

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**



American
Heart
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

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE‡
CLASS 1 (STRONG) Benefit >>> Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: <ul style="list-style-type: none"> – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B 	LEVEL A <ul style="list-style-type: none"> • High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
CLASS 2a (MODERATE) Benefit >> Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: <ul style="list-style-type: none"> – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B 	LEVEL B-R (Randomized) <ul style="list-style-type: none"> • Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
CLASS 2b (Weak) Benefit ≥ Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established 	LEVEL B-NR (Nonrandomized) <ul style="list-style-type: none"> • Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
CLASS 3: No Benefit (MODERATE) Benefit = Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other 	LEVEL C-LD (Limited Data) <ul style="list-style-type: none"> • 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
CLASS 3: Harm (STRONG) Risk > Benefit Suggested phrases for writing recommendations: <ul style="list-style-type: none"> • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other 	LEVEL C-EO (Expert Opinion) <ul style="list-style-type: none"> • Consensus of expert opinion based on clinical experience.

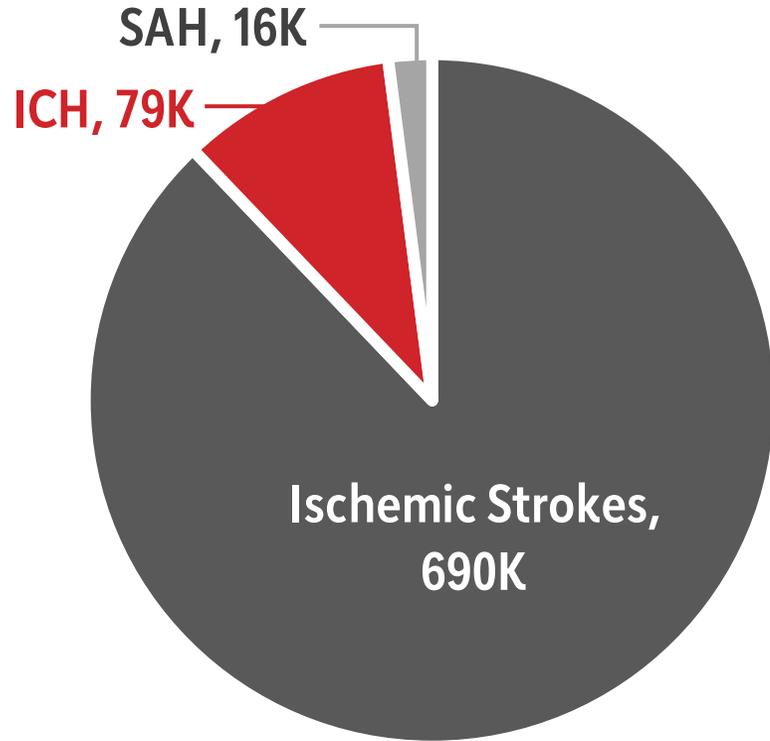
COR and LOE are determined independently (any COR may be paired with any LOE).
 A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be 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



**Total Strokes:
~795K**

**Early-term
ICH Mortality
is 30-40%**

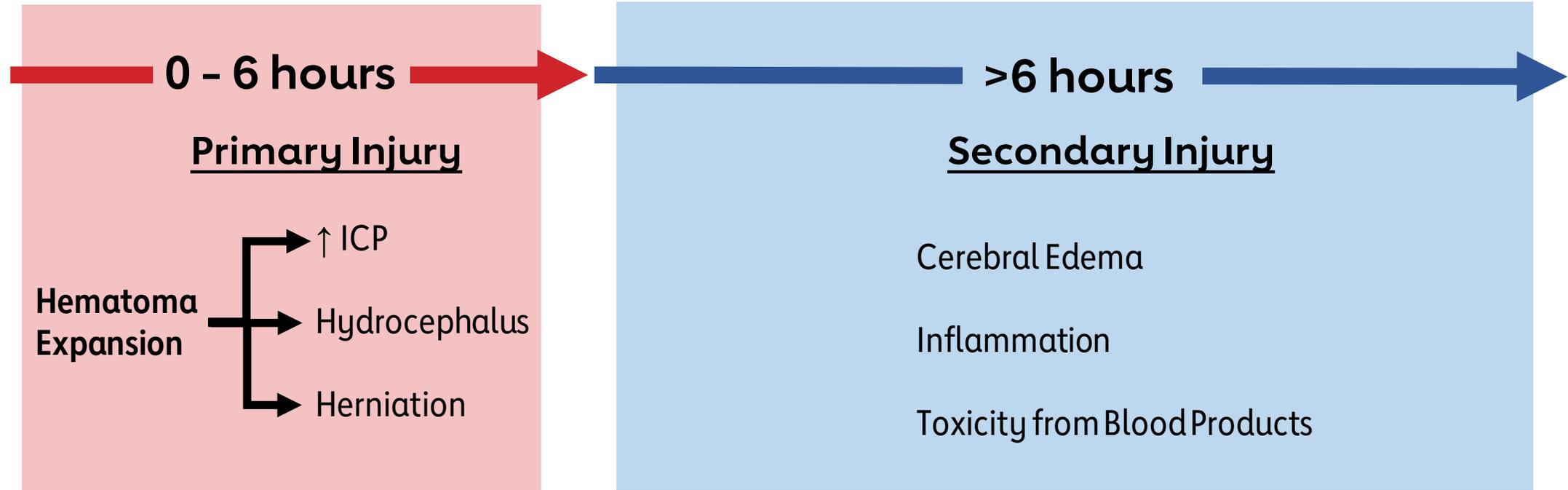


Incidence of ICH by Race

- ≈1.6-fold greater among Black than White people
- ≈1.6-fold greater among Mexican American than non-Hispanic White people



Mechanisms of ICH Injury



General Principle: Acute ICH management targets these mechanisms.



ICH Etiology Determines Hemorrhage Location

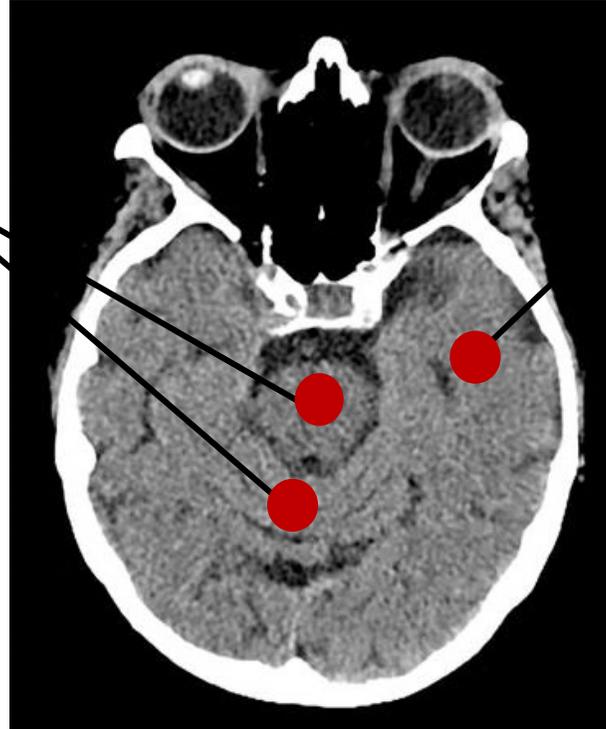
Deep/Posterior Fossa ICH Etiologies

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

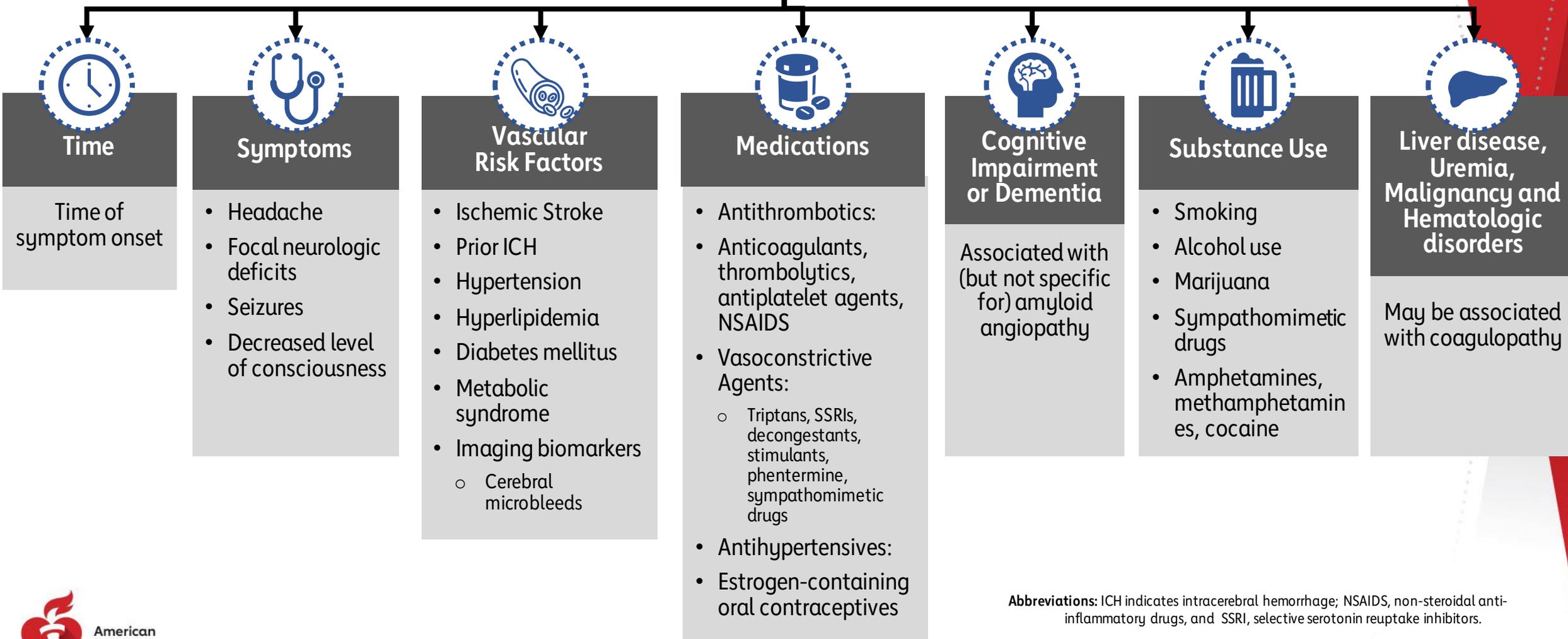
Diagnostic Reasoning: CAA typically causes only lobar (or superficial cerebellar) hemorrhages. Arteriolosclerosis may cause both deep and lobar hemorrhages. Coexistent pathology is possible.

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

History



Abbreviations: ICH indicates intracerebral hemorrhage; NSAIDS, non-steroidal anti-inflammatory drugs, and SSRI, 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



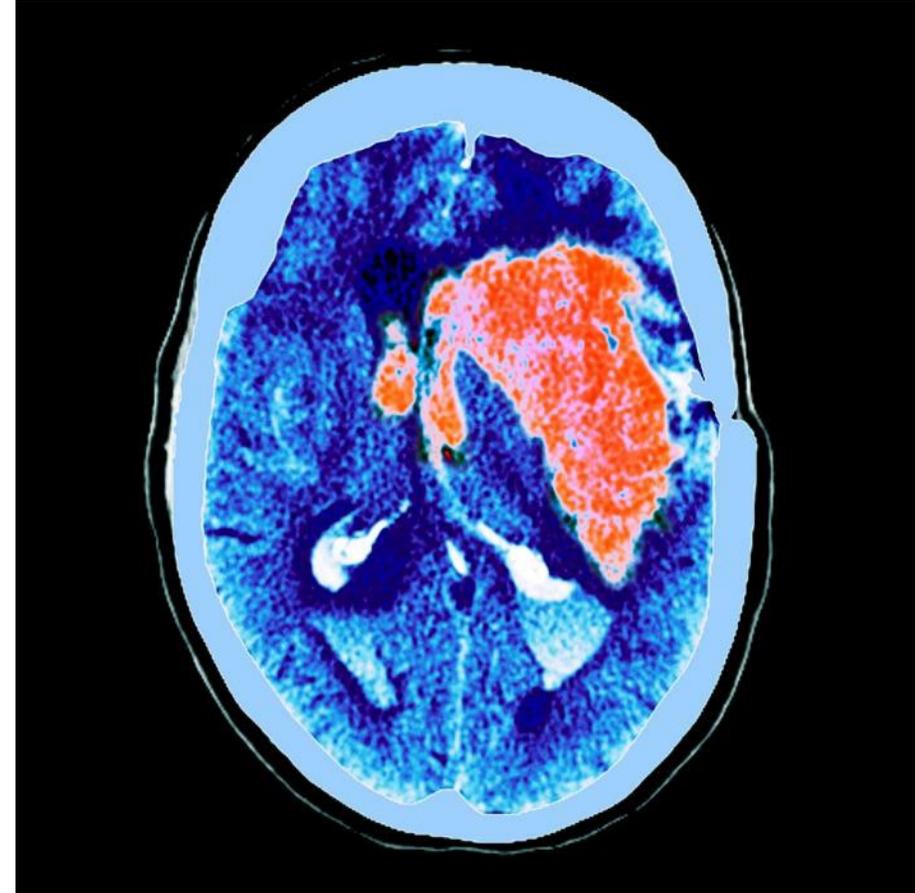
Diagnosis & Assessment | Work-Up in Acute ICH

Indicators of Increased Morbidity & Mortality:

- Thrombocytopenia
- Hyperglycemia
- Acute Kidney Injury
- Elevated troponin

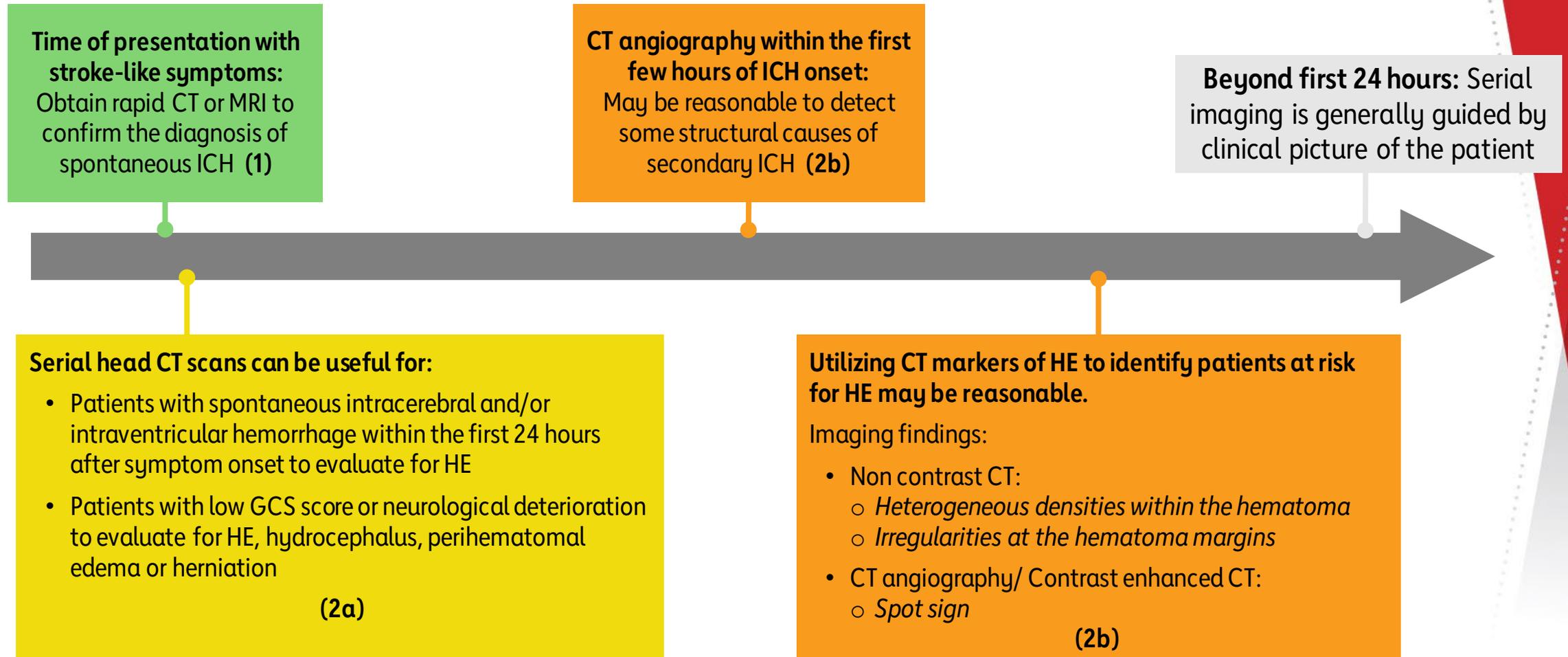
Indicators of Increased HE:

- Anemia
- 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.
- Anticoagulant-related hemorrhages





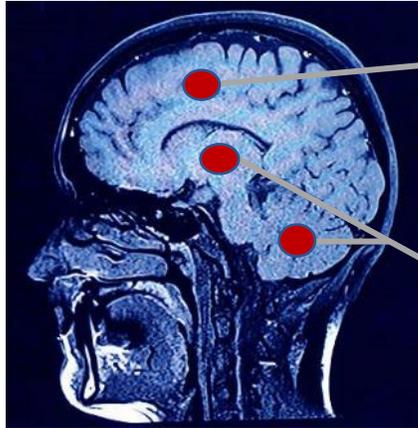
Diagnosis & Assessment | Neuroimaging to Diagnose ICH





Diagnosis & Assessment | Strategy to Determine ICH Etiology

For Patients With...



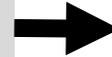
Lobar ICH

- Age <70 yrs

- OR -

Deep/Posterior Fossa ICH

- Age <45
- Age 45-70 yrs, NO HTN



Utilize This Diagnostic Strategy...

CT Angiogram/Venogram Recommended (1)

- AND -

MRI + MR Angiogram Reasonable (2a)

- AND -

Cerebral Angiogram Reasonable (2a)

Spontaneous IVH with NO parenchymal hemorrhage (any age)

- OR -

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



Cerebral Angiogram Recommended (1)



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)

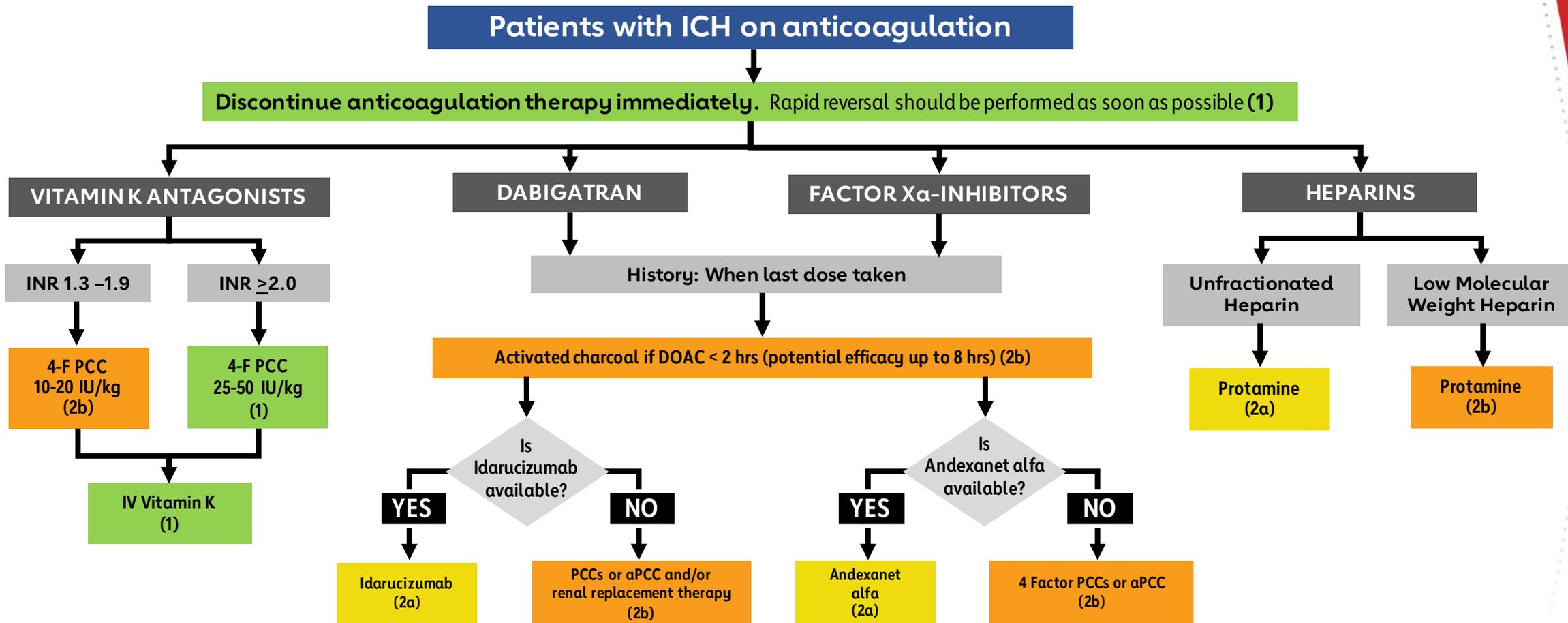
If ICH is mild to moderate severity presenting with SBP >150 mmHg, acute lowering of SBP to hrs. <130 mmHg is potentially harmful. (3:Harm)

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



Hemostasis & Coagulopathy

Management of Anticoagulant-Related Hemorrhage



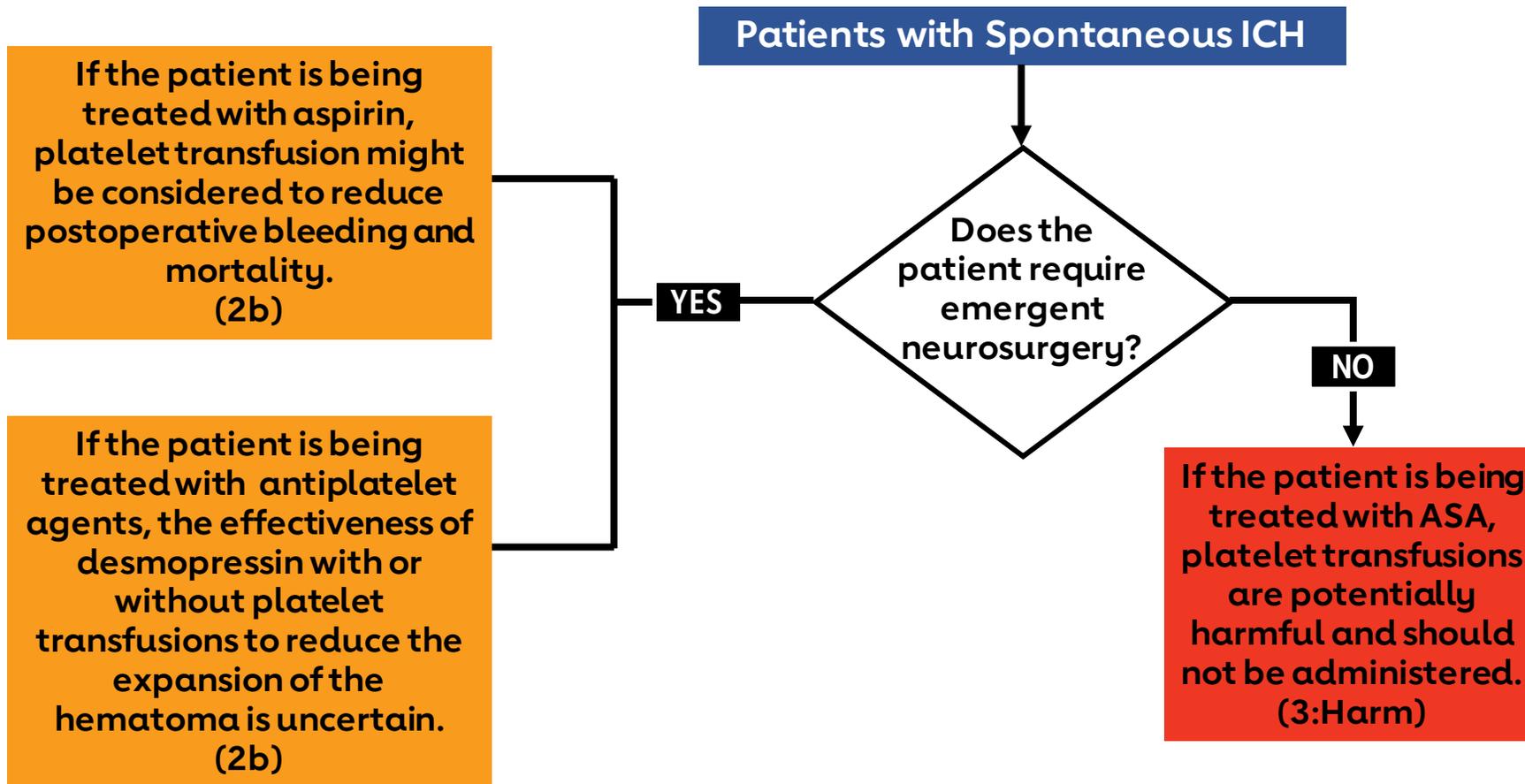
Abbreviations: 4-F PCC indicates four-factor prothrombin complex concentrate; aPCC, activated prothrombin complex concentrate; DOAC, direct oral anticoagulant; ICH, intracerebral hemorrhage; and INR, international normalized ratio.

Greenberg, S. M. 2022 AHA/ASA . Guideline for the Management of Patients with Spontaneous Intracerebral Hemorrhage. *Circulation*.



Hemostasis & Coagulopathy

Antiplatelet-Related Hemorrhage in Spontaneous ICH



Abbreviations: ASA indicates aspirin; and ICH, intracerebral hemorrhage.



Hemostasis & Coagulopathy

General Hemostatic Treatments

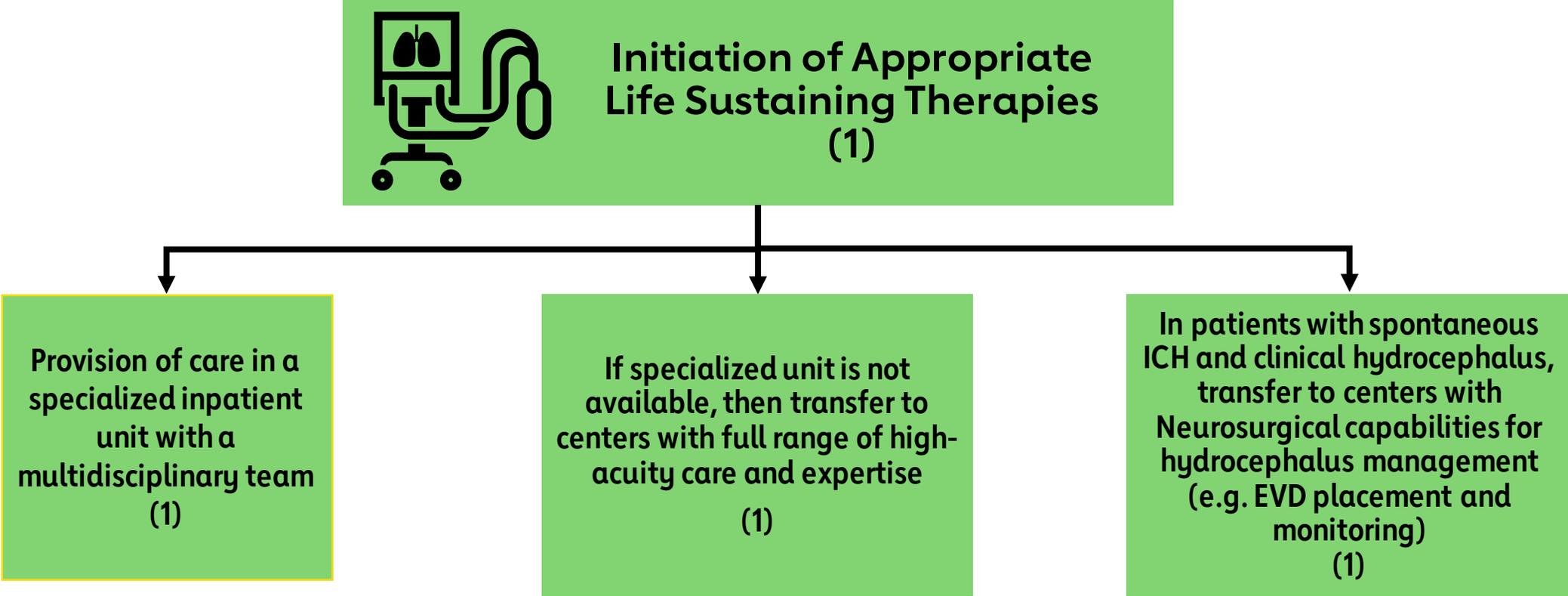
Synopsis of the Evidence

- 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



General Inpatient Care

Considerations for Inpatient Care Setting





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)





Inpatient Care Checklist



In Non-Ambulatory Spontaneous ICH... *Thromboprophylaxis & Tx of Thrombosis*

Prophylaxis

... , intermittent pneumatic compression starting on the day of diagnosis is recommended for VTE (DVT and PE) prophylaxis. (1)

... low-dose UFH or LMWH can be useful to reduce risk of PE (2a)

... temporary use of retrievable filter as bridge until anticoagulation initiated. (2a)

... 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)

... graduated compression stockings of knee-high or thigh-high length alone are not beneficial for VTE prophylaxis. (3: No Benefit)

Treatment

... and proximal DVT who are not yet candidates for anticoagulation, temporary use of retrievable filter is reasonable as a bridge until anticoagulation initiated. (2a)

... and proximal DVT or PE, delaying treatment with UFH or LMWH 1 to 2 weeks after onset of ICH might be considered. (2b)

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.

Greenberg, S. M. 2022 AHA/ASA . Guideline for the Management of Patients with Spontaneous Intracerebral Hemorrhage. *Circulation*.



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.

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)



Temperature Management

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

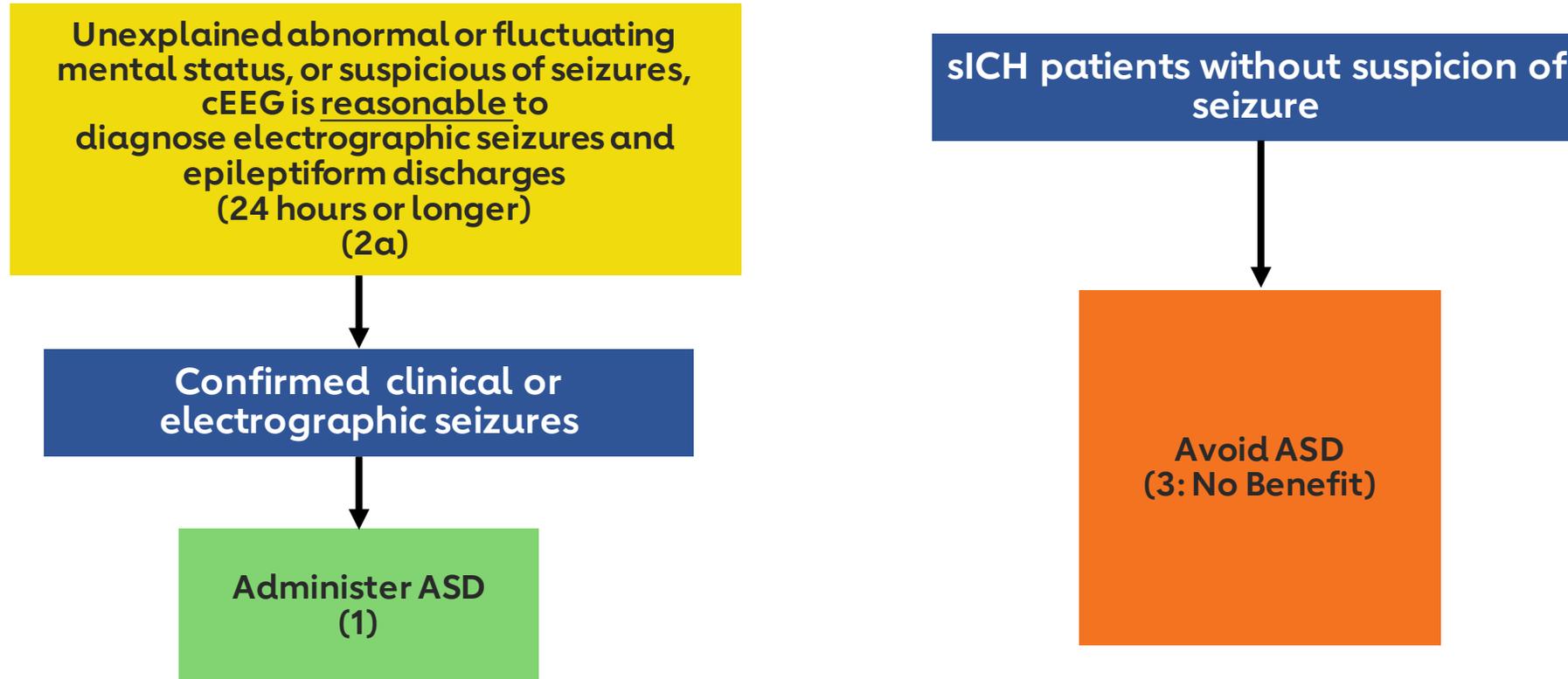
The usefulness of therapeutic hypothermia (<35°C/95°F) to decrease peri-ICH edema is unclear. (2b)

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



Seizures and Antiseizure Drugs

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



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)

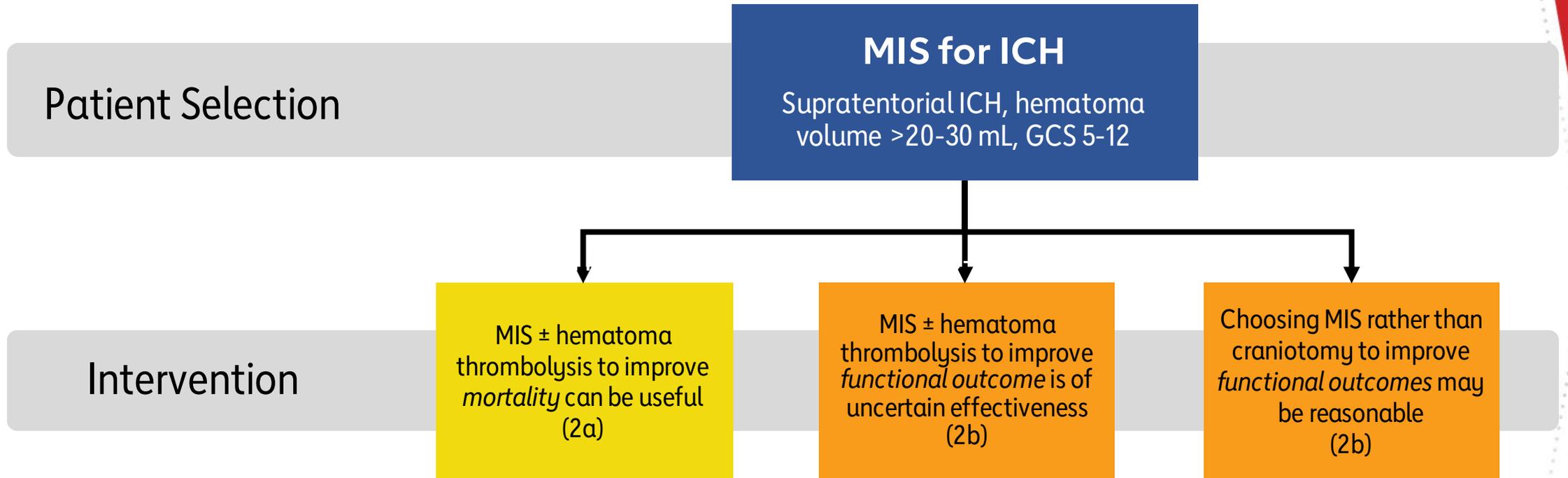
Abbreviation: ICP indicates intracranial pressure; IVH, intraventricular hemorrhage; and sICH, spontaneous intracerebral hemorrhage.

Greenberg, S. M. 2022 AHA/ASA . Guideline for the Management of Patients with Spontaneous Intracerebral Hemorrhage. *Circulation*.



Surgical Interventions

Minimally Invasive Surgical Evacuation of ICH

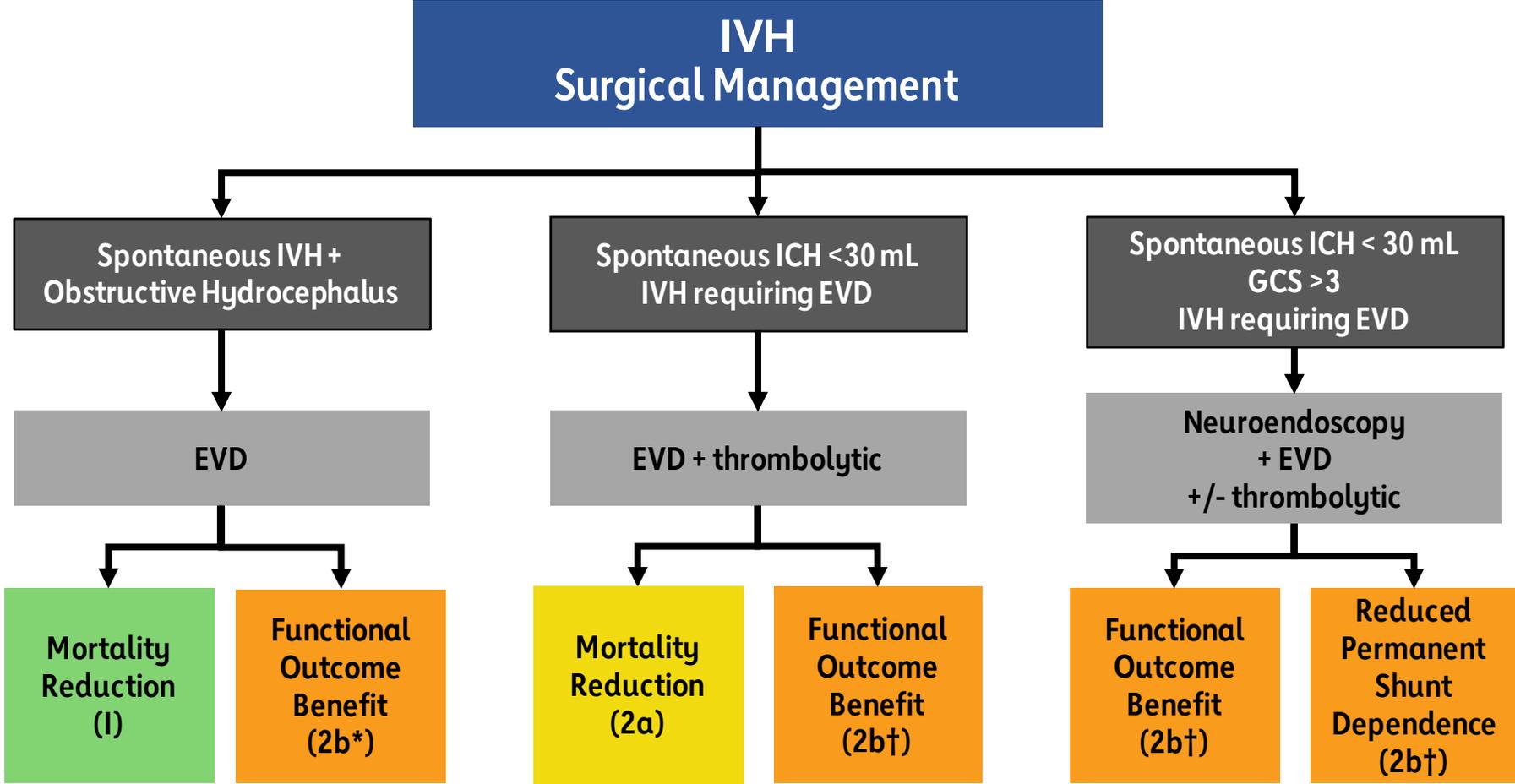


Abbreviations: GCS indicates Glasgow Coma Scale; ICH, intracerebral hemorrhage; and MIS, minimally invasive surgery.



Surgical Interventions

Minimally Invasive Surgical Evacuation of Intraventricular Hemorrhage



Note: *Not well established. †Uncertain

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



Surgical Interventions

Craniotomy for Supratentorial Hemorrhage



Supratentorial ICH of moderate or greater severity*

Note: * >10 cc with a significant neurologic deficit

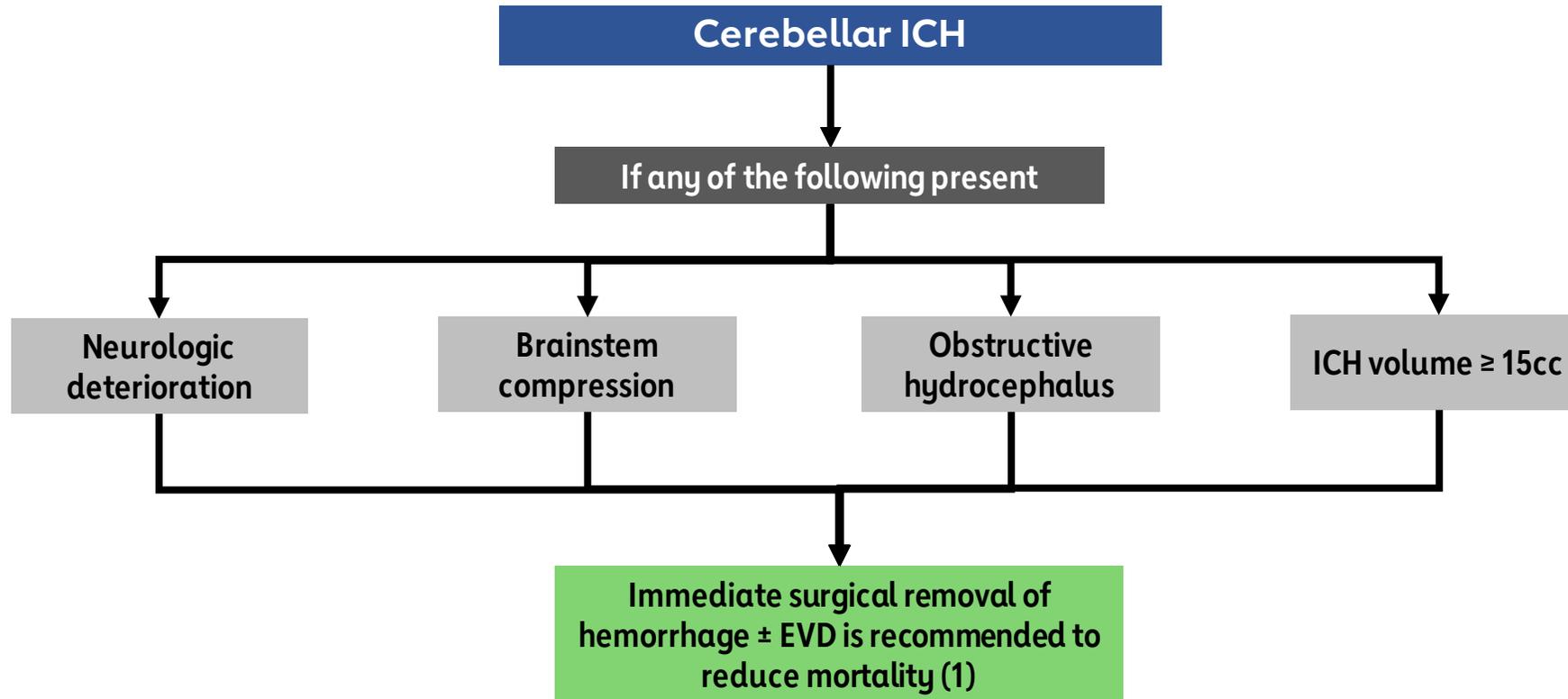
Craniotomy for hemorrhage evacuation to improve mortality or functional outcomes is of uncertain usefulness (2b)

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



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

Click to view Measures for Evaluating Overall Hemorrhage Severity

... 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

Can not fully participate in medical decision-making

Shared decision-making between surrogates and physicians is **reasonable** (2a)

No pre-existing life-sustaining therapy limitations

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)

For patients who have DNAR Status

Limiting other medical and surgical interventions unless explicitly specified is associated with increased patient mortality (3: Harm)



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)**

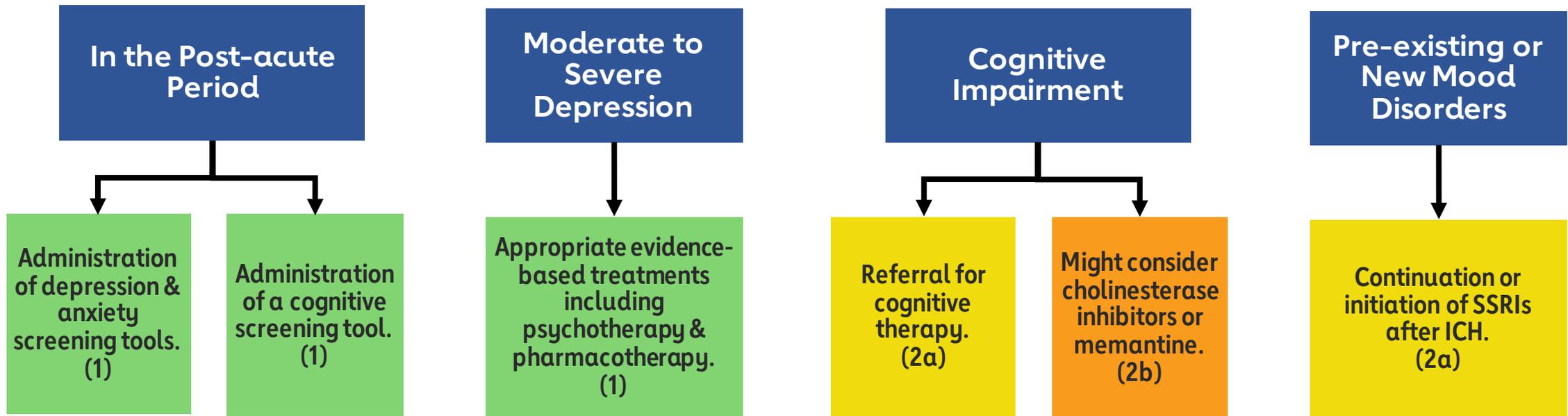
Very early and intense mobilization < 24 hours: **potentially harmful** (3: Harm)

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



Neurobehavioral Complications

In patients with spontaneous ICH



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

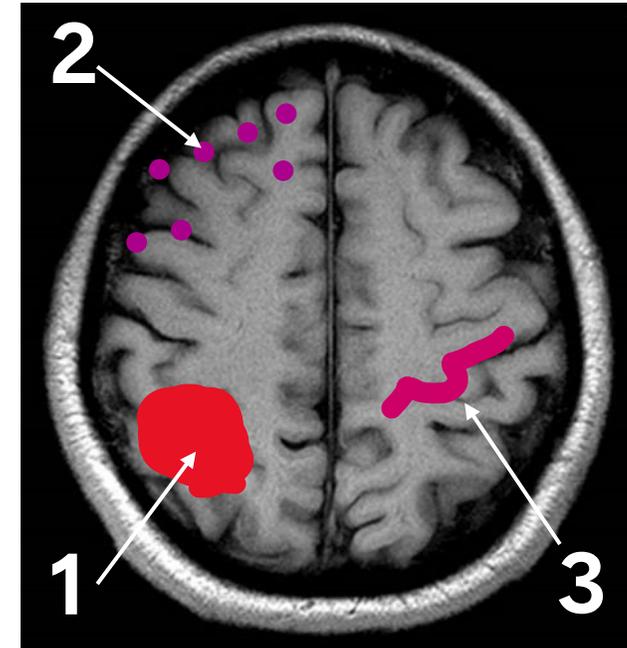


Secondary Prevention

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 ϵ 2 or ϵ 4 alleles. (2a)



MRI imaging characteristics:

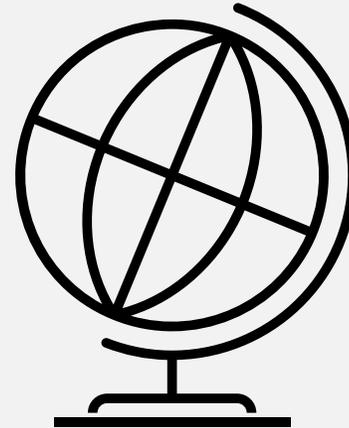
- 1) Lobar location of initial ICH
- 2) Number and lobar location of microbleeds
- 3) Presence of cortical superficial siderosis

Secondary Prevention

Blood Pressure Management



Uncontrolled HTN accounts for 74% of global population-attributable risk for ICH.



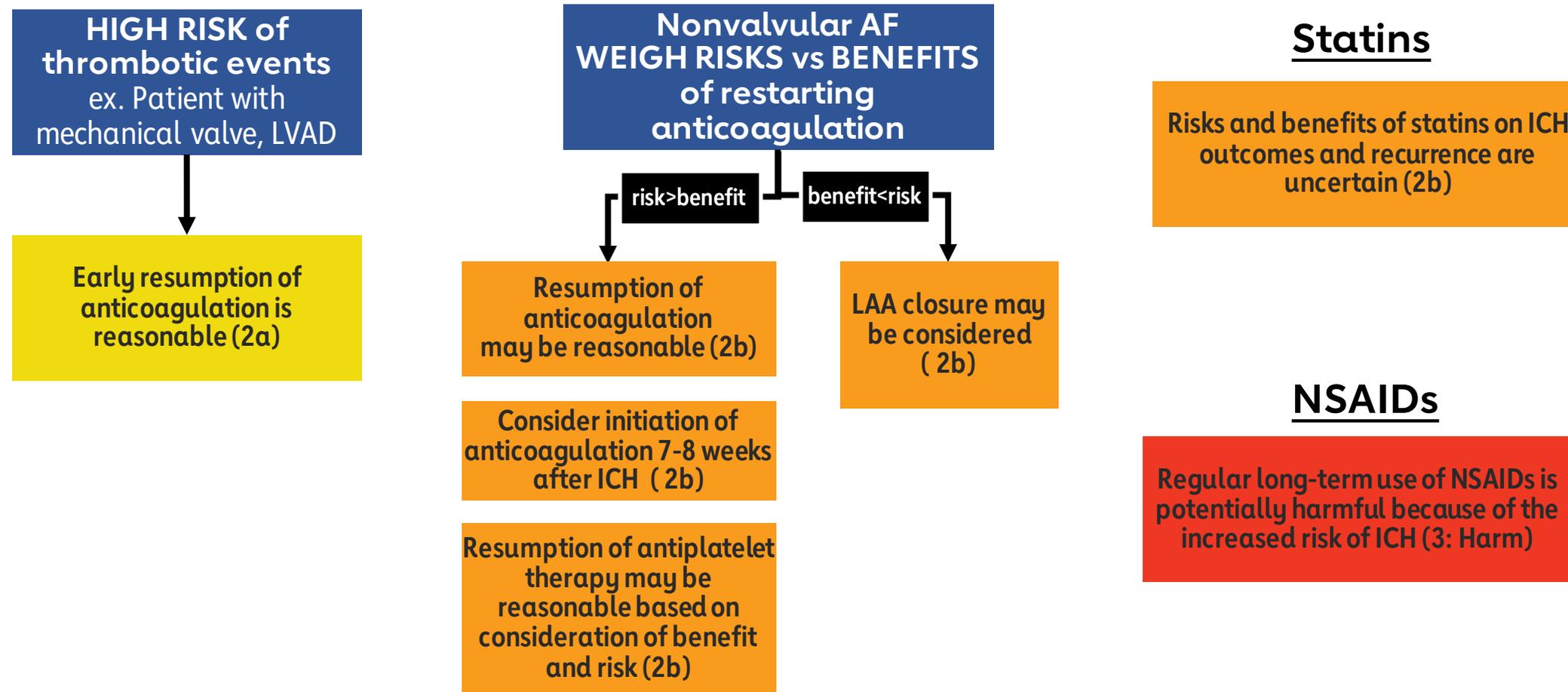
Guiding Principle

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



Secondary Prevention

Management of Antithrombotic Agents and Other Medications



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

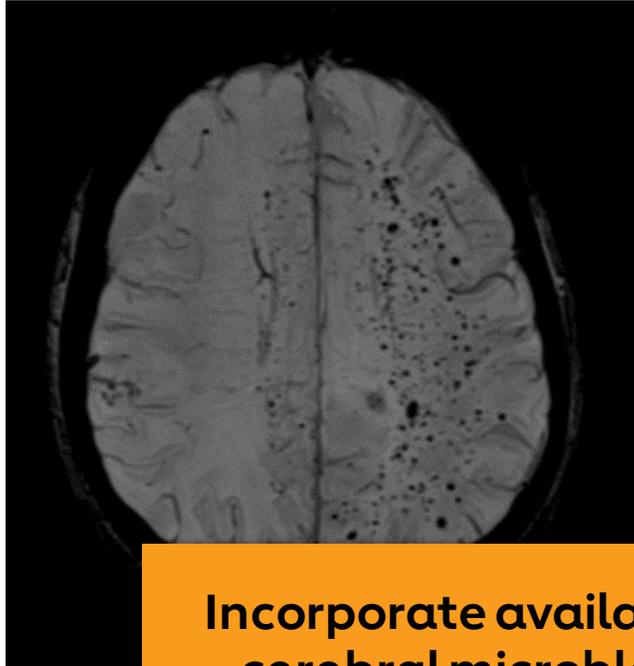


Caregiver support & training

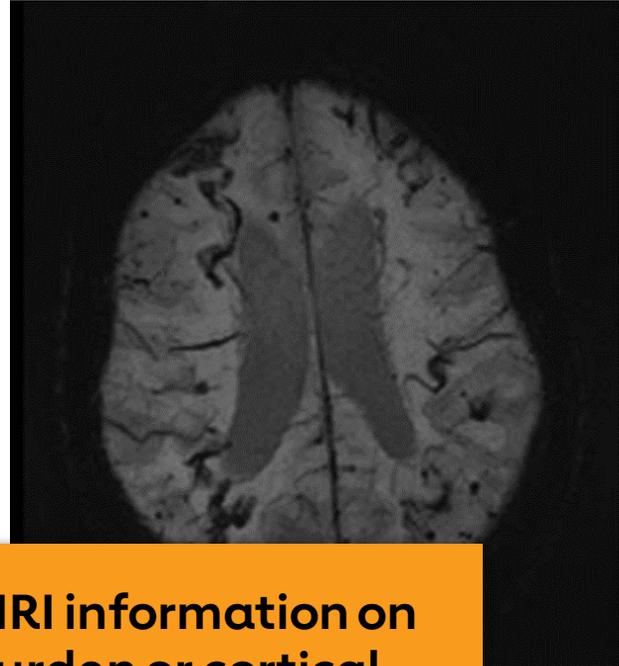


Primary ICH Prevention in Individuals with High-Risk Imaging Findings

Cerebral microbleed

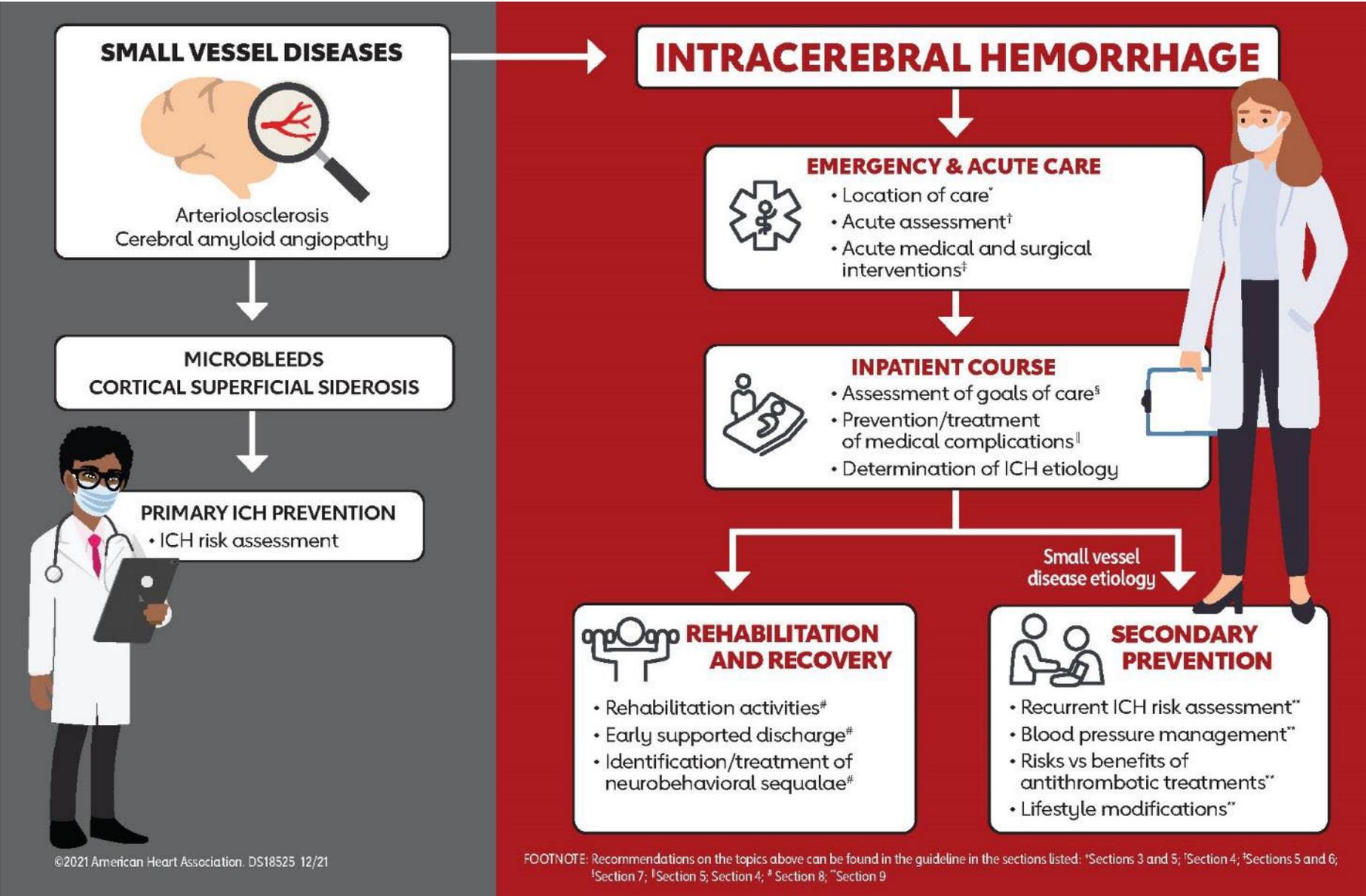


Cortical superficial siderosis



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

Gregório T, Pipa S, Cavaleiro P, Atanásio G, Albuquerque I, Castro Chaves P, Azevedo L. Original intracerebral hemorrhage score for the prediction of short-term mortality in cerebral hemorrhage: systematic review and meta-analysis. *Crit Care Med*. 2019;47:857–864. doi: 10.1097/CCM.0000000000003744

Gregório T, Pipa S, Cavaleiro P, Atanásio G, Albuquerque I, Chaves PC, Azevedo L. Assessment and comparison of the four most extensively validated prognostic scales for intracerebral hemorrhage: systematic review with meta-analysis. *Neurocrit Care*. 2019;30:449–466. doi: 10.1007/s12028-018-0633-6

Gregório T, Pipa S, Cavaleiro P, Atanásio G, Albuquerque I, Chaves PC, Azevedo L. Prognostic models for intracerebral hemorrhage: systematic review and meta-analysis. *BMC Med Res Methodol*. 2018;18:145. doi: 10.1186/s12874-018-0613-8

Sembill JA, Gerner ST, Volbers B, Bobinger T, Lücking H, Kloska SP, Schwab S, Huttner HB, Kuramatsu JB. Severity assessment in maximally treated ICH patients: the max-ICH score. *Neurology*. 2017;89:423–431. doi: 10.1212/WNL.0000000000004174

Sembill JA, Castello JP, Sprügel MI, Gerner ST, Hoelter P, Lücking H, Doerfler A, Schwab S, Huttner HB, Biffi A, et al. Multicenter validation of the max-ICH score in intracerebral hemorrhage. *Ann Neurol*. 2021;89:474–484. doi: 10.1002/ana.25969