Other patients*:
 - In patients with severe ICH or requiring neurosurgical intervention, ideal SBP targets are not available from the evidence and should be done in consultation with neurosurgery.
 - In patients with presenting SBP greater than 220 mm Hg, targeted blood pressure (BP) reduction by 15% to 25% is reasonable.
- Time metrics for BP: While there are no clear recommendations on timepoint metrics for early intensive blood pressure lowering (EIBPL), data clearly show improved outcome with earlier initiation and achievement of target SBP.²⁸ The 2022 AHA Guidelines recommend targeting an initiation of EIBPL therapy within 2 hours of ICH onset and achievement of target BP within 1 hour of therapy

initiation. There are, of course, factors outside of the emergency medicine clinician's control that may impact this metric (delay to presentation, transport time, and others.) More recently, bundled care trials have targeted a metric of 30 to 60 minutes from ED presentation for BP management, blood sugar correction, temperature control, and AC reversal.^{29,30}

Anticoagulation management: With the goal of avoiding HE, rapid reversal of anticoagulation (AC) is paramount in the management of ICH. Specific reversal agents and dosing will depend on the AC the patient is on and time since last dose. Because of the time sensitive nature of this reversal, patient's weight and laboratory draw of INR should be obtained as soon as ICH is suspected.

- Warfarin:
 - 4-factor prothrombin complex concentrate (PCC) should be administered based on INR:
 - INR 1.3 to 1.9: PCC administration (10–20 units/kg) may be reasonable and should be discussed with pharmacist and neurointensivist
 - INR 2.0 to 3.9: 25 units/kg; maximum dose 2500 units
 - INR 4.0 to 6: 35 units/kg; maximum dose 3500 units
 - INR greater than 6: 50 units/kg; maximum dose 5000 units.
 - Vitamin K: 10 mg IV over 10 to 20 minutes
- Direct Oral Anticoagulants (DOACS)
 - Xa Inhibitors
 - Preferred: Andexanet alfa-dosing dependent upon timing of last DOAC use:

	Last Dose	Time Since Last Dose	
		< 8 h or unknown	> 8 h
Rivaroxaban	≤ 10 mg	Low dose	Low dose
	> 10 mg or unknown	High dose	
Apixaban	≤ 5 mg	Low dose	
	> 5 mg or unknown	High dose	

- Alternative: 4-factor PCC—25 to 50 units/kg IV or 2000 units IV or Activated PCC—50 units/kg IV
 - Other considerations: If last DOAC dosing was within the previous few hours, oral activated charcoal is reasonable, though benefit must be weighed against risk of neurologic decompensation and aspiration.
- Dabigatran
 - Preferred: Idarucizumab—5 mg (given as two 2.5 mg doses spaced up to 15 minutes)
 - If Idarucizumab is not available, hemodialysis may be considered but should not interfere with resuscitative or neurocritical measures.
 - Alternative: 4-factor PCC—25 to 50 units/kg IV or 2000 units IV or Activated PCC—50 units/kg IV
 - Other considerations: Similar to DOACs, if last dabigatran dosing was within preceding few hours, oral activated charcoal is reasonable while weighing risks of oral medication administration and clinical deterioration.
- Heparins-: although rare for the emergency medicine (EM) clinician to encounter a patient on heparin or low-molecular weight heparin (LMWH), reversal with protamine should be enacted if a patient is on this form of AC.

- Protamine dosing—based on units of heparin given. Max dose of protamine is 50 mg.
 - Heparin: 1 mg protamine per 100 U heparin
 - LMWH:
 - Last dose less than 8 hours—1 mg protamine per 1 mg LMWH
 - Last dose 8 to 12 hours—0.5 mg protamine per 1 mg LMWH
- Antiplatelet agents:
 - Outside of patients planned for surgical intervention, there has not been strong evidence to support the use of platelet transfusions for patients on antiplatelet therapy (commonly aspirin, clopidogrel, or DAPT), and some studies have shown harm. In patients with plans for emergent neurosurgical intervention, platelet transfusion can be considered, and the transfusion decision should be made in concert with the neurosurgeon (Fig. 1).³¹

Other care considerations: Other components of ICH management in the ED include (with guidelines provided by AHA)¹¹

- a. Markedly elevated ICP/herniation: Patients with large ICH and mass effect on the ventricular system are at risk for herniation and should undergo aggressive treatment of intracranial hypertension in the ED. This can be recognized by ICP greater than 22 mm Hg if monitoring is in place or clinical findings suggestive of herniation (reduced level of consciousness, new anisocoria, Cushing's triad of hypertension, bradycardia, and irregular respirations). Therapeutic options include
 1. Hypertonic sodium chloride:
 - i. 3%: 250 to 500 mL bolus IV
 - ii. 7.5%: 250 mL bolus IV
 - iii. 23.4%: 30 mL IV
 2. Mannitol: 0.5 to 2 g/kg bolus IV

It is important to note these therapies will transiently lower ICP and are not to be thought of as definitive management of elevated intracranial pressure.

- b. Antiseizure medications (ASMs): Prophylaxis against seizure with ASMs is not recommended. If seizure is suspected but not confirmed, continuous electroencephalography (EEG), if available, may confirm the diagnosis. If seizure activity is

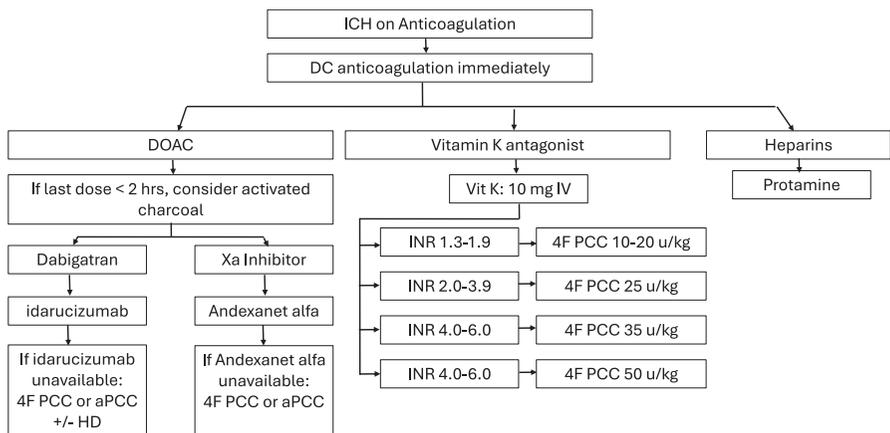


Fig. 1. Summary table of anticoagulation reversal guidelines.

confirmed, either by EEG or clinically apparent seizure activity, benzodiazepines and ASM should be administered. There is no data on which ASM should be used in ICH patients with seizure. Local practice patterns and provider's familiarity and comfort with the agent should guide selection.

- c. Glucose management: Hypoglycemia should be treated and profound hyperglycemia should be avoided. Aggressive and tight BG control may increase the risk for hypoglycemic events and poor outcomes. Blood sugars should be maintained between 60 and 180 to 200 mg/dL with treatment initiated when outside of this target range.
- d. Temperature management: While an elevated temperature in the setting of ICH portends a worse outcome, data on temperature control are conflicting. Treatment of hyperthermia/elevated temperature, often referenced as temperatures at or above 38° C, is reasonable and recommended by the AHA 2022 guidelines.¹¹
- e. Transfer decision and inpatient care team: Patients with ICH require a well-coordinated and multidisciplinary care team and may progress to require neurosurgical intervention, even if without indications for surgery during ED provision of care. The AHA 2022 guidelines¹¹ have a level 1A recommendation for admission to a specialized inpatient unit (eg, stroke unit) with access to neurosurgical specialists either in-house or via transfer for all ICH patients. In patients with findings of hydrocephalus, admission or transfer to a center with in-house neurosurgical capabilities is recommended (level 1B recommendation).

BUNDLES OF CARE/TIME METRICS/CODE INTRACEREBRAL HEMORRHAGE

ICH continues to carry high rates of morbidity and mortality with few current interventions demonstrating long-term benefit. However, recent studies have demonstrated that bundling together multiple interventions in parallel as goal-directed care bundles is the most impactful intervention in ICH management.^{32,33}

As in sepsis, bundles of care refer to a set of evidence-based practices implemented together often with specific time goals to improve patient care and outcomes. These can often be easily facilitated as an electronic medical record (EMR)-based order-set that allows standardized timely orders with nursing instructions particularly for titration of BP meds. Part of this certainly requires some quality improvement (QI) process implementation across the ED, neurointensive care unit, laboratory services, radiology, and pharmacy for smooth enactment of protocols.

In the study, acute bundle of care for intracerebral hemorrhage (ABC-ICH), implementation of a care bundle including anticoagulation reversal ≤ 90 -min of arrival, intensive intravenous BP lowering initiated ≤ 60 -min from arrival, and adherence to a strict neurosurgery (NSG) referral guideline, was associated with lower 30-day case fatality after ICH.^{32,34} The Quality in Acute Stroke Care (QASC) trial provided evidence that bundling temperature management, glucose control, and swallow assessments in all stroke patients led to improved outcomes.³⁵ INTERACT3 demonstrated the effectiveness of a goal-directed care bundle including intensive BP lowering and management algorithms for glucose, temperature, and anticoagulation on improved patient outcomes.³⁰ Per expert consensus, individual interventions that should be considered for inclusion in an acute, ICH-specific bundle of care includes proposed ICH bundle of care for the ED (**Table 1**).

NEUROSURGERY/SURGICAL MANAGEMENT

There are several neurosurgical interventions that can be considered in patients with ICH. These can range from bedside placement of ICP monitors through to

Table 1
Individual interventions for possible inclusion in an acute, emergent department-based intracerebral hemorrhage-specific bundle of care

	<i>Intervention</i>	<i>Time Goal</i>	<i>Information</i>	<i>Supporting Guidelines/Evidence</i>
1	Prompt assessment, HPI, and physical examination	Immediate	Rapidly obtain information regarding history of trauma, anticoagulation use (medication, dose, Game of last dose, and kidney function), and previous history of hemorrhagic or ischemic stroke.	
2	Emergent neuro- imaging	Door to laboratory results, goal ≤ 30 min	In critically ill patients with altered mentation with/without focal neurologic deficits, expedited imaging for diagnosis is critical and time sensitive. It may additionally provide important information to guide transfer and surgical decision-making.	
3	Intravenous access and laboratory results	Door to laboratory results, goal ≤ 30 min	Rapid IV placement and laboratory studies (including INR, other coagulation studies, and kidney function) should be obtained as quickly as possible to facilitate treatment, particularly reversal of anticoagulation if needed.	
4	Anticoagulation reversal	Door to laboratory results, goal ≤ 30 min	HE most commonly occurs in the first few hours after initial bleed, so early reversal maximizes the benefits. While a goal of ≤ 30 min is aspirational, it provides a sense of urgency that is warranted to ensure reversal is achieved as quickly as possible. Achieving this goal often requires a cooperative effort across the ED, pharmacy, and laboratory.	ESO anticoagulant- associated ICH guideline (2019) AHA/ASAICH guideline (2022) REVERSE-AD ANNEXA-4

5	Blood pressure management	Door to 1st agent, goal \leq 30 min	<p>There is evidence to support the critical importance of achieving early and stable systolic BP reduction in patients with mild-to-moderately severe ICH. Ideally BP reduction should be initiated within 30 min of arrival and target SBP achieved within 60 min. While optimal SBP goals in acute ICH remain controversial, one good approach is:</p> <ul style="list-style-type: none"> • <6 h from onset with initial SBP 150–220 mm Hg. aim for SBP <140 mm Hg • >6 hrs, AHA guidelines recommend SBP target of 130–150 mm Hg and ESO guidelines target 110–140 mm Hg. <p>Target SBP should be achieved smoothly without fluctuations or large dips (>90 mm Hg) especially within the first hour. SBP control should be maintained for the next 7 d.</p>	<p>ESO BP guideline(2021) AHA/ASAICH guideline (2022) INTERACT2 & 3</p>
6	BG management	Door to BG management-sustained euglycemia for the first 7 d	<p>Elevated BG levels are common in ICH and may worsen outcomes. While further studies are needed, a recommended approach (based off the INTERACT-3 trial) includes</p> <ul style="list-style-type: none"> • Target BG level of 110–140 mg/dL for nondiabetic patients • Target BG level of 140–180 mg/dL for diabetic patients • Sustained control for 7 d or hospital discharge 	<p>INTERACT3 QASC AHA/ASA guideline (2022)</p>

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Table 1
(continued)

	<i>Intervention</i>	<i>Time Goal</i>	<i>Information</i>	<i>Supporting Guidelines/Evidence</i>
7	Temperature management	Door to hyperthermia management- within 1 h of measured fever	Elevated temperature is relatively common in ICH and linked to poor outcome. ICH guidelines recommend antipyretic treatment. This can be implemented through every 4-h temperature checks and treatment of any temperature $\geq 37^{\circ}\text{C}$ with antipyretic agents.	INTERACT3 QASC AHA/ASA guideline (2022)
8	Neurosurgical evaluation	Good to NSG, if done, earlier is better	ICH volume predicts functional outcome thus neurosurgical management may be an important consideration in ICH care. Hematoma evaluation may reduce mass effect, lower intracranial pressure, and lessen secondary injuries. Multiple studies have shown benefit with early removal of most of hematoma volume. Each institution should develop a neurosurgery consultation practice based on local experience and resources including evaluation for EVD or posterior fossa decompression for specific patients.	ESO ICH guideline (2014) AHA/ASA/ICH guideline (2022)
9	Cohorted care	Admission	Access to stroke unit OT dedicated Neuro-ICU, AHA recommends that ICH patients be cared for in a dedicated neuroscience intensive care unit when available as this has been associated with a lower mortality rate.	INTERACT3 QASC AHA/ASA guideline (2022)

Abbreviations: ASA, American Stroke Association; ESO, european Stroke Organization; NSG, neurosurgery.^{30,34,35,44-47}

Adapted from Parry-Jones AR, Järhult SJ, Kreitzer N, et al. Acute care bundles should be used for patients with intracerebral hemorrhage: An expert consensus statement. Eur Stroke J 2023.

decompressive craniectomy. These surgical decisions will, in the end, be made in concert with the neurosurgical team. The EM clinician should be aware of the spectrum of these interventions and in which patients they are recommended by national guidelines.

- External Ventricular Drainage (EVD): In patients with ICH (or intraventricular hemorrhage) and hydrocephalus and decreased level of consciousness, external ventricular drainage is recommended.
- Hematoma evacuation: The majority of data supporting hematoma evacuation via minimally invasive surgery is for bleed volumes of 20 to 30 mL. This is done in patients with a GCS greater than 3, with or without thrombolytic use.^{36–38}
- Decompressive craniectomy is considered a potential life-saving measure in patients with supratentorial ICH, often large hematoma size, who are clinically deteriorating.

DISPOSITION AND PROGNOSTICATION

ICH patients present to the ED critically ill, often with altered mental status, and frequently have preexisting comorbid conditions, all of which can make prognostication challenging. AHA guidelines recommend that new care limitations or withdrawal of support should not be recommended by treating physicians in the first 24 hours after presentation.¹¹ In the ED setting, it is appropriate to initiate goals-of-care conversations with patients and family members as in any critical illness but avoid early prognostication as evidence suggests that physicians tend to be overly pessimistic in the acute phase of ICH and inaccurate in predicting outcomes for specific cases at hand.^{39,40} Withdrawal of medical support and other early care limitations (like do not resuscitate [DNR] orders) within the first day of hospitalization are independent outcome predictors, even in those patients who do not actually have a cardiac arrest or require intubation.^{41–43}

Summary: While goals-of-care conversations with patient and family members are important, avoid prognostication, early care limitations, or withdrawal of medical support in the first 24 hours.

FUTURE DIRECTIONS/ONGOING CLINICAL TRIALS

Current research is focused on bundled care and its effect on morbidity and mortality, time points and targets for hemodynamic stabilization and AC reversal, and minimally invasive neurosurgical interventions. There are ongoing clinical trials in neuroendoscopic surgery, medication efficacy (including interleukin-1 receptor antagonists, tranexamic acid, and others), prophylactic levetiracetam, and effect of continuous blood pressure monitoring on morbidity.

Summary: ICH is the most common form of hemorrhagic stroke and understanding the important components of assessment and management in the ED is critical for patient outcome, beginning with initial stabilization and avoidance of HE. Other critical components include

- Rapid and smooth blood pressure management
- Rapid reversal of any anticoagulated state
- Frequent neurologic checks and airway procurement if deteriorating
- Multidisciplinary care with coordination of emergency medicine clinician, nursing, pharmacy, and neurosurgery/neurocritical care
- Bundled care plans such as the ABC care plan, attention to time and quality metrics and quality assurance assessments to guide improvements in care

- Patient disposition to a neurologic or neurosurgical intensive care unit

CLINICS CARE POINTS

Time is brain in ICH management too! We must have a renewed focus on expedited management of ICH patients to reduce hematoma expansion and improve outcomes. Critical time-sensitive actions include

- System/processes in place to allow for expedited imaging, laboratory testing, and access to reversal agents.
- BP management in hypertensive patients should be implemented as soon as possible ideally with intravenous-agents to allow for smooth titration and careful control
- Anticoagulation reversal when applicable should be implemented as rapidly as possible
- Temperature (particularly avoidance of hyperthermia) and blood glucose control should be maintained
- Emergent neurosurgical evaluation for select patients and appropriate transfer decisions should be made as soon as possible but not at the expense of anticoagulation reversal and BP control.

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