AHA Clinical Update

ADAPTED FROM:
2022 Guideline for the Management of Patients With Spontaneous Intracerebral Hemorrhage: A Guideline From the American Heart Association/American Stroke Association
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Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care

<table>
<thead>
<tr>
<th>CLASS (STRENGTH) OF RECOMMENDATION</th>
<th>Benefit &gt;&gt;&gt; Risk</th>
<th>Benefit &gt;&gt; Risk</th>
<th>Benefit = Risk</th>
<th>Risk &gt; Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLASS 1 (STRONG)</strong></td>
<td></td>
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</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>Is recommended</td>
<td>Is indicated/useful/effective/beneficial</td>
<td>Should be performed/administered/other</td>
<td>Comparative-Effectiveness Phrases:</td>
</tr>
<tr>
<td></td>
<td>Treatment/strategy A is recommended/indicated in preference to treatment B</td>
<td>Treatment A should be chosen over treatment B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **CLASS 2a (MODERATE)**          | Benefit >> Risk |                |               |               |
| Suggested phrases for writing recommendations: | Is reasonable | Can be useful/effective/beneficial | Comparative-Effectiveness Phrases: |
|                                  | Treatment/strategy A is probably recommended/indicated in preference to treatment B | It is reasonable to choose treatment A over treatment B |

| **CLASS 2b (Weak)**              | Benefit = Risk |                |               |               |
| Suggested phrases for writing recommendations: | May/might be reasonable | May/might be considered | Usefulness/effectiveness is unknown/unclear/uncertain or not well-established |

| **CLASS 3: No Benefit (MODERATE)** | Benefit = Risk |                |               |               |
| Suggested phrases for writing recommendations: | Is not recommended | Is not indicated/useful/effective/beneficial | Should not be performed/administered/other |

| **CLASS 3: Harm (STRONG)**       | Risk > Benefit |                |               |               |
| Suggested phrases for writing recommendations: | Potentially harmful | Causes harm | Associated with excess morbidity/mortality | Should not be performed/administered/other |

<table>
<thead>
<tr>
<th>LEVEL (QUALITY) OF EVIDENCE‡</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>LEVEL A</strong></td>
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<tr>
<td>High-quality evidence‡ from more than 1 RCT</td>
<td>Meta-analyses of high-quality RCTs</td>
<td>One or more RCTs corroborated by high-quality registry studies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **LEVEL B-R**                   |                 |                |               |               |
| Moderate-quality evidence‡ from 1 or more RCTs | Meta-analyses of moderate-quality RCTs |

| **LEVEL B-NR**                  |                 |                |               |               |
| Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies | Meta-analyses of such studies |

| **LEVEL C-LD**                  |                 |                |               |               |
| Randomized or nonrandomized observational or registry studies with limitations of design or execution | Meta-analyses of such studies | Physiological or mechanistic studies in human subjects |

| **LEVEL C-EO**                  |                 |                |               |               |
| Consensus of expert opinion based on clinical experience. |

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

*The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

†For comparative-effectiveness recommendation (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.
Population Health Implications

Annual Ischemic Stroke & ICH Incidence

- ICH, 79K
- SAH, 16K
- Ischemic Strokes, 690K

Total Strokes: ~795K

Early-term ICH Mortality is 30-40%

Incidence of ICH by Race
- ≈1.6-fold greater among Black than White people
- ≈1.6-fold greater among Mexican American than non-Hispanic White people

Abbreviations: ICH indicates intracerebral hemorrhage; and SAH, subarachnoid hemorrhage.

Mechanisms of ICH Injury

0 - 6 hours

Primary Injury
- Hematoma Expansion
  - ↑ ICP
  - Hydrocephalus
  - Herniation

>6 hours

Secondary Injury
- Cerebral Edema
- Inflammation
- Toxicity from Blood Products

General Principle: Acute ICH management targets these mechanisms.

Abbreviations: ICH indicates intracerebral hemorrhage; and ICP, intracranial pressure.
ICH Etiology Determines Hemorrhage Location

Deep/Posterior Fossa ICH Etiologies

Arteriolosclerosis
- Penetrating arteriole lipohyalinosis due to HTN, DM, Age

Macrovascular
- AVM
- Aneurysm
- Dural AVF
- Cavernous Malformation/Cavernoma
- Cerebral Venous Thrombosis

Lobar ICH Etiologies

- Cerebral Amyloid Angiopathy
  - Amyloid deposition in vessel walls
- Arteriolosclerosis
- Macrovascular

Diagnostic Reasoning: CAA typically causes only lobar (or superficial cerebellar) hemorrhages. Arteriolosclerosis may cause both deep and lobar hemorrhages. Coexistent pathology is possible.

Abbreviations: AVF indicates arteriovenous fistula; AVM, arteriovenous malformation; CAA, cerebral amyloid angiopathy; DM, diabetes mellitus; HTN, hypertension; and ICH, intracerebral hemorrhage.

Diagnosis & Assessment | Work-Up for Acute ICH Course

**Time**
- Time of symptom onset

**Symptoms**
- Headache
- Focal neurologic deficits
- Seizures
- Decreased level of consciousness

**Vascular Risk Factors**
- Ischemic Stroke
- Prior ICH
- Hypertension
- Hyperlipidemia
- Diabetes mellitus
- Metabolic syndrome
- Imaging biomarkers
  - Cerebral microbleeds

**Medications**
- Antithrombotics:
  - Anticoagulants, thrombolytics, antiplatelet agents, NSAIDS
- Vasoconstrictive Agents:
  - Triptans, SSRIs, decongestants, stimulants, phentermine, sympathomimetic drugs
- Antihypertensives:
- Estrogen-containing oral contraceptives

**Cognitive Impairment or Dementia**
- Associated with (but not specific for) amyloid angiopathy

**Substance Use**
- Smoking
- Alcohol use
- Marijuana
- Sympathomimetic drugs
- Amphetamines, methamphetamine, cocaine

**Liver disease, Uremia, Malignancy and Hematologic disorders**
- May be associated with coagulopathy

**Abbreviations:** ICH indicates intracerebral hemorrhage; NSAIDS, non-steroidal anti-inflammatory drugs; and SSRIs, selective serotonin reuptake inhibitors.
**Diagnosis & Assessment | Work-Up in Acute ICH**

### Physical Examination
- **Airway, Breathing & Circulation**
- **Vital signs**
- **General**: Focused on the head, heart, lungs, abdomen, and extremities
- **Focused Neurological Exam** (NIHSS, GCS)

### Serum
- **CBC**
- **BUN and Creatinine**
- **LFTs**
- **Glucose**
- **Inflammatory markers** (ESR and/or CRP)
- **PT (with INR)**
- **aPTT**
- **Specific tests for DOACs**

### Urine
- **Urine toxicology screen**
- **Pregnancy test**

### Cardiac-specific
- **Troponin**
- **ECG**

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**Abbreviations**: aPTT indicates activated partial thromboplastin time; BUN, blood urea nitrogen; CRP, C-reactive protein; DOAC, direct oral anticoagulant; ECG, electrocardiogram; ESR, erythrocyte sedimentation rate; GCS, Glasgow coma scale; ICH, intracerebral hemorrhage; INR, international normalized ratio; LFTs, liver function tests; NIHSS, National Institutes of Health Stroke Scale; and PT, prothrombin time.
Indicators of Increased Morbidity & Mortality:
- Thrombocytopenia
- Hyperglycemia
- Acute Kidney Injury
- Elevated troponin

Indicators of Increased HE:
- Anemia
- Anticoagulant-related hemorrhages
- Identification of a spot sign on CTA or contrast-enhanced OR certain imaging features on NCCT such as heterogeneous densities within the hematoma or irregularities at its margins.

Abbreviations: CTA indicates computed tomography angiography; HE, hematoma expansion; ICH, intracerebral hemorrhage; and NCCT, noncontrast computed tomography.
Diagnosis & Assessment | Neuroimaging to Diagnose ICH

Time of presentation with stroke-like symptoms: Obtain rapid CT or MRI to confirm the diagnosis of spontaneous ICH (1)

Serial head CT scans can be useful for:
- Patients with spontaneous intracerebral and/or intraventricular hemorrhage within the first 24 hours after symptom onset to evaluate for HE
- Patients with low GCS score or neurological deterioration to evaluate for HE, hydrocephalus, perihematomal edema or herniation (2a)

CT angiography within the first few hours of ICH onset: May be reasonable to detect some structural causes of secondary ICH (2b)

Utilizing CT markers of HE to identify patients at risk for HE may be reasonable.

Imaging findings:
- Non contrast CT:
  - Heterogeneous densities within the hematoma
  - Irregularities at the hematoma margins
- CT angiography/ Contrast enhanced CT:
  - Spot sign (2b)

Abbreviations: CT indicates computed tomography; HE, hematoma expansion; ICH, intracerebral hemorrhage; and MRI, magnetic resonance imaging.
**Diagnosis & Assessment | Strategy to Determine ICH Etiology**

**For Patients With...**

**Lobar ICH**
- Age <70 yrs

**Deep/Posterior Fossa ICH**
- Age <45
- Age 45-70 yrs, NO HTN

**Spontaneous IVH with NO parenchymal hemorrhage (any age)**
- OR -

**CTA/MRA suggestive of macrovascular ICH etiology (any age)**

**Utilize This Diagnostic Strategy...**

- **CT Angiogram/Venogram Recommended (1)**
- AND -
- **MRI + MR Angiogram Reasonable (2a)**
- AND -
- **Cerebral Angiogram Reasonable (2a)**

Abbreviations: CT indicates computed tomography; CTA, computed tomography angiogram; HTN, hypertension; ICH, intracerebral hemorrhage; IVH, intraventricular hemorrhage; MRA, magnetic resonance angiogram; and MRI, magnetic resonance imaging.

Medical and Neurointensive Treatment for ICH
Acute Blood Pressure Lowering in Spontaneous ICH

To improve functional outcomes.

- Medication titration to ensure continuous smooth & sustained control of BP, avoiding peaks and large variability in SBP, can be beneficial. (2a)
- Initiating tx within 2 hrs of ICH onset and reaching target within 1-hr can be beneficial to reduce the risk of HE. (2a)
- In ICH of mild to moderate severity presenting with SBP between 150 and 220 mmHg, acute lowering of SBP to a target of 140 mmHg with the goal of maintaining in the range of 130 to 150 mmHg is safe and may be reasonable. (2b)
- If presenting with large or severe ICH or those requiring surgical decompression, the safety and efficacy of intensive BP lowering are not well established. (2b)
- If ICH is mild to moderate severity presenting with SBP >150 mmHg, acute lowering of SBP to hrs. <130 mmHg is potentially harmful. (3:Harm)

Abbreviations: HE indicates hematoma expansion; ICH, intracerebral hemorrhage; mmHg, millimeters of mercury; SBP, systolic blood pressure; and tx, treatment.
Patients with ICH on anticoagulation

Discontinue anticoagulation therapy immediately. Rapid reversal should be performed as soon as possible (1)

VITAMIN K ANTAGONISTS

INR 1.3 –1.9

4-F PCC 10-20 IU/kg (2b)

IV Vitamin K (1)

INR >2.0

4-F PCC 25-50 IU/kg (1)

DABIGATRAN

History: When last dose taken

Activated charcoal if DOAC < 2 hrs (potential efficacy up to 8 hrs) (2b)

Is Idarucizumab available?

YES

Idarucizumab (2a)

NO

PCCs or aPCC and/or renal replacement therapy (2b)

FACTOR Xa-INHIBITORS

History: When last dose taken

Is Andexanet alfa available?

YES

Andexanet alfa (2a)

NO

4 Factor PCCs or aPCC (2b)

HEPARINS

Unfractionated Heparin

Protamine (2a)

Low Molecular Weight Heparin

Protamine (2b)

Abbreviations: 4-F PCC indicates four-factor prothrombin complex concentrate; aPCC, activated prothrombin complex concentrate; DOAC, direct oral anticoagulant; ICH, intracerebral hemorrhage; and INR, international normalized ratio.

Hemostasis & Coagulopathy
Antiplatelet-Related Hemorrhage in Spontaneous ICH

If the patient is being treated with aspirin, platelet transfusion might be considered to reduce postoperative bleeding and mortality. (2b)

If the patient is being treated with antiplatelet agents, the effectiveness of desmopressin with or without platelet transfusions to reduce the expansion of the hematoma is uncertain. (2b)

Does the patient require emergent neurosurgery?

YES

If the patient is being treated with ASA, platelet transfusions are potentially harmful and should not be administered. (3:Harm)

NO

Abbreviations: ASA indicates aspirin; and ICH, intracerebral hemorrhage.
### Hemostasis & Coagulopathy
#### General Hemostatic Treatments

#### Synopsis of the Evidence

- HE occurs in up to a third of patients after ICH and is associated with poor outcome.
- Hemostatic therapy for the prevention of HE remains an attractive therapeutic target after ICH.
- In patients with spontaneous ICH (with or without the spot sign), the effectiveness of recombinant factor VIIa to improve functional outcome is unclear. (2b)
- In patients with spontaneous ICH (with or without the spot sign, black hole sign, or blend sign), the effectiveness of TXA to improve functional outcome is not well established. (2b)
- ICH expansion most commonly occurs very early after onset, and future studies need to target earlier treatment

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**Abbreviations:** CTA indicates computed tomography angiography; HE, hematoma expansion; and ICH, intracerebral hemorrhage.
General Inpatient Care
Considerations for Inpatient Care Setting

Initiation of Appropriate Life Sustaining Therapies (1)

Provision of care in a specialized inpatient unit with a multidisciplinary team (1)

If specialized unit is not available, then transfer to centers with full range of high-acuity care and expertise (1)

In patients with spontaneous ICH and clinical hydrocephalus, transfer to centers with Neurosurgical capabilities for hydrocephalus management (e.g. EVD placement and monitoring) (1)

Abbreviations: EVD indicates external ventricular drain; and ICH, intracerebral hemorrhage.
# Inpatient Care Checklist

## In Non-Ambulatory Spontaneous ICH...

### Prevention & Management of Acute Medical Complications

- Use of standardized protocols/order sets is recommended to reduce disability and mortality. (1)
- Formal dysphagia screening protocol should be implemented prior to initiation of oral intake to reduce disability and the risk of pneumonia. (1)
- Continuous cardiac monitoring for first 24 to 72 hrs is reasonable to monitor for cardiac arrhythmias & new cardiac ischemia. (2a)
- Laboratory and radiographic testing for infection on admission and throughout the hospital course is reasonable to improve outcomes. (2a)

### Priorities for Nursing Care

- Frequent neurological assessments (including GCS) should be performed by ED nurses in the early hyperacute phase of care to assess change in status, neurological examination, or LOC. (1)
- Frequent neuro assessments in ICU/Stroke unit up are reasonable up to 72 hrs from admission to detect early ND. (2a)
- Nursing staff with specialized stroke competency education can be effective in improving outcome & mortality. (2a)

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**Abbreviations:** DVT indicates deep vein thrombosis; ED, emergency department; HE, hematoma expansion; hrs, hours; GCS, Glasgow Coma Scale; ICH, intracerebral hemorrhage; ICU, intensive care unit; LMWH, low molecular weight heparin; LOC, level of consciousness; ND, neurological deterioration; PE, pulmonary embolism; Tx, treatment; UFH, unfractionated heparin; and VTE, venous thromboembolism.

### Inpatient Care Checklist

#### Prophylaxis

<table>
<thead>
<tr>
<th>Recommendation</th>
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</thead>
<tbody>
<tr>
<td>Intermittent pneumatic compression starting on the day of diagnosis is recommended for VTE (DVT and PE) prophylaxis. (1)</td>
</tr>
<tr>
<td>Low-dose UFH or LMWH can be useful to reduce risk of PE (2a)</td>
</tr>
<tr>
<td>Temporary use of retrievable filter as bridge until anticoagulation initiated. (2a)</td>
</tr>
<tr>
<td>Low-dose UFH or LMWH prophylaxis at 24 to 48 hrs from ICH onset may be reasonable to optimize the benefits of preventing thrombosis relative to the risk of HE. 2b)</td>
</tr>
<tr>
<td>Graduated compression stockings of knee-high or thigh-high length alone are not beneficial for VTE prophylaxis. (3: No Benefit)</td>
</tr>
</tbody>
</table>

#### Treatment

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>And proximal DVT who are not yet candidates for anticoagulation, temporary use of retrievable filter is reasonable as a bridge until anticoagulation initiated. (2a)</td>
</tr>
<tr>
<td>And proximal DVT or PE, delaying treatment with UFH or LMWH 1 to 2 weeks after onset of ICH might be considered. (2b)</td>
</tr>
</tbody>
</table>

**Abbreviations:** DVT indicates deep vein thrombosis; HE, hematoma expansion; hrs, hours; ICH, intracerebral hemorrhage; LMWH, low molecular weight heparin; PE, pulmonary embolism; Tx, treatment; UFH, unfractionated heparin; and VTE, venous thromboembolism.
General Inpatient Care
Glucose and Temperature Management

**Glucose Management**

- Monitor serum glucose to reduce both hyper/hypoglycemia. (1)
- Treat serum glucose <40-60 mg/dL to reduce mortality. (1)

**NICE-SUGAR trial findings:**
- In critically ill, target of <180 mg/dL associated with lower mortality than target of 81-108 mg/dL.
- Intensive glucose control (target 81-108 mg/dL) more likely to result in severe hypoglycemic events compared to control.

**Temperature Management**

- In patients with spontaneous ICH, pharmacologically treating an elevated temperature may be reasonable to improve functional outcomes. (2b)

**In patients with spontaneous ICH, treating moderate to severe hyperglycemia (>180–200 mg/dL, >10.0–11.1 mmol/L) is reasonable to improve outcomes. (2a)**

**The usefulness of therapeutic hypothermia (<35°C/95°F) to decrease peri-ICH edema is unclear. (2b)**

Temperature abnormalities can occur in over 30% of acute ICH patients, with fever associated with higher clinical severity and worse outcomes.

**Abbreviations:** dl indicates deciliter; ICH, intracerebral hemorrhage; mg/dL, milligram per deciliter; mmol/L, millimoles per liter; and NICE-SUGAR, Normoglycemia in Intensive Care Evaluation and Surviving Using Glucose Algorithm Regulation.
Seizures and Antiseizure Drugs

New onset seizures in sICH are relatively common (2.8-28%) and occur within the first 24 hrs of hemorrhage.

- **Unexplained abnormal or fluctuating mental status, or suspicious of seizures, cEEG is reasonable to diagnose electrographic seizures and epileptiform discharges (24 hours or longer) (2a)**

- **Confirmed clinical or electrographic seizures**

  - **Administer ASD (1)**

  - **sICH patients without suspicion of seizure**

  - **Avoid ASD (3: No Benefit)**

**Abbreviation:** ASD indicates antiseizure drugs; cEEG, continuous electroencephalography; hrs, hours; and sICH, spontaneous intracerebral hemorrhage. 
Neuroinvasive Monitoring, Intracranial Pressure & Edema Treatment

sICH or IVH and hydrocephalus which is contributing to decreased level of consciousness:

- Ventricular drainage should be performed to reduce mortality (1)
- ICP monitoring and treatment to reduce mortality and improve outcomes (2b)
- Corticosteroids should not be administered for treatment of elevated ICP (3: No Benefit)
- Early prophylactic hyperosmolar therapy for improving outcomes is not well established (2b)
- Bolus hyperosmolar therapy may be considered for transiently reducing ICP (2b)

**Abbreviation:** ICP indicates intracranial pressure; IVH, intraventricular hemorrhage; and sICH, spontaneous intracerebral hemorrhage.
Surgical Interventions
Minimally Invasive Surgical Evacuation of ICH

Patient Selection

MIS for ICH
Supratentorial ICH, hematoma volume >20-30 mL, GCS 5-12

Intervention

MIS ± hematoma thrombolysis to improve mortality can be useful (2a)

MIS ± hematoma thrombolysis to improve functional outcome is of uncertain effectiveness (2b)

Choosing MIS rather than craniotomy to improve functional outcomes may be reasonable (2b)

Abbreviations: GCS indicates Glasgow Coma Scale; ICH, intracerebral hemorrhage; and MIS, minimally invasive surgery.
Surgical Interventions
Minimally Invasive Surgical Evacuation of Intraventricular Hemorrhage

**IVH Surgical Management**

- **Spontaneous IVH + Obstructive Hydrocephalus**
  - EVD
  - Mortality Reduction (I)
  - Functional Outcome Benefit (2b*)

- **Spontaneous ICH <30 mL IVH requiring EVD**
  - EVD + thrombolytic
  - Mortality Reduction (2a)
  - Functional Outcome Benefit (2b†)

- **Spontaneous ICH < 30 mL GCS >3 IVH requiring EVD**
  - Neuroendoscopy + EVD +/- thrombolytic
  - Functional Outcome Benefit (2b†)
  - Reduced Permanent Shunt Dependence (2b†)

Abbreviations: EVD indicates external ventricular drain; GCS, Glasgow coma scale; ICH, Intracerebral hemorrhage, and IVH, intraventricular hemorrhage.

Note: *Not well established. †Uncertain
Surgical Interventions
Craniotomy for Supratentorial Hemorrhage

Supratentorial ICH of moderate or greater severity*

Note: * >10 cc with a significant neurologic deficit

- Craniotomy for hemorrhage evacuation to improve mortality or functional outcomes is of uncertain usefulness (2b)
- Craniotomy for hemorrhage evacuation may be considered as a life-saving measure in patients who are deteriorating (2b)

Abbreviations: ICH indicates intracerebral hemorrhage.
Surgical Interventions
Craniotomy for Posterior Fossa Hemorrhage

Cerebellar ICH

If any of the following present

- Neurologic deterioration
- Brainstem compression
- Obstructive hydrocephalus
- ICH volume ≥ 15cc

Immediate surgical removal of hemorrhage ± EVD is recommended to reduce mortality (1)

Abbreviations: EVD indicates external ventricular drain; and ICH, intracerebral hemorrhage.
Surgical Interventions
Craniectomy for ICH

In patients with supratentorial ICH who are in a coma, have large hematomas with significant midline shift, or have elevated ICP refractory to medical management:

- Decompressive craniectomy with or without hematoma evacuation may be considered to reduce mortality. (2b)
- Effectiveness of decompressive craniectomy with or without hematoma evacuation to improve functional outcomes is uncertain. (2b)

Abbreviation: ICH indicates intracerebral hemorrhage; and ICP, intracranial pressure.
Outcome Prediction and Goals of Care

In patients with spontaneous ICH

... administering a baseline measure of overall hemorrhage severity is recommended as part of the initial evaluation to provide an overall measure of clinical severity. (1)

Examples:
- ICH-score
- Max-ICH

... a baseline severity score might be reasonable to provide a general framework for communication with the patient and their caregivers. (2b)

... a baseline severity score should NOT be used as the sole basis for forecasting individual prognosis or limiting life-sustaining treatment. (3:Harm)

Abbreviations: ICH indicates intracerebral hemorrhage.
Decisions to Limit Life-Sustaining Treatment

In patients with spontaneous ICH

<table>
<thead>
<tr>
<th>Can not fully participate in medical decision-making</th>
<th>No pre-existing life-sustaining therapy limitations</th>
<th>For patients who have DNAR Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared decision-making between surrogates and physicians is reasonable (2a)</td>
<td>Aggressive care including postponement of new DNAR orders or withdrawal of medical support until at least the 2nd full day of hospitalization is reasonable (2b)</td>
<td>Limiting other medical and surgical interventions unless explicitly specified is associated with increased patient mortality (3: Harm)</td>
</tr>
</tbody>
</table>

*Abbreviations:* DNAR indicates do not attempt resuscitation; and ICH, intracerebral hemorrhage.
Rehabilitation and Recovery

In patients with spontaneous ICH

- Multidisciplinary rehabilitation with regular team meetings and discharge planning is recommended (1)
- Mild-moderate ICH severity: Early supported discharge is beneficial (1)
- Moderate ICH severity: Early rehabilitation (24-48 hours after onset) may be considered (2b)
- ICH without depression, fluoxetine therapy is not effective to enhance poststroke functional status. (3: No Benefit)
- Very early and intense mobilization < 24 hours: potentially harmful (3: Harm)

Abbreviations: ICH indicates intracerebral hemorrhage; and SSRIs, selective serotonin reuptake inhibitors.

Neurobehavioral Complications

In patients with spontaneous ICH

In the Post-acute Period
- Administration of depression & anxiety screening tools. (1)
- Administration of a cognitive screening tool. (1)

Moderate to Severe Depression
- Appropriate evidence-based treatments including psychotherapy & pharmacotherapy. (1)
- Referral for cognitive therapy. (2a)
- Might consider cholinesterase inhibitors or memantine. (2b)

Cognitive Impairment
- Referral for cognitive therapy. (2a)
- Might consider cholinesterase inhibitors or memantine. (2b)

Pre-existing or New Mood Disorders
- Continuation or initiation of SSRIs after ICH. (2a)

Abbreviations: ICH, intracerebral hemorrhage; and SSRIs, selective serotonin reuptake inhibitors.
Secondary Prevention
Prognostication of Future ICH Risk

In patients with spontaneous ICH in whom the risk for recurrent ICH may facilitate prognostication or management decisions, it is reasonable to incorporate the following risk factors for ICH recurrence into decision-making:

- Lobar location of the initial ICH;
- older age;
- presence, number, and lobar location of microbleeds on MRI;
- presence of disseminated cortical superficial siderosis on MRI;
- poorly controlled hypertension;
- Asian or Black race;
- and presence of apolipoprotein E ε2 or ε4 alleles. (2a)

Abbreviation: ICH indicates intracerebral hemorrhage; and MRI, magnetic resonance imaging.
Uncontrolled HTN accounts for 74% of global population-attributable risk for ICH.

**Guiding Principle**

In patients with spontaneous ICH, it is reasonable to lower BP to 130/80 mmHg for long-term management to prevent hemorrhage recurrence (2a).

**Abbreviations:** BP indicates blood pressure; HTN, hypertension; ICH, intracerebral hemorrhage; and mmHg, millimeters of mercury.
**Secondary Prevention**

**Management of Antithrombotic Agents and Other Medications**

**HIGH RISK of thrombotic events**
ex. Patient with mechanical valve, LVAD

**Early resumption of anticoagulation is reasonable (2a)**

**Nonvalvular AF**

**WEIGH RISKS vs BENEFITS of restarting anticoagulation**

- **risk>benefit**
- **benefit>risk**

**Resumption of anticoagulation may be reasonable (2b)**

**LAA closure may be considered (2b)**

**Consider initiation of anticoagulation 7-8 weeks after ICH (2b)**

**Resumption of antiplatelet therapy may be reasonable based on consideration of benefit and risk (2b)**

**Statins**

- Risks and benefits of statins on ICH outcomes and recurrence are uncertain (2b)

**NSAIDs**

- Regular long-term use of NSAIDs is potentially harmful because of the increased risk of ICH (3: Harm)

**Abbreviations:**
- AF indicates atrial fibrillation;
- ICH, intracerebral hemorrhage;
- LAA, left atrial appendage;
- LVAD, left ventricular assist device;
- and NSAID, non-steroidal anti-inflammatory drugs.
Secondary Prevention
Lifestyle Modifications / Patient and Caregiver Education

LIFESTYLE MODIFICATIONS
- Blood pressure control
- Avoiding heavy alcohol use
- Supervised training and counseling

PATIENT & CAREGIVER EDUCATION
- Psychosocial education
- Caregiver support & training
Primary ICH Prevention in Individuals with High-Risk Imaging Findings

Incorporate available MRI information on cerebral microbleed burden or cortical superficial siderosis to inform decision-making for primary prevention (2b)

Abbreviation: ICH indicates intracerebral hemorrhage.
Acknowledgments

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Appendix
Measures for evaluating overall hemorrhage severity


Abbreviation: ICH indicates intracerebral hemorrhage.