2022 Update on Intracerebral Hemorrhage Neurosurgical Management

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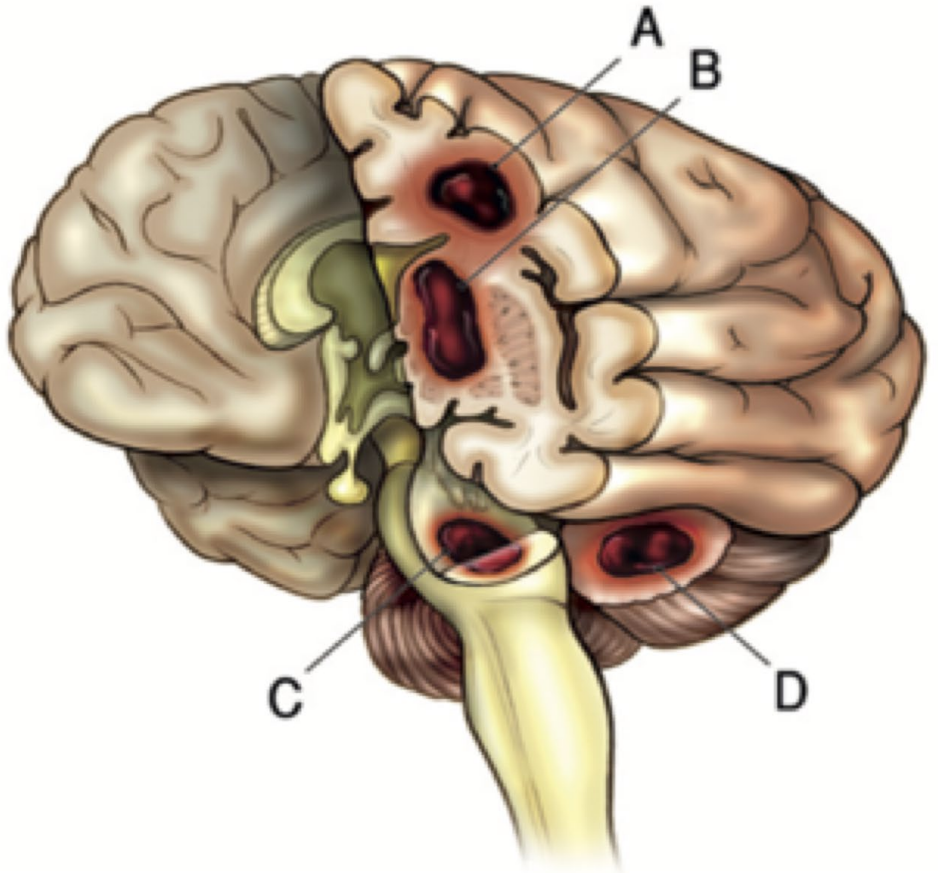
GLOBAL NEUROSCIENCES INSTITUTE

CLINICAL EXCELLENCE | RESEARCH | INNOVATION

Introduction

- Hemorrhagic Stroke accounts for 20% of total strokes
- High burden of disease – 30d mortality of 40%
- High rate of disability:
  - 10-25% return to functional independence
  - <10% when initial hematoma >30ml
- Prolonged ICU stay:
  - Ventilation
  - Nutrition support
  - Infections



Causes of Intracerebral Hemorrhage

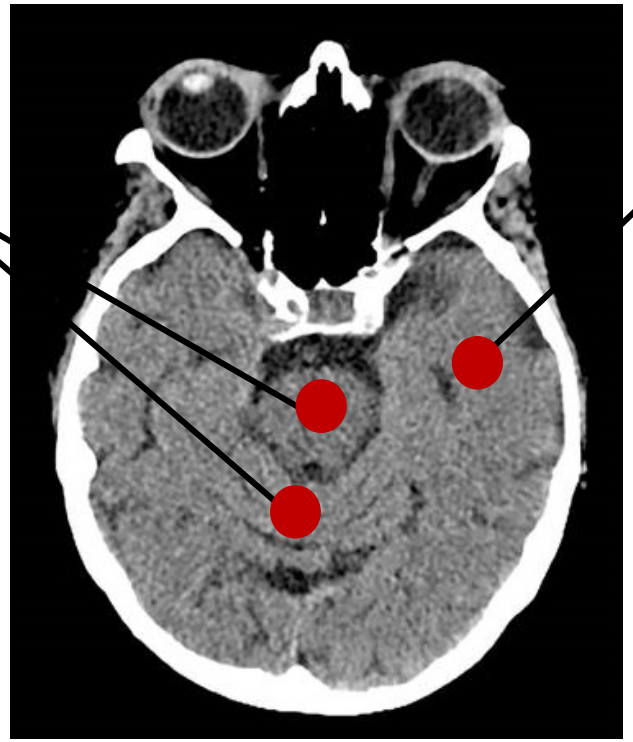
- Trauma
- Anticoagulation or clotting disorders
- Aneurysms
- AVMs
- Cavernous Malformations
- Tumors
- Substance Abuse
  - EtoH
  - Sympathomimetics
- Ischemic Stroke with hemorrhagic conversion
- Hypertension
- Vasculitis
- Amyloid Angiopathy
- Venous Sinus Thrombosis
- Idiopathic
- CNS Infections
  - HSV encephalitis
  - Mycotic aneurysms

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.

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Diagnosis & Assessment | Work-Up for Acute ICH Course

History

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, methamphetamines, 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 SSRI, selective serotonin reuptake inhibitors.

American Heart Association.

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

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:** • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B	**LEVEL A** • 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:** • 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	**LEVEL B-R (Randomized)** • Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
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	**LEVEL B-NR (Nonrandomized)** • 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:** • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other	**LEVEL C-LD (Limited Data)** • 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:** • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other	**LEVEL C-EO (Expert Opinion)** • 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.

American Heart Association.

Medical Management

- Acute Resuscitation/ABC
- BP Management
- ICP management
- Reversal of coagulopathy

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

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.

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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)**

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

Beyond first 24 hours: Serial imaging is generally guided by clinical picture of the patient

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)

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.

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Medical Management

- BP is increased in up to 75 to 80% of patients with acute stroke then goes back to normal within a few days.
- Causes of the transient increase is unknown:
  - Physiologic reaction to the stroke itself due to disturbed cerebral autoregulation
  - Damage or compression of brain regions that regulate the ANS
  - Neuroendocrine factors
  - Nonstroke-specific factors: Headache, urine retention, infection, physiological stress of admission to the hospital…

Rationale for BP lowering in Acute Stroke

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Medical Management

Rationale for BP lowering in Acute Stroke

- High BP in hemorrhagic stroke:
  - Increased the risk of hematoma expansion
  - Growth of the perihematomal edema
  - Early rebleeding
- Lowering BP can also treat concomitant heart conditions (Heart failure, Takutsubo…)

Rationale against lowering BP

- End organ hypoperfusion
- Cerebral ischemia due to low cerebral blood flow:
  - Patients with chronic HTN
  - Autoregulatory curve shifted to the right

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.

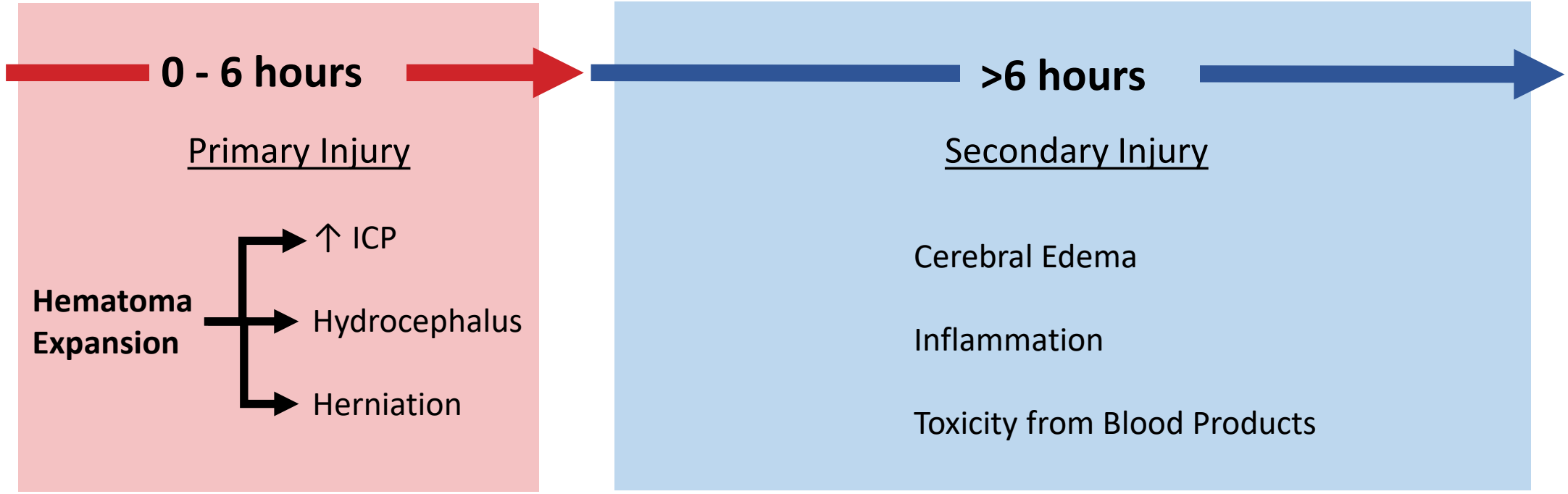
American Heart Association.

Reversal of Coagulopathy

- Patient with ICH on antithrombotics:
  - Higher likelihood of secondary hematoma expansion
  - Increased risk of death
  - Increased risk of poor functional outcomes

- Patients taking OAC constitute 12-20% of patients with ICH

Mechanisms of ICH Injury



General Principle: Acute ICH management targets these mechanisms.

Abbreviations: ICH indicates intracerebral hemorrhage; and ICP, intracranial pressure.

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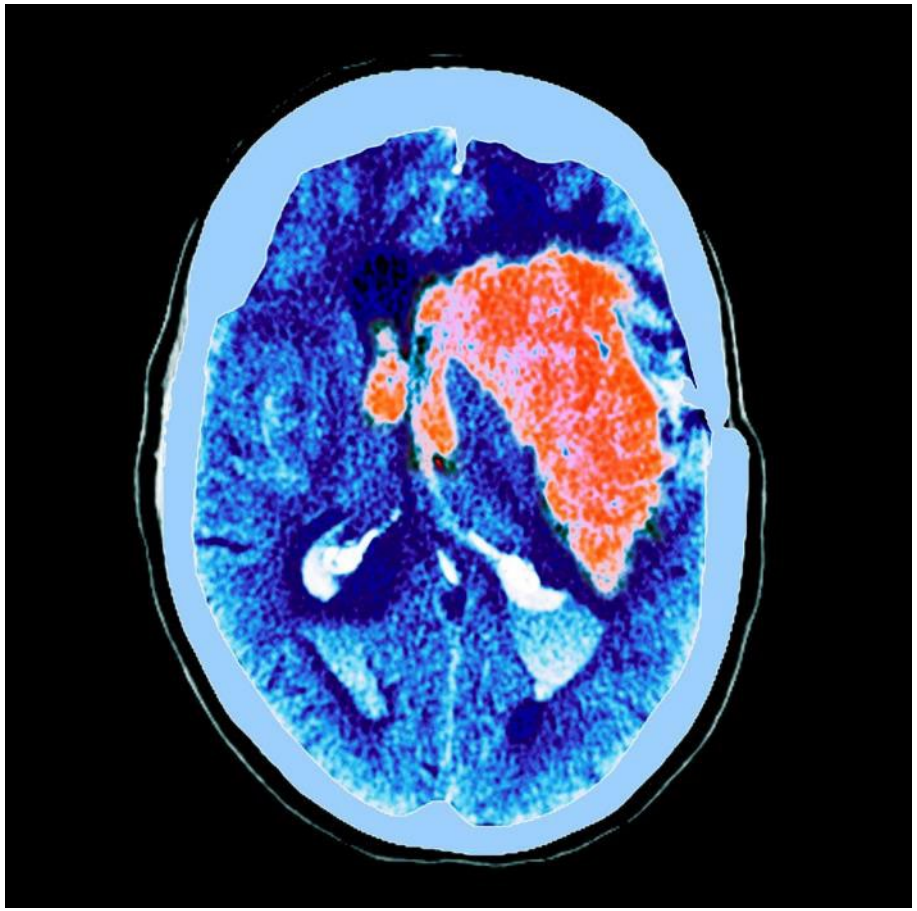
Diagnosis & Assessment | Work-Up in Acute ICH

Indicators of Increased Morbidity & Mortality:

- **Thrombocytopenia**
- **Acute Kidney Injury**
- **Hyperglycemia**
- **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 .

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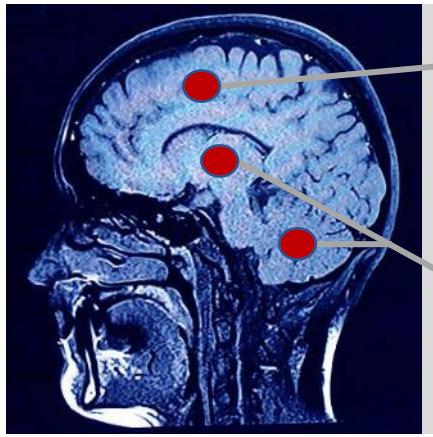
Diagnosis & Assessment | Strategy to Determine ICH Etiology

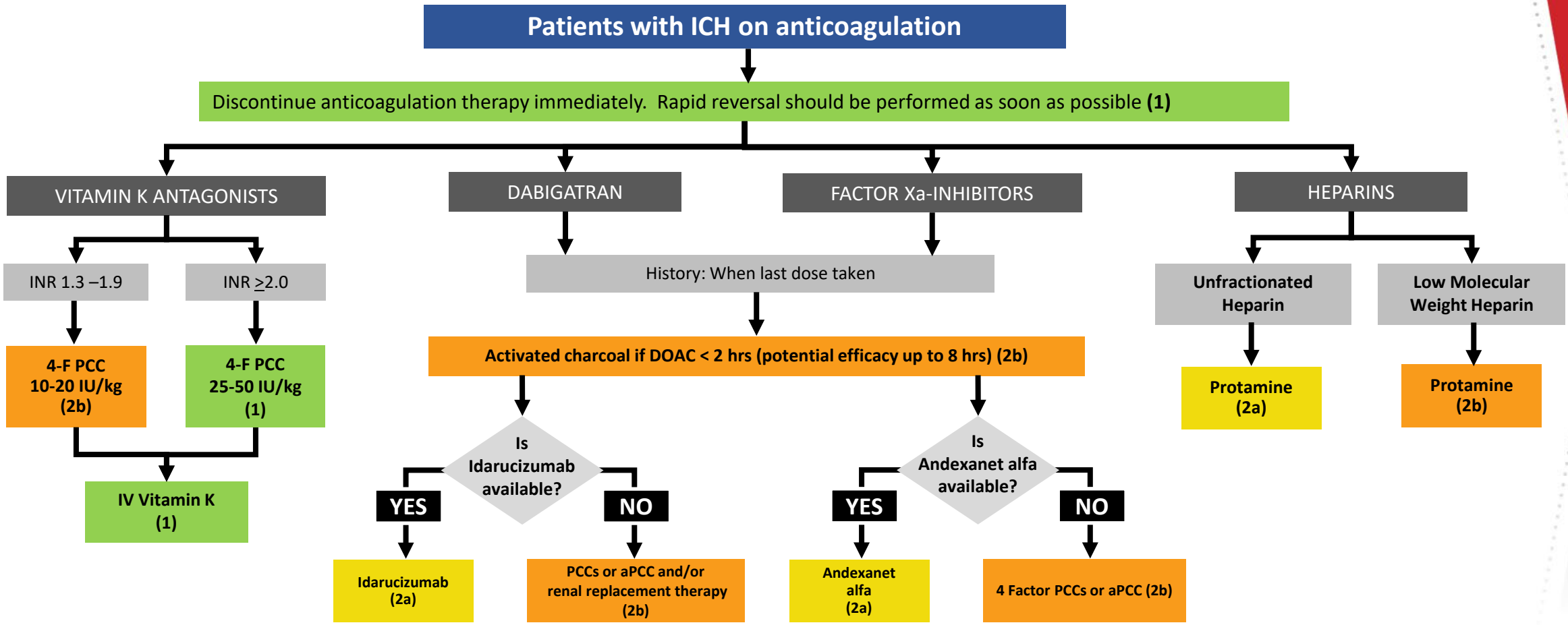
For Patients With…	Utilize This Diagnostic Strategy…
 **Lobar ICH** • Age <70 yrs **- OR -** **Deep/Posterior Fossa ICH** • Age <45 • Age 45-70 yrs, NO HTN	**CT Angiogram/Venogram Recommended (1)** **- AND -** **MRI + MR Angiogram Reasonable (2a)** **- AND -** **Cerebral Angiogram Reasonable (2a)**
Spontaneous IVH with NO parenchymal hemorrhage (any age) **- OR -** **CTA/MRA suggestive of macrovascular ICH etiology (any age)**	**Cerebral Angiogram Recommended (1)**

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.

American Heart Association.

Hemostasis & Coagulopathy

Management of Anticoagulant-Related Hemorrhage

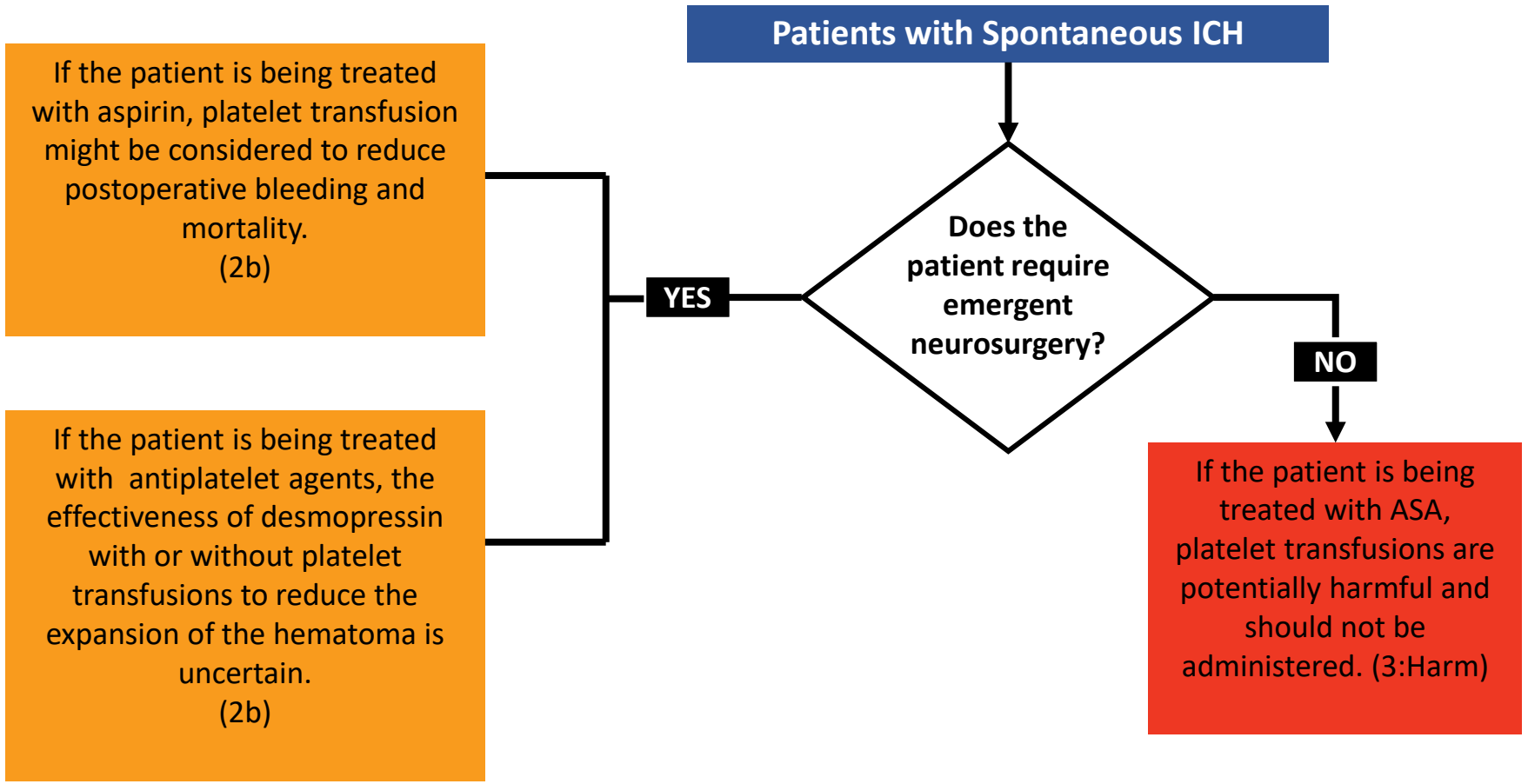


Abbreviations: 4-F PCC indicates four-factor prothrombin complex concentrate; aPCC, activated prothrombin complex concentrate; DOAC, direct oral anticoagulant; ICH, intracerebral hemorrhage; and INR, international normalized ratio.

American Heart Association.

Hemostasis & Coagulopathy

Antiplatelet-Related Hemorrhage in Spontaneous ICH



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

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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

Abbreviations: CTA indicates computed tomography angiography; HE, hematoma expansion; and ICH, intracerebral hemorrhage.

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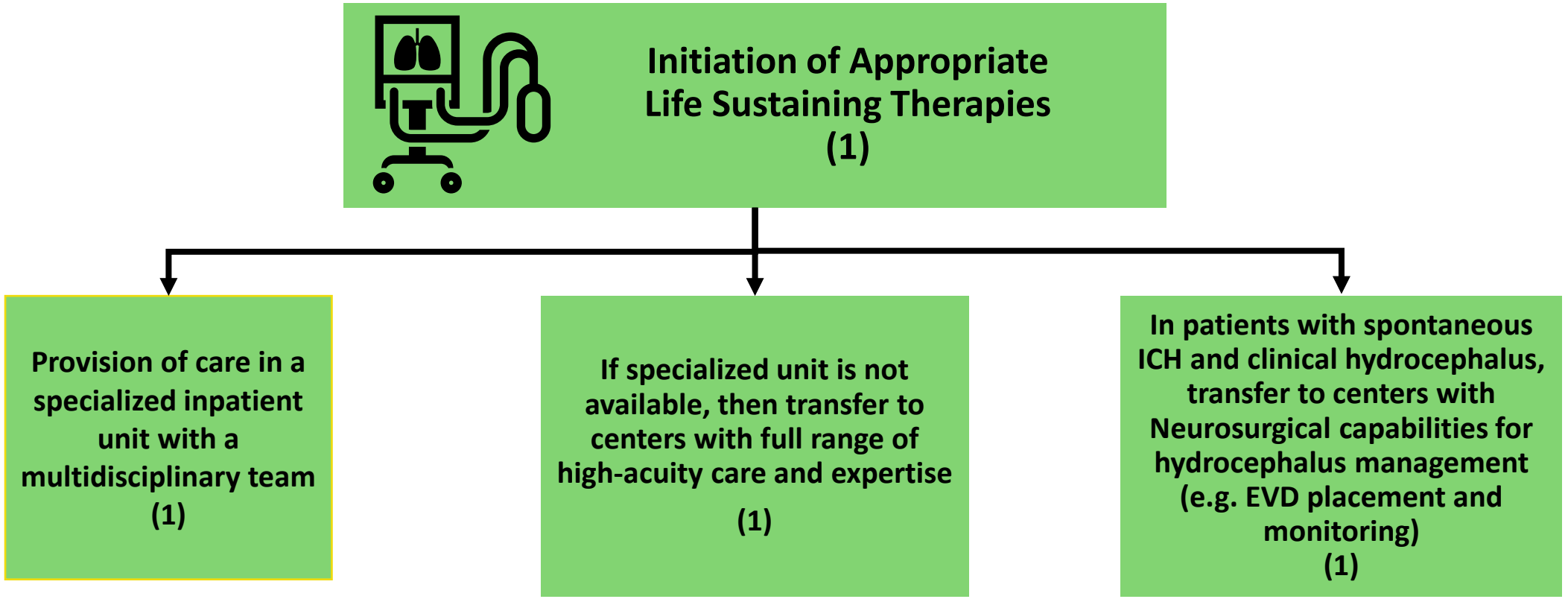
General Inpatient Care

Considerations for Inpatient Care Setting



Abbreviations: EVD indicates external ventricular drain; and ICH, intracerebral hemorrhage.

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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)

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.

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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.

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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.

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.

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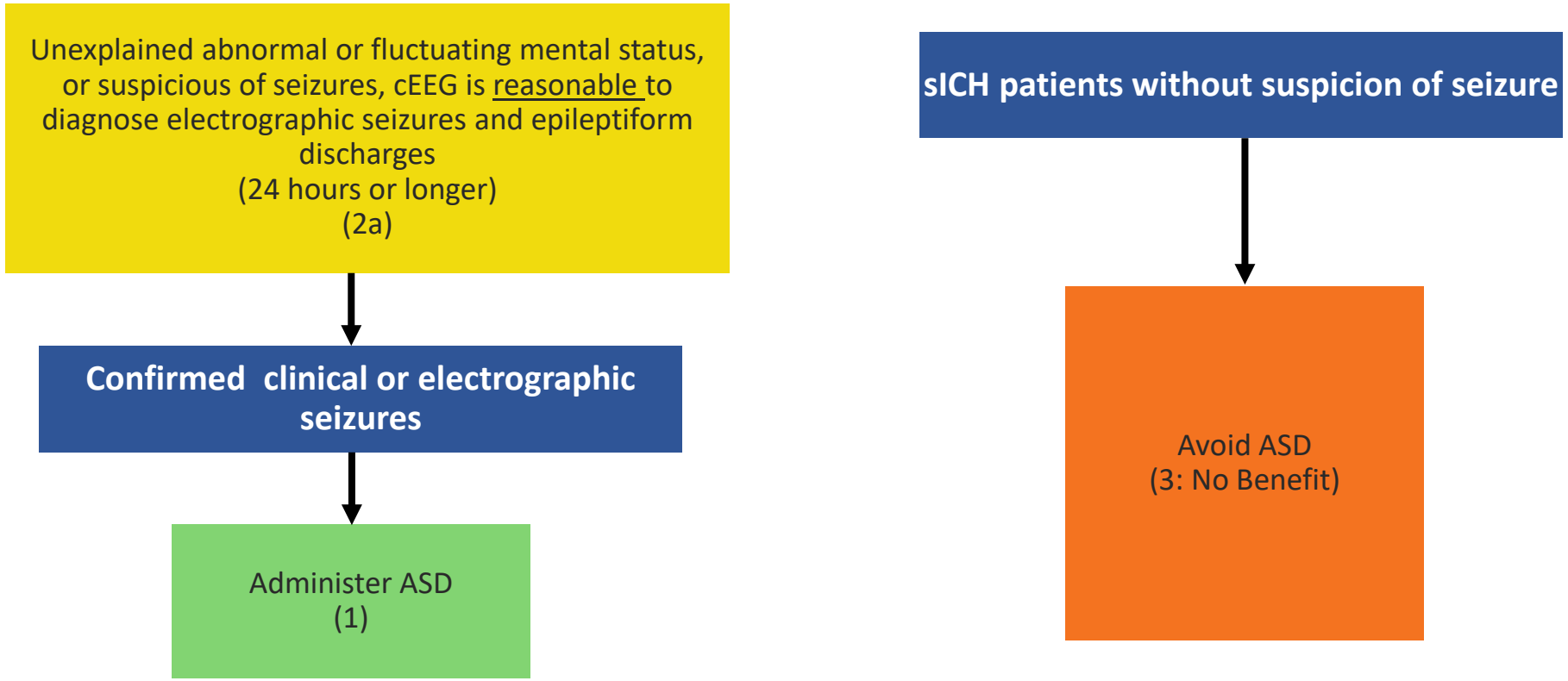
Seizures and Antiseizure Drugs

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.

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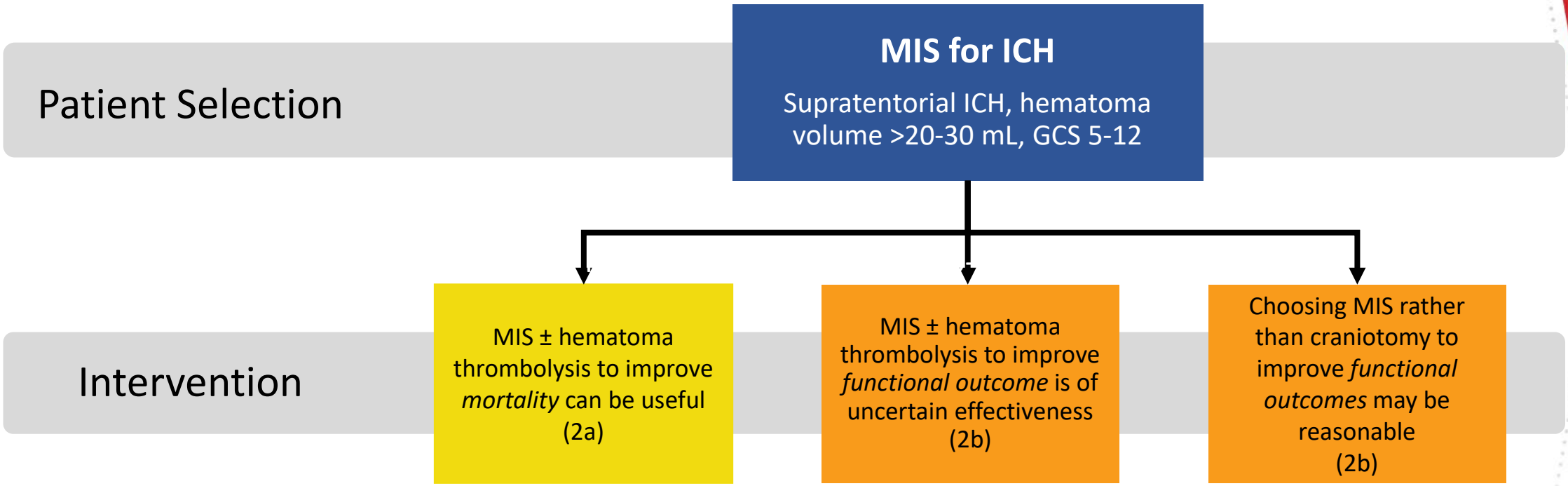
Surgical Interventions

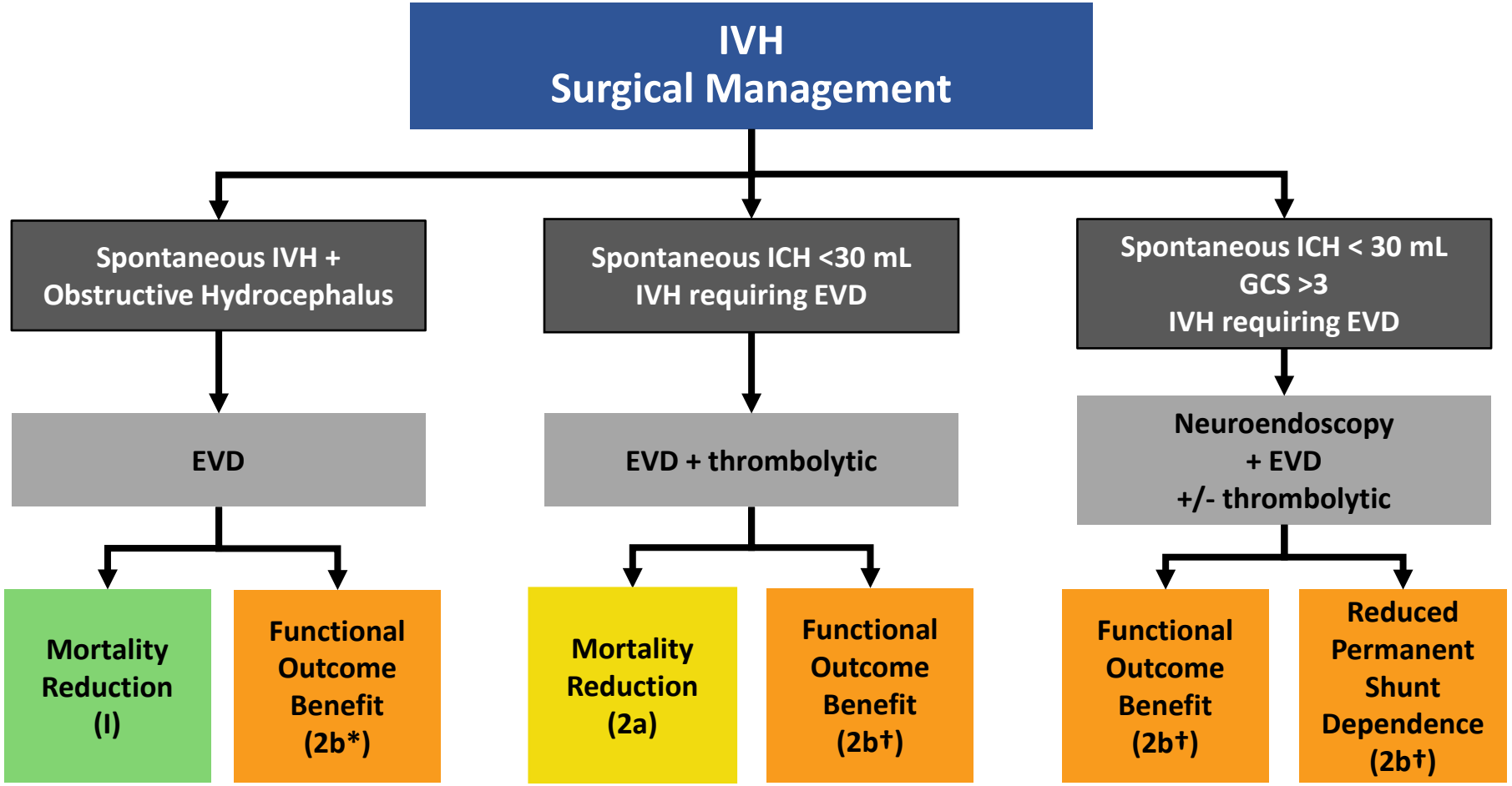
Minimally Invasive Surgical Evacuation of ICH



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.

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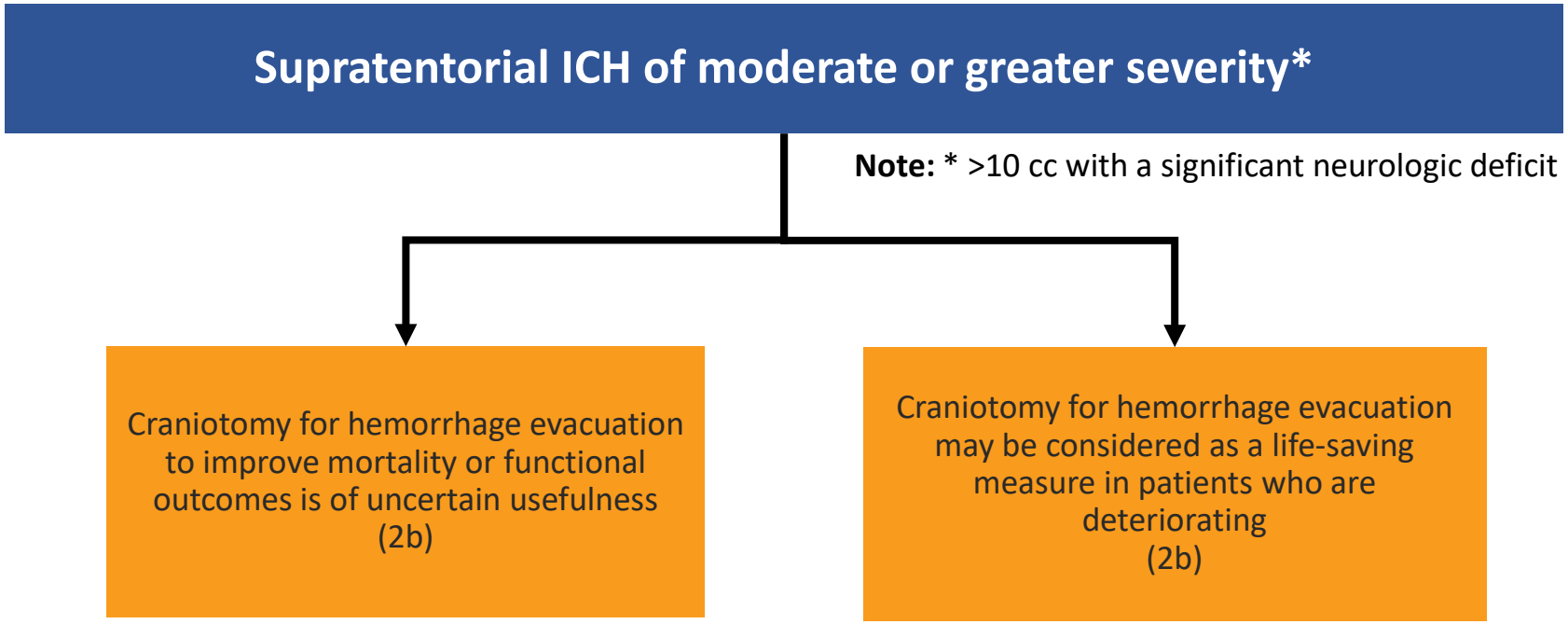
Surgical Interventions

Craniotomy for Supratentorial Hemorrhage



Abbreviations: ICH indicates intracerebral hemorrhage.

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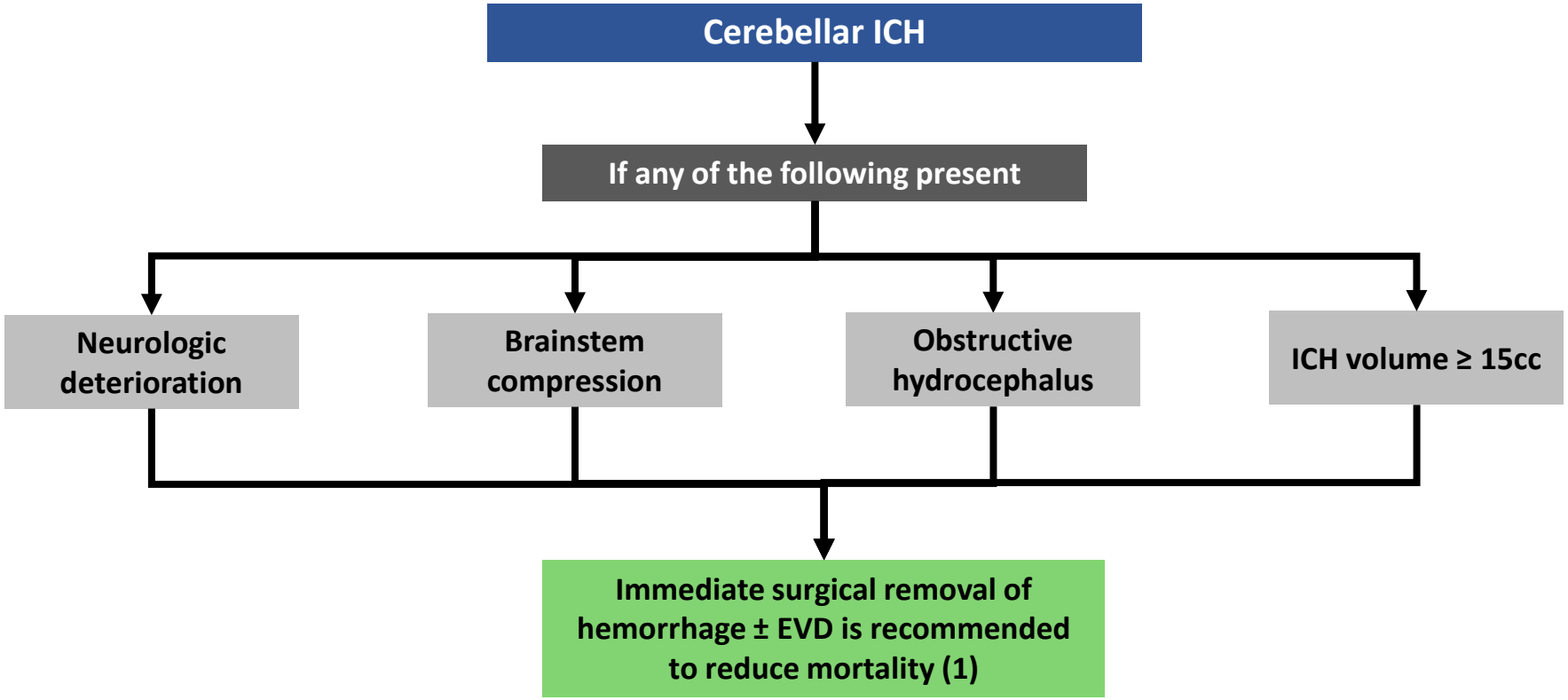
Surgical Interventions

Craniotomy for Posterior Fossa Hemorrhage



Abbreviations: EVD indicates external ventricular drain; and ICH, intracerebral hemorrhage.

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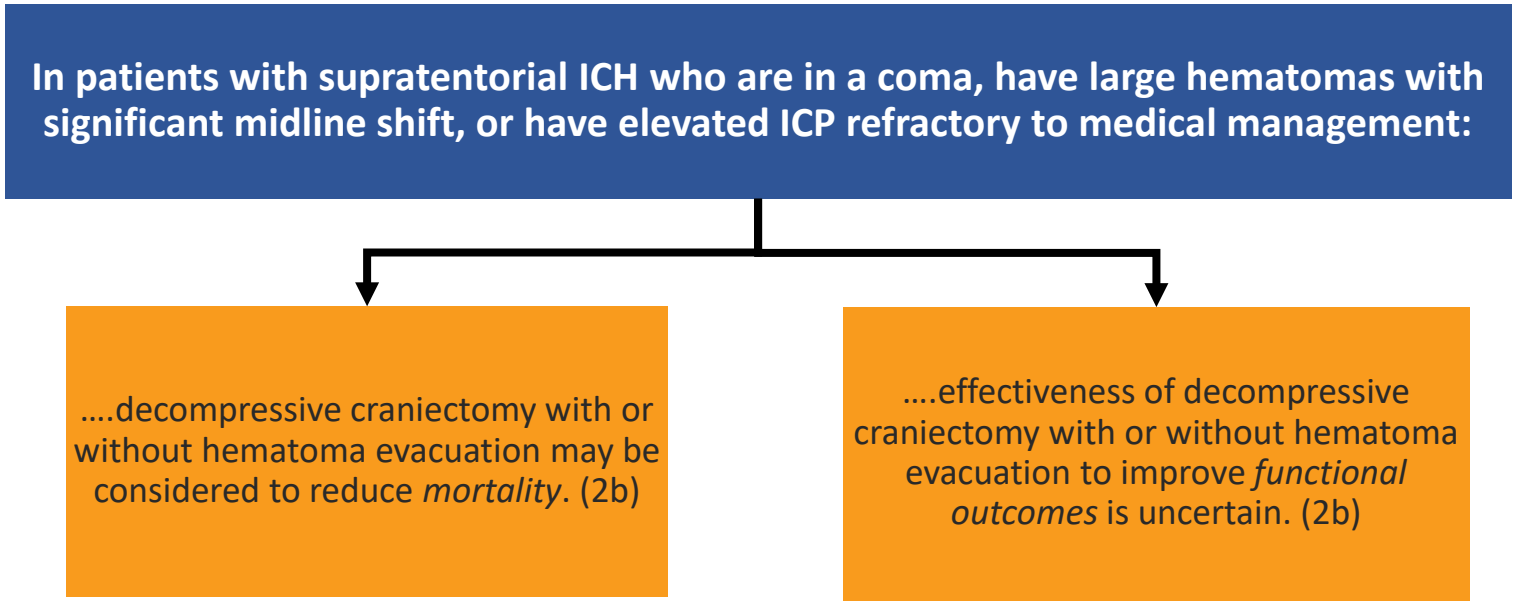
Surgical Interventions
Craniectomy for ICH



Abbreviation: ICH indicates intracerebral hemorrhage; and ICP, intracranial pressure.

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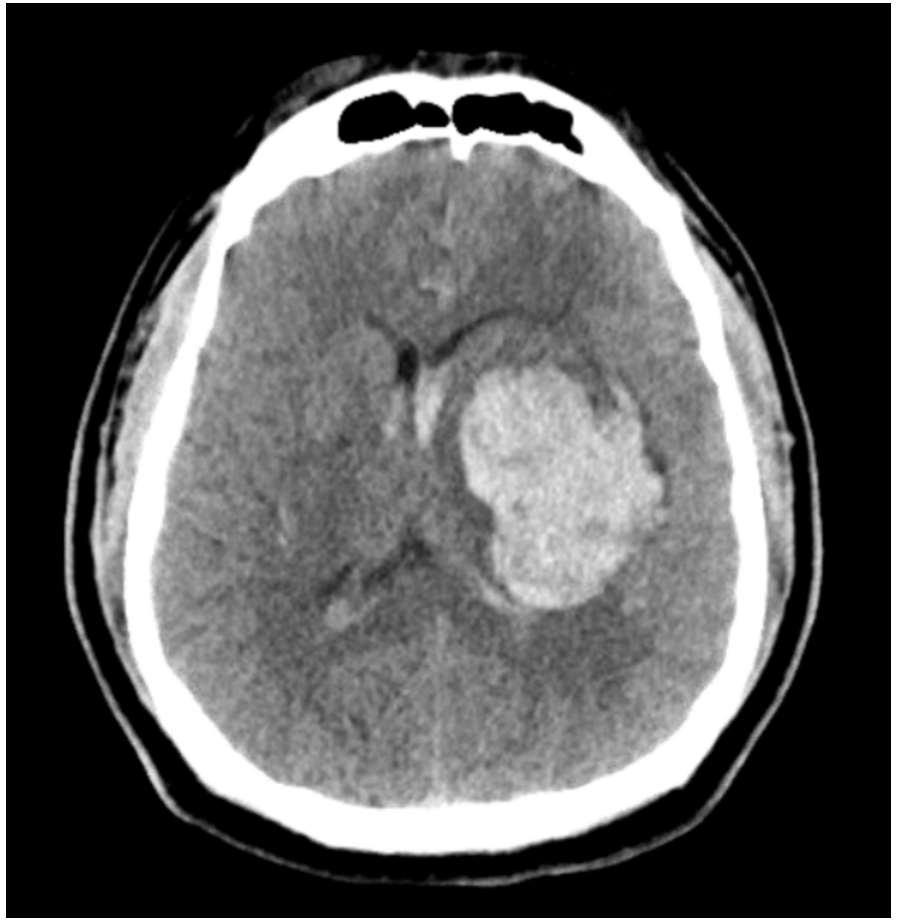
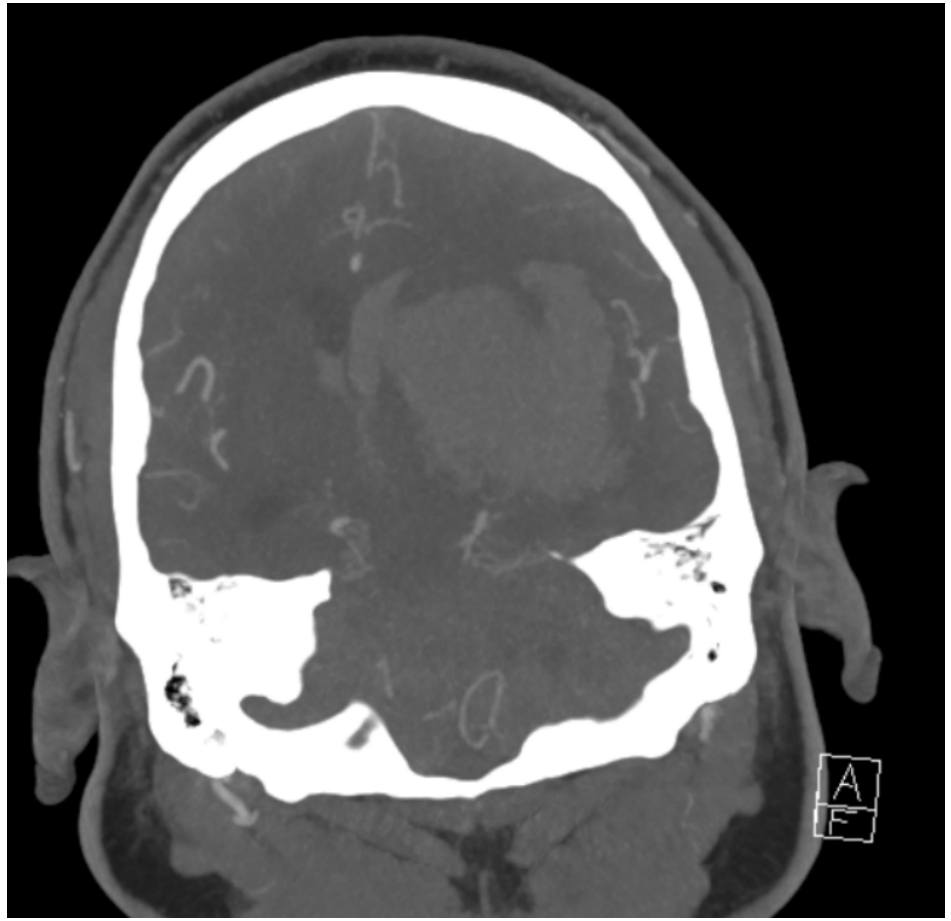
Craniotomy for ICH

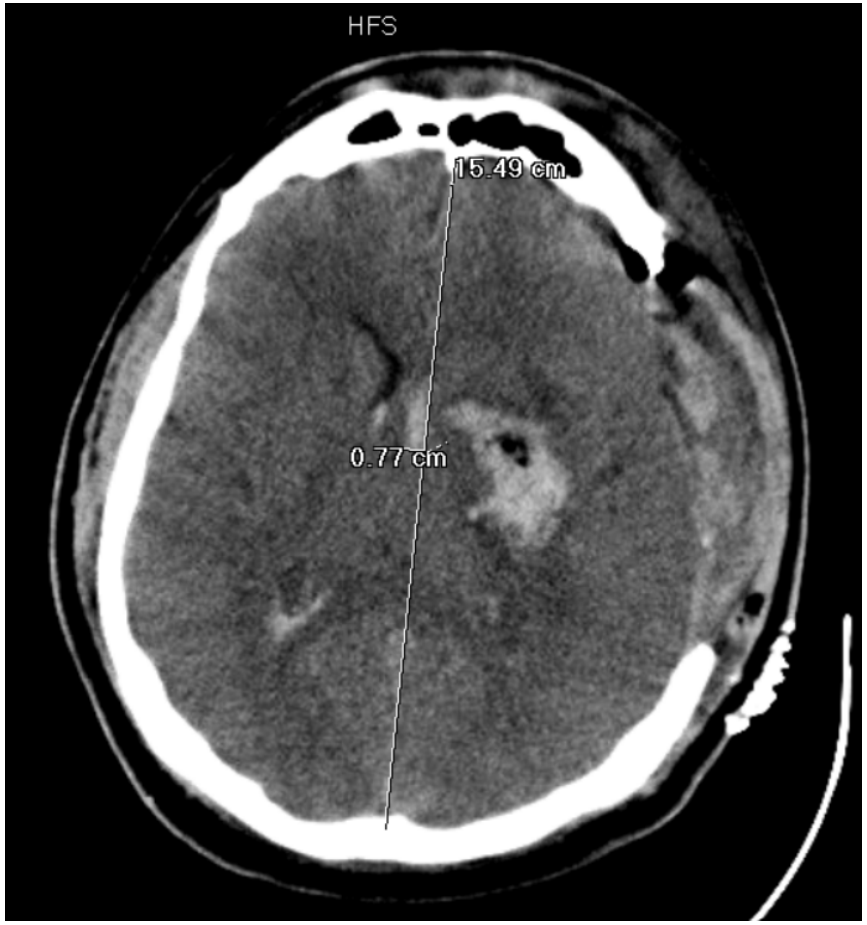
- STITCH: No superiority of surgical group vs medical management
- Post-hoc analysis: Superficial Clots do benefit from surgery
- STITCH II:
  - Early surgery does not increase rate of death or disability
  - Small but clinically relevant survival advantage for surgical group

Craniotomy for ICH



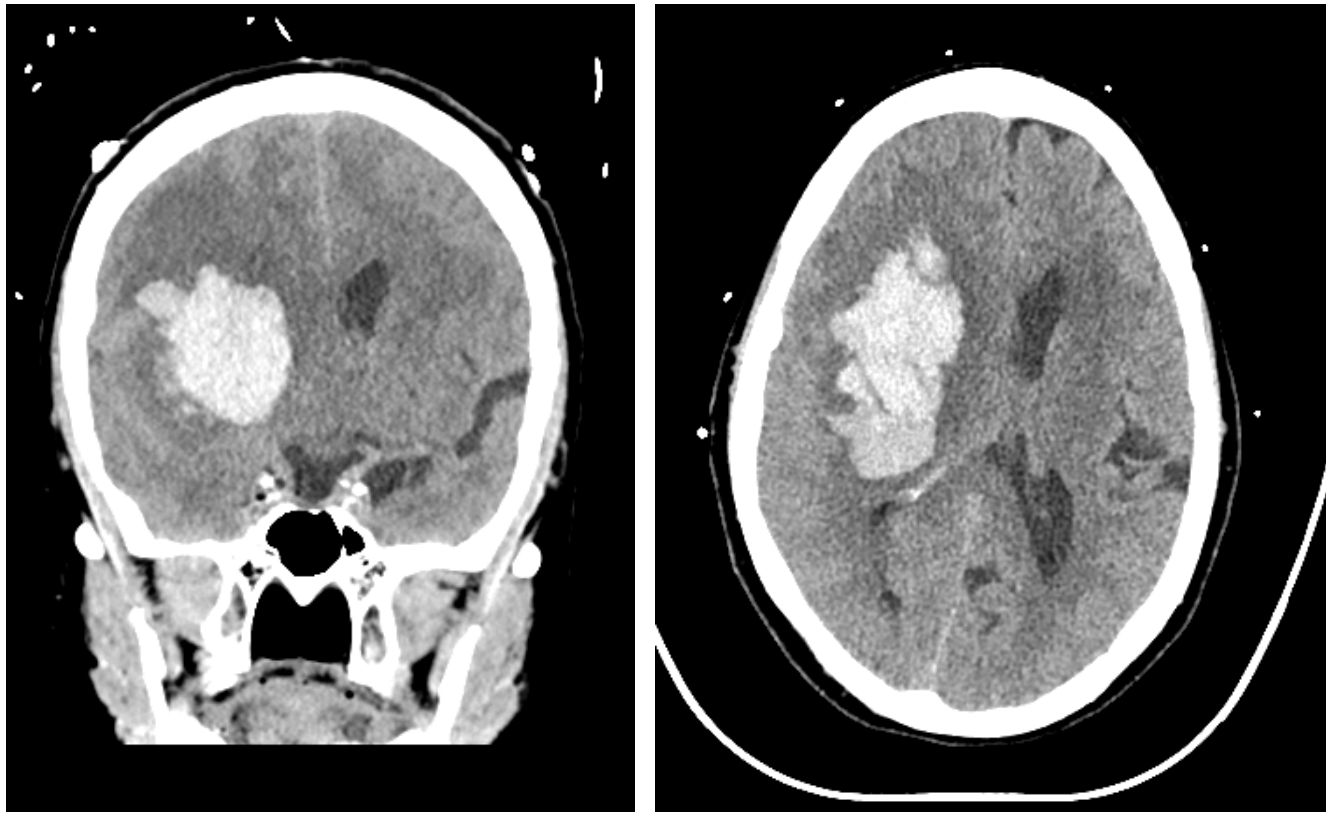


Craniotomy for ICH



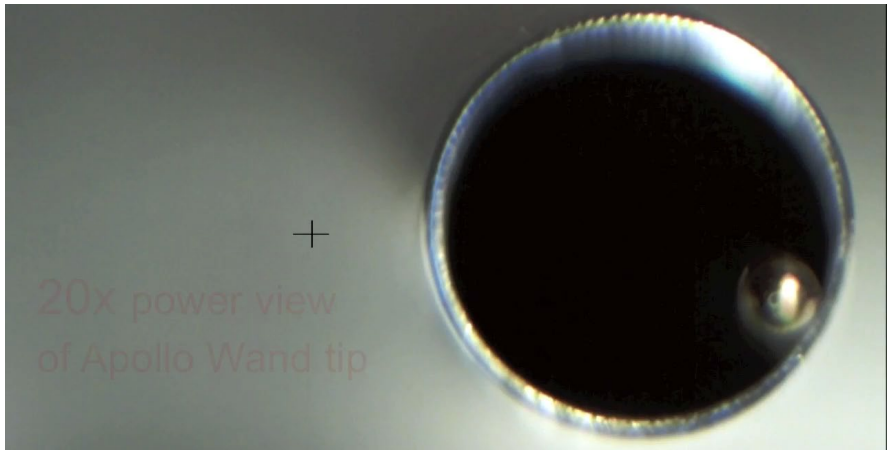
MIS ICH Evacuation

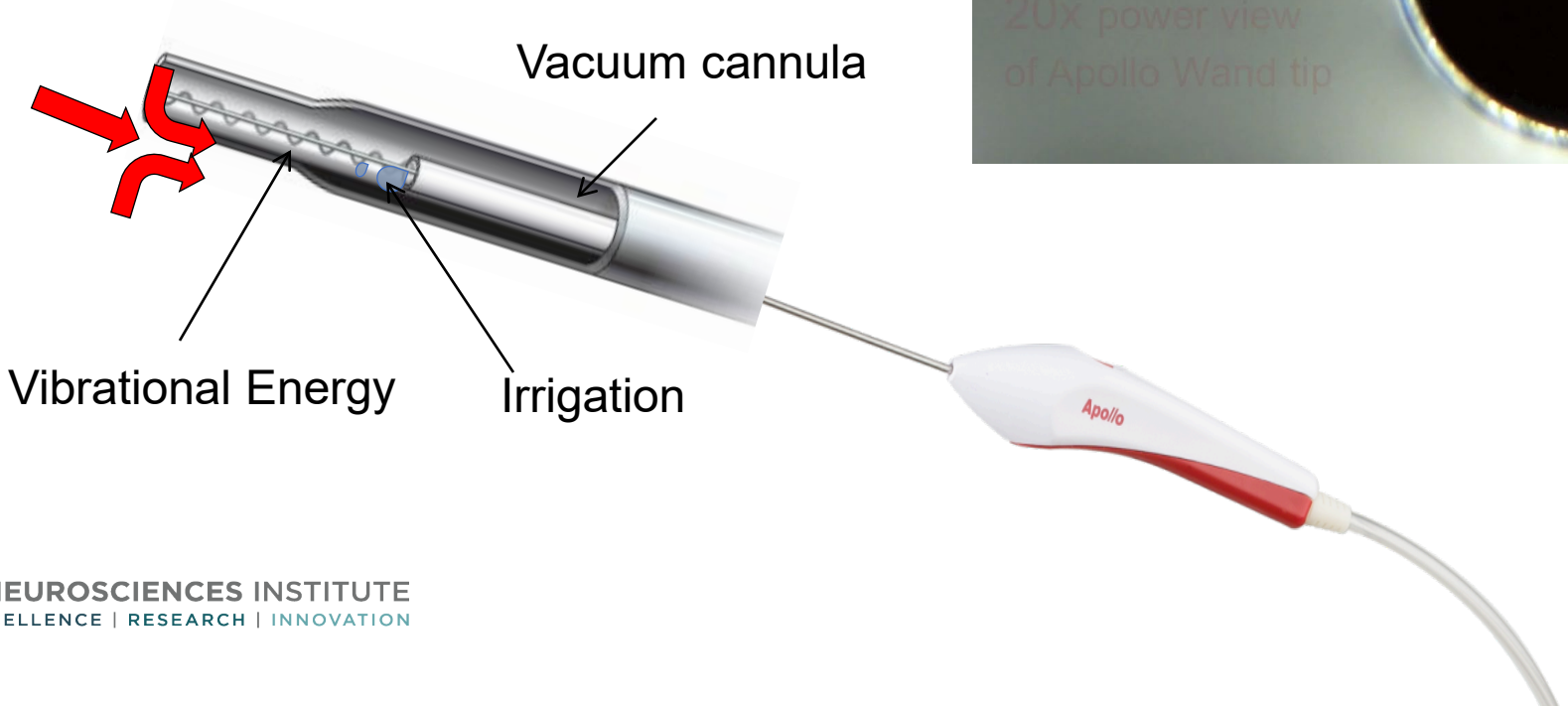
- 62 y.o. female presented as a stroke code
- CT head:
  - Large right basal ganglia hemorrhage
  - 12 mm of right-to-left midline shift.
- Exam:
  - GCS 12 on arrival (E2 V4 M6)
  - Sleepy, left plegic



Gentle end-hole aspiration without any exposed cutting elements.

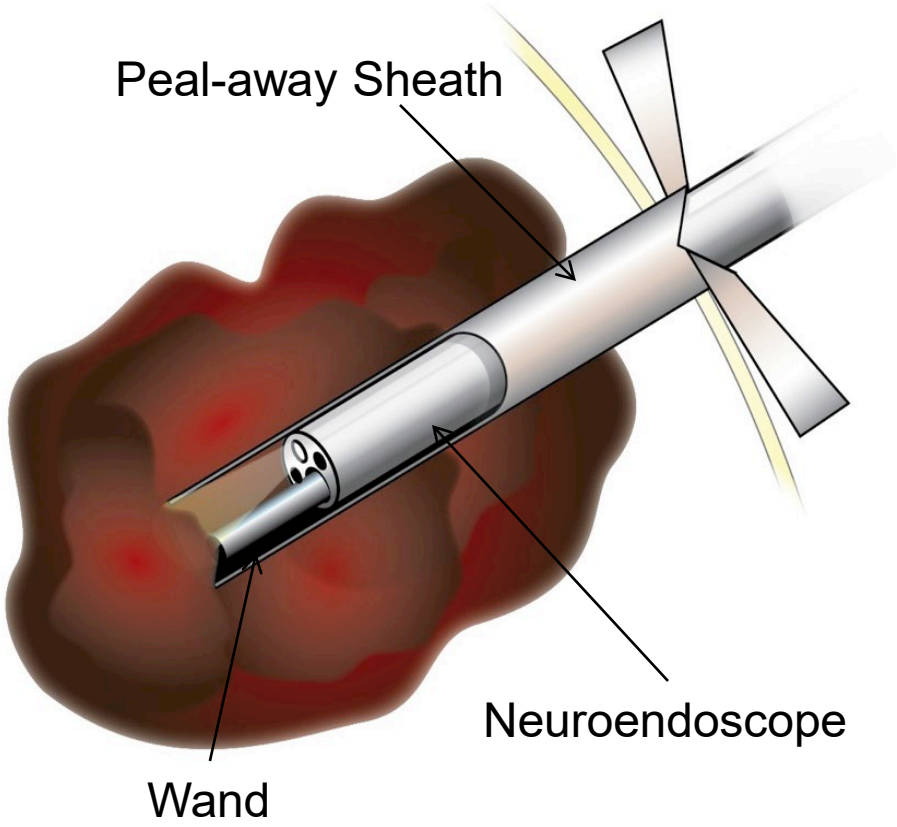
Material first extrudes into the tip of the Wand under vacuum before the vibrational energy takes effect.

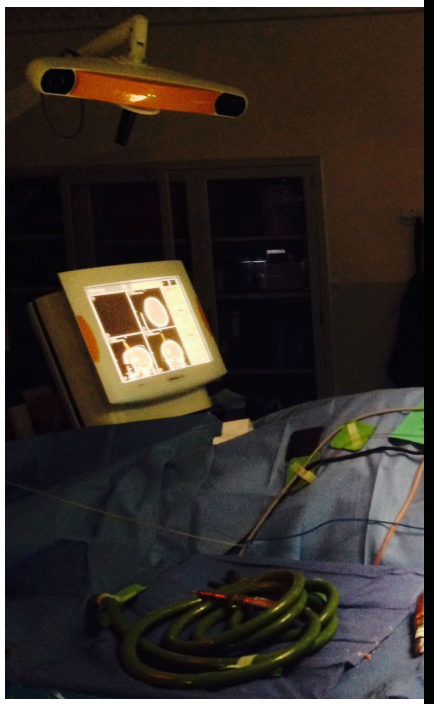


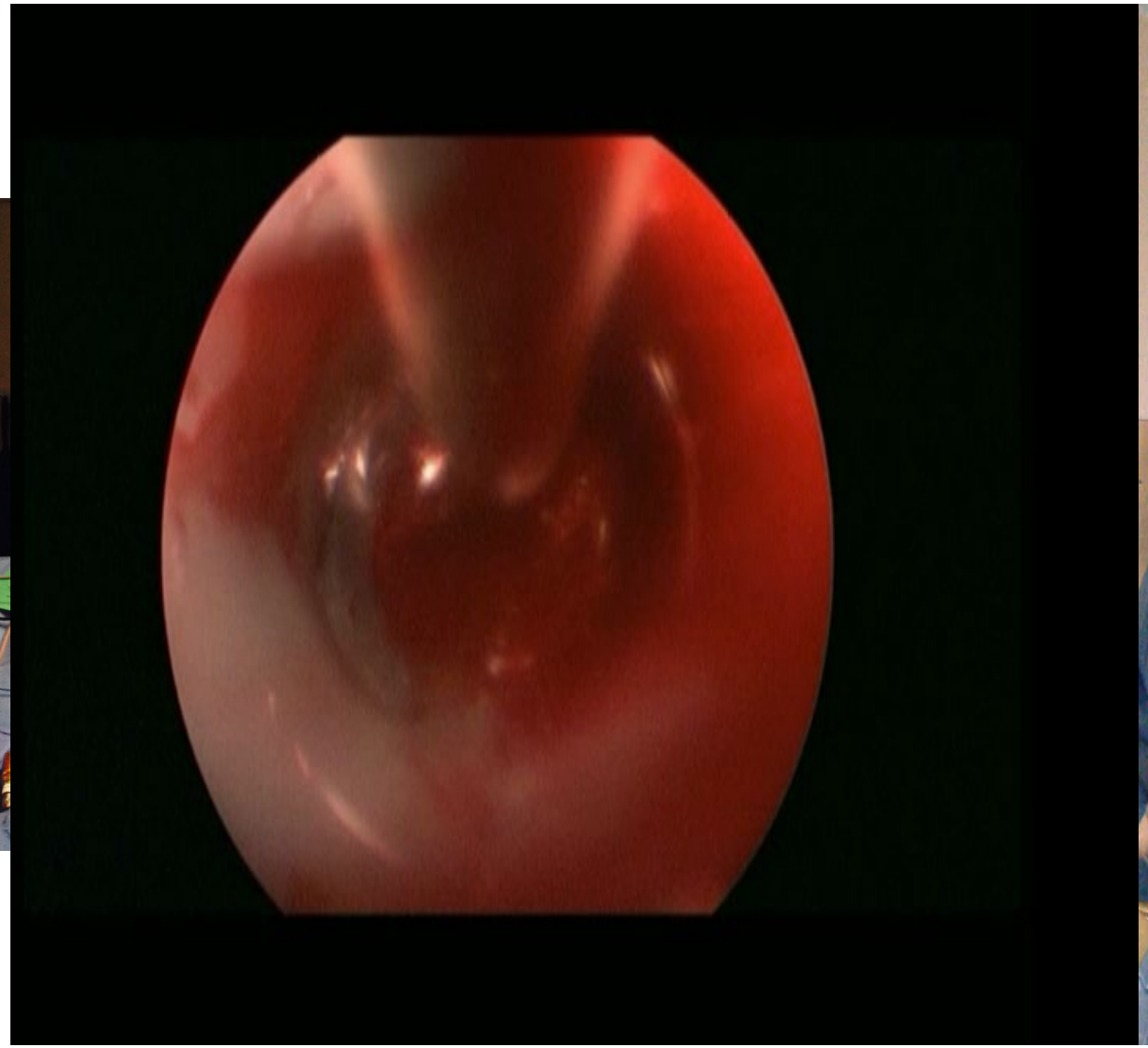


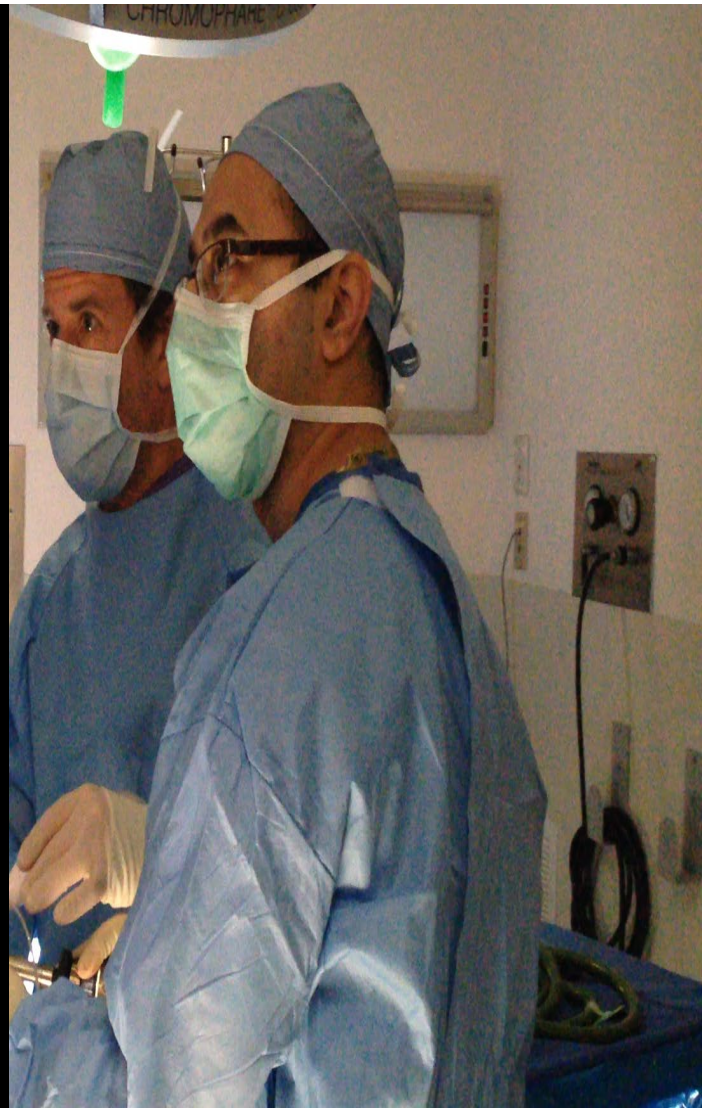
Methods

- This endoscopic aspiration system is introduced through one of the channels of the channel scope.
- Noncontrast head CT were obtained immediately post-op.









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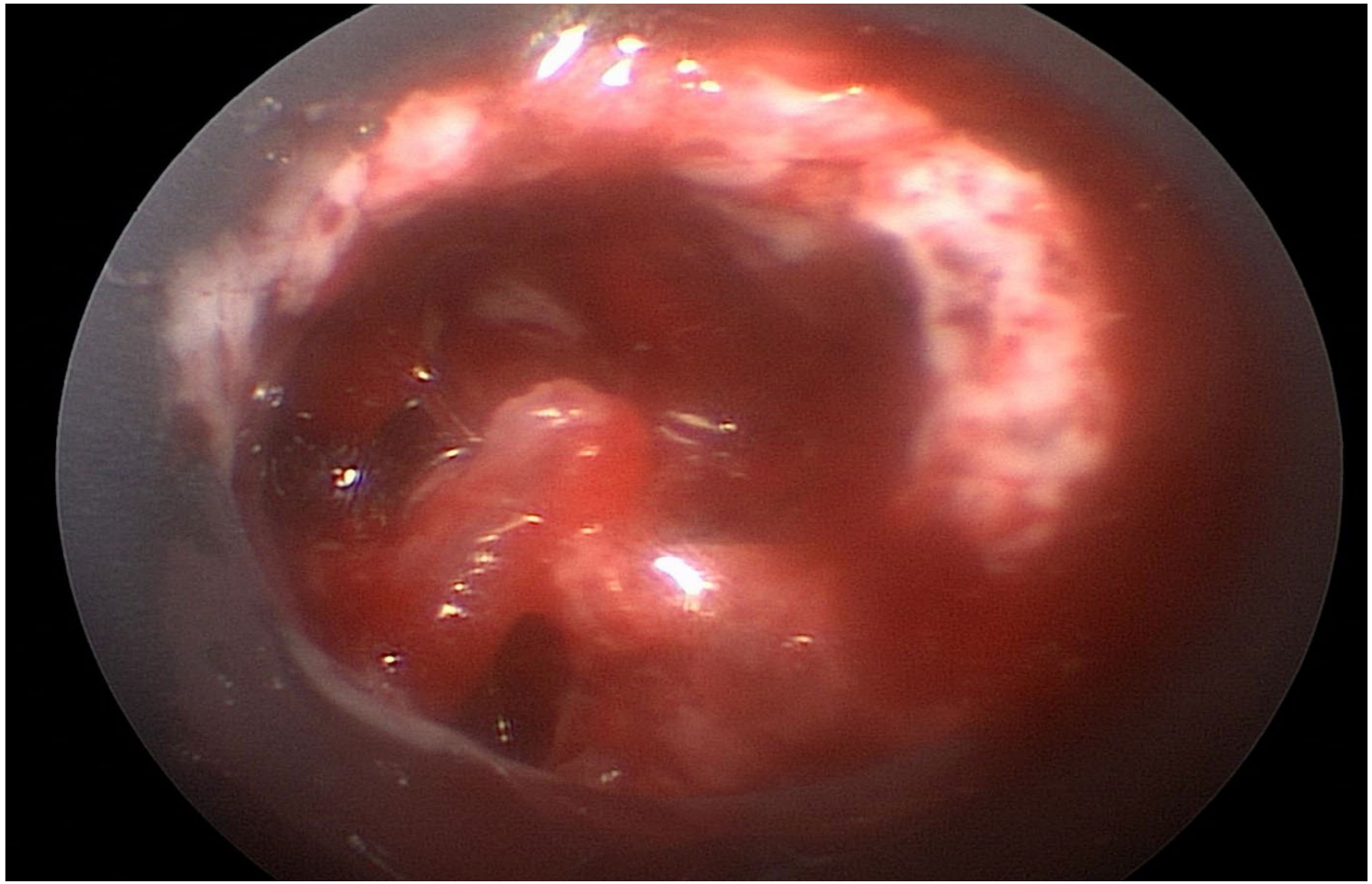
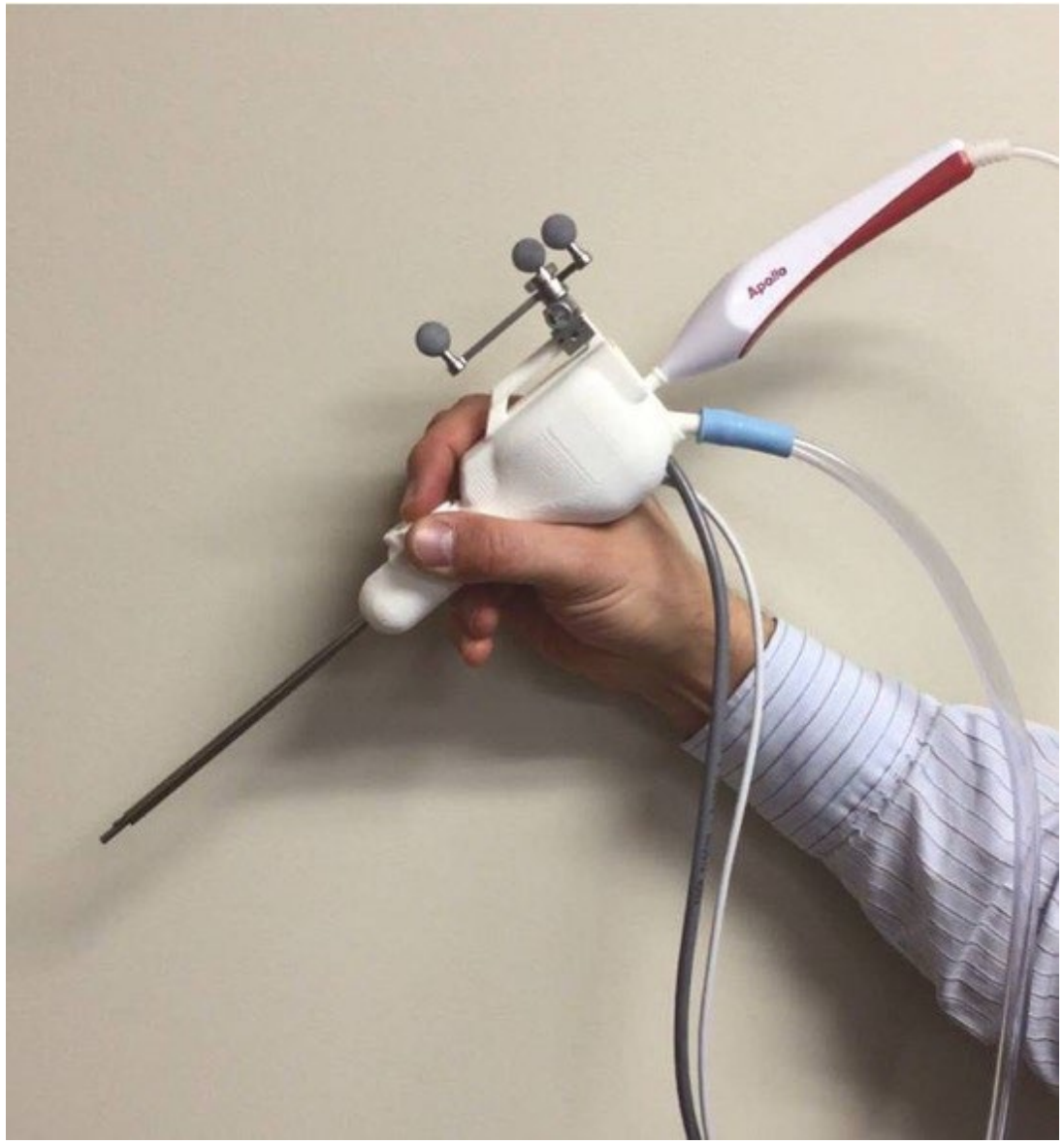


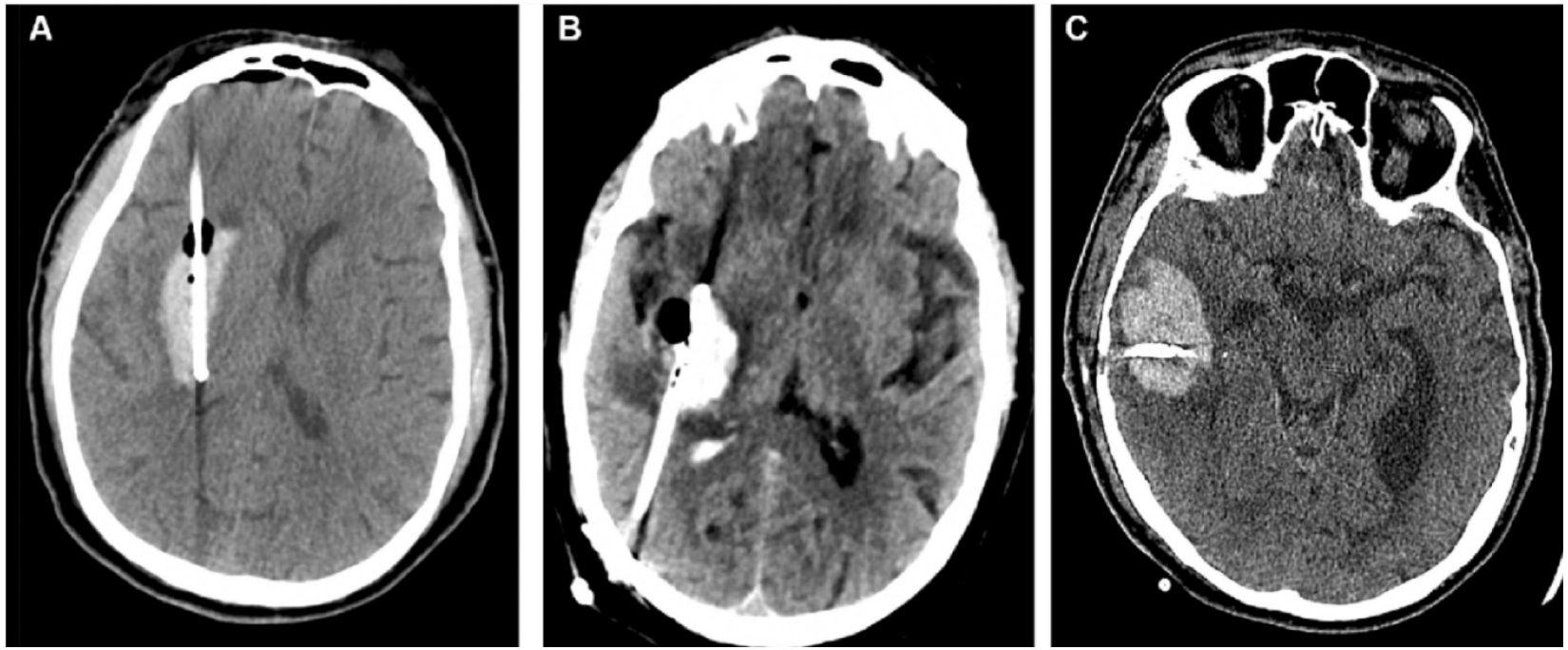
MIS ICH Evacuation


Apollo

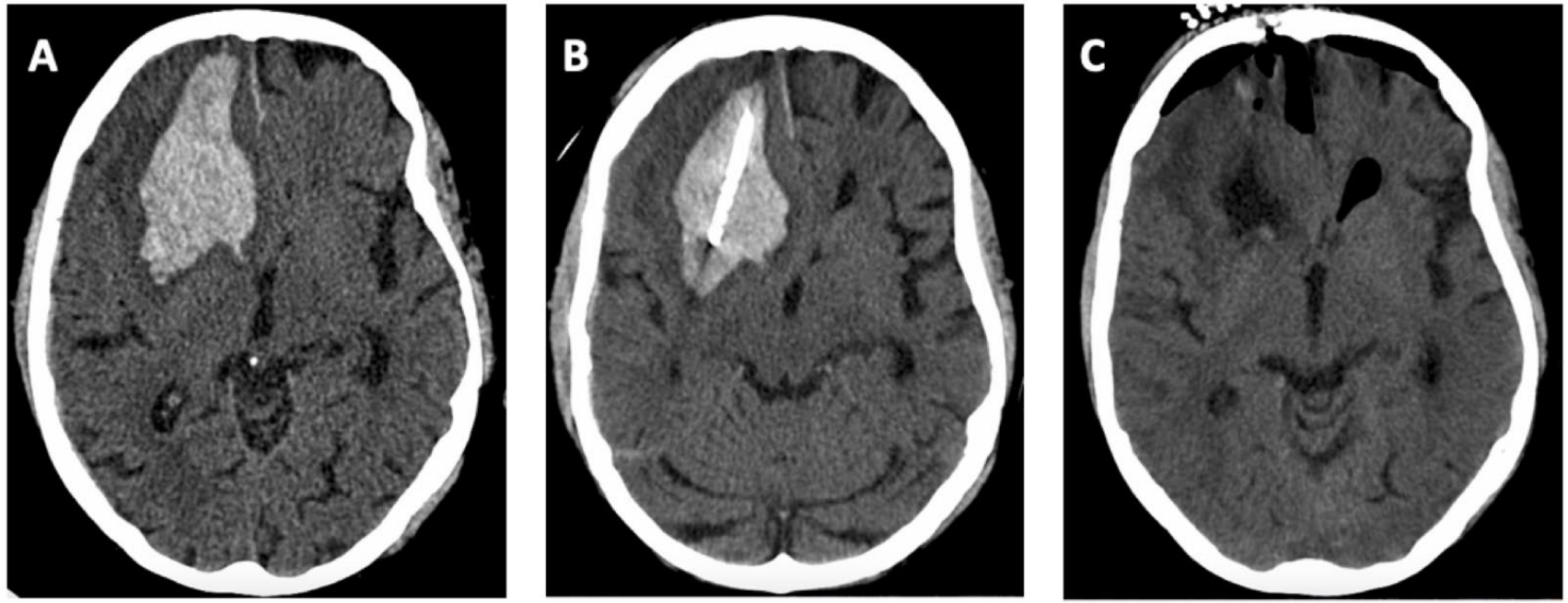
Trial Results

- ICH volume >30ml, Clot stability >6hrs; No obstructive HCP, no clinical herniation
- MISTIE II:
  - Adequate trajectory necessary
  - 1mg q8h for up to 9 doses
- MISTIE III:
  - No difference in good functional recovery at 1 year (mRS 0-3)
  - **Subgroup analysis: significant correlation between extent of removal and good functional outcome**

MISTIE

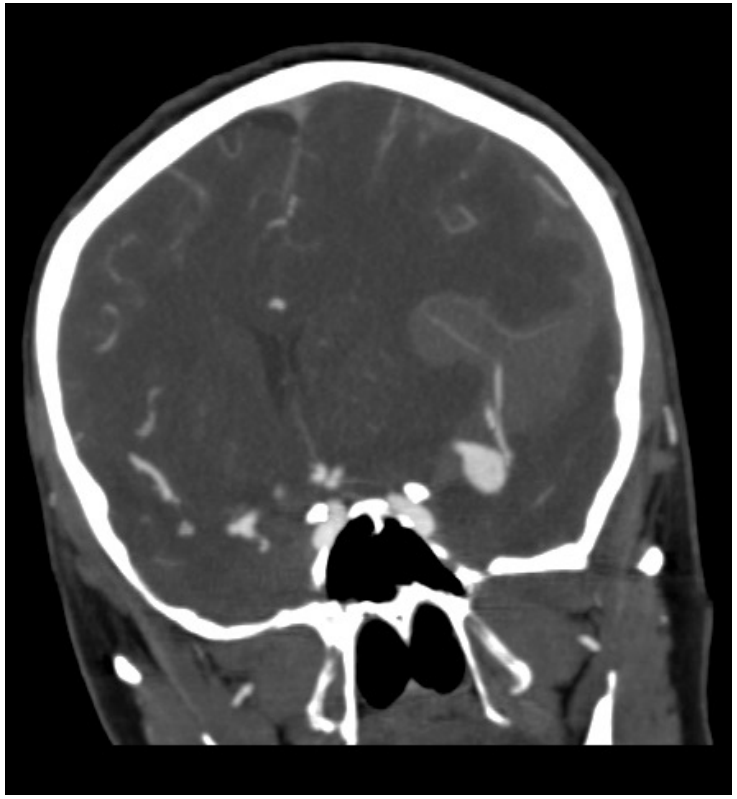


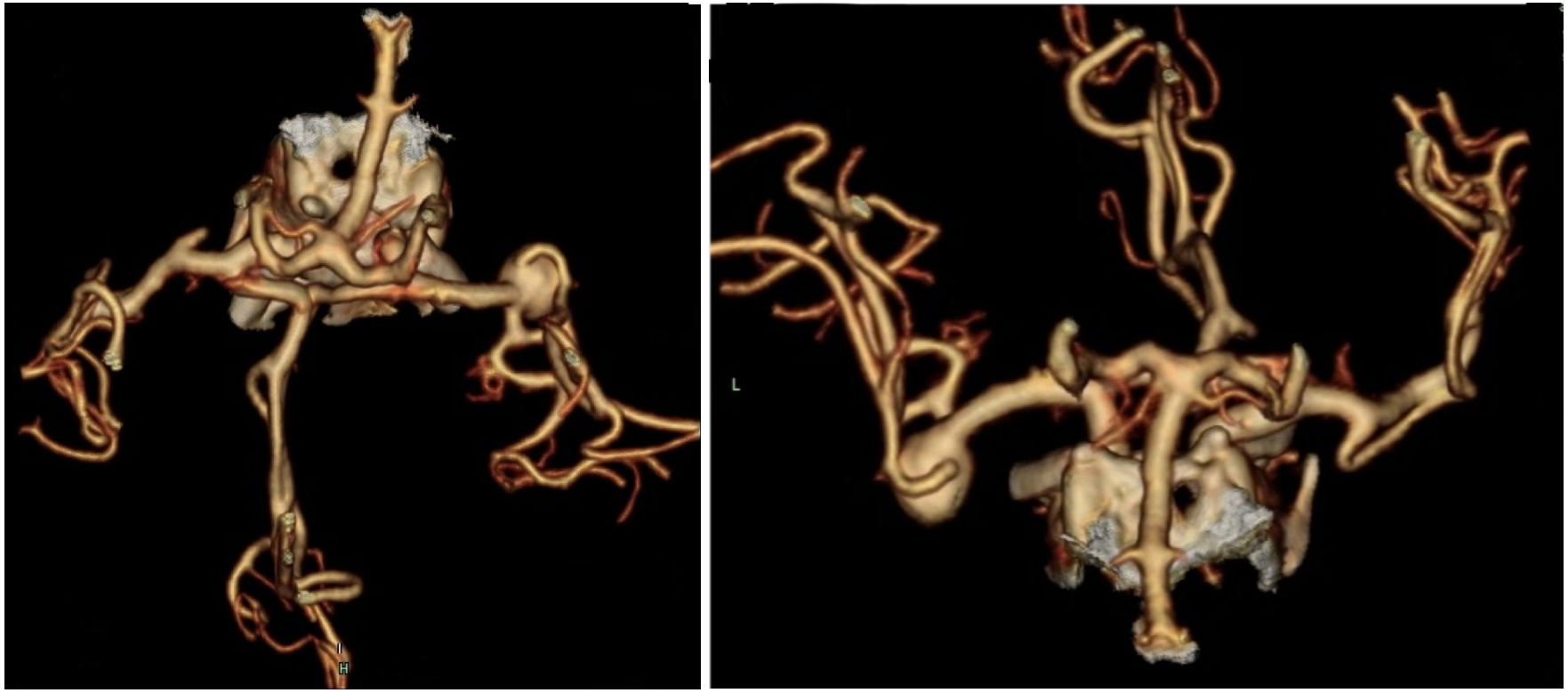
MISTIE



Beware of what lurks underneath!

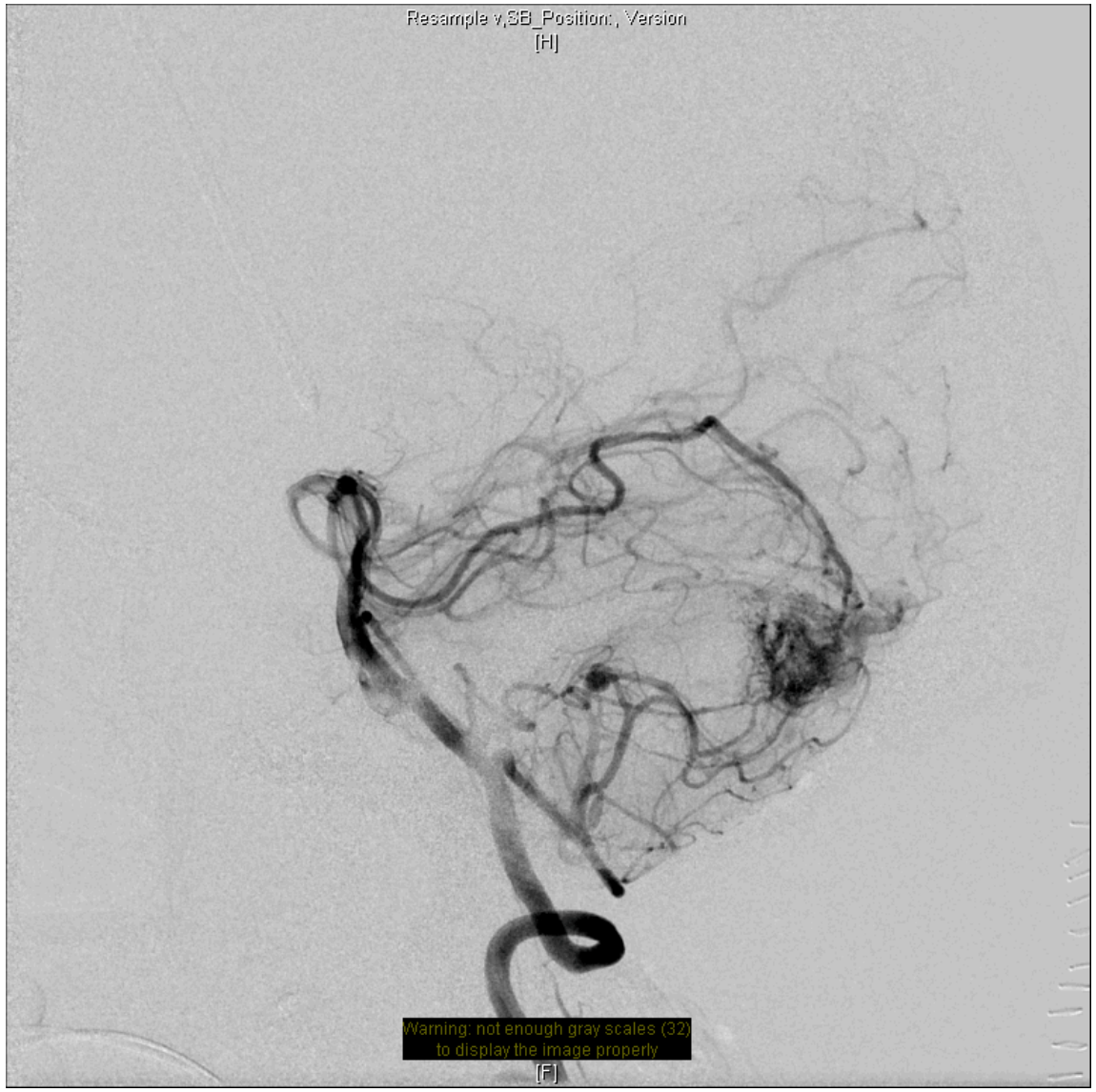





L

Case 2

- **51 yo male**
- **HTN, DL, A fib**
- **Collapsed at work**
- **GCS at presentation: 3**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to display the image properly
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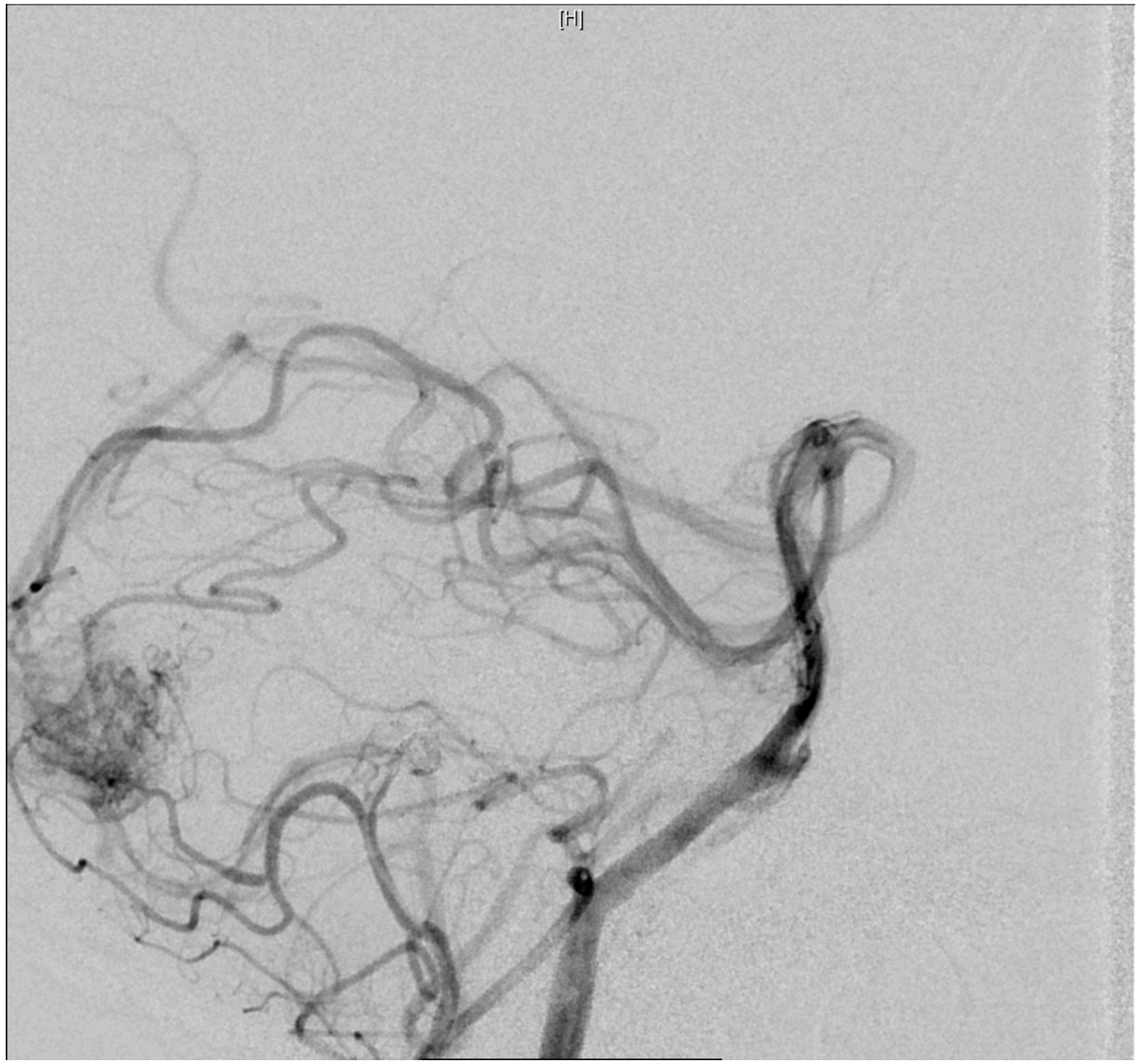

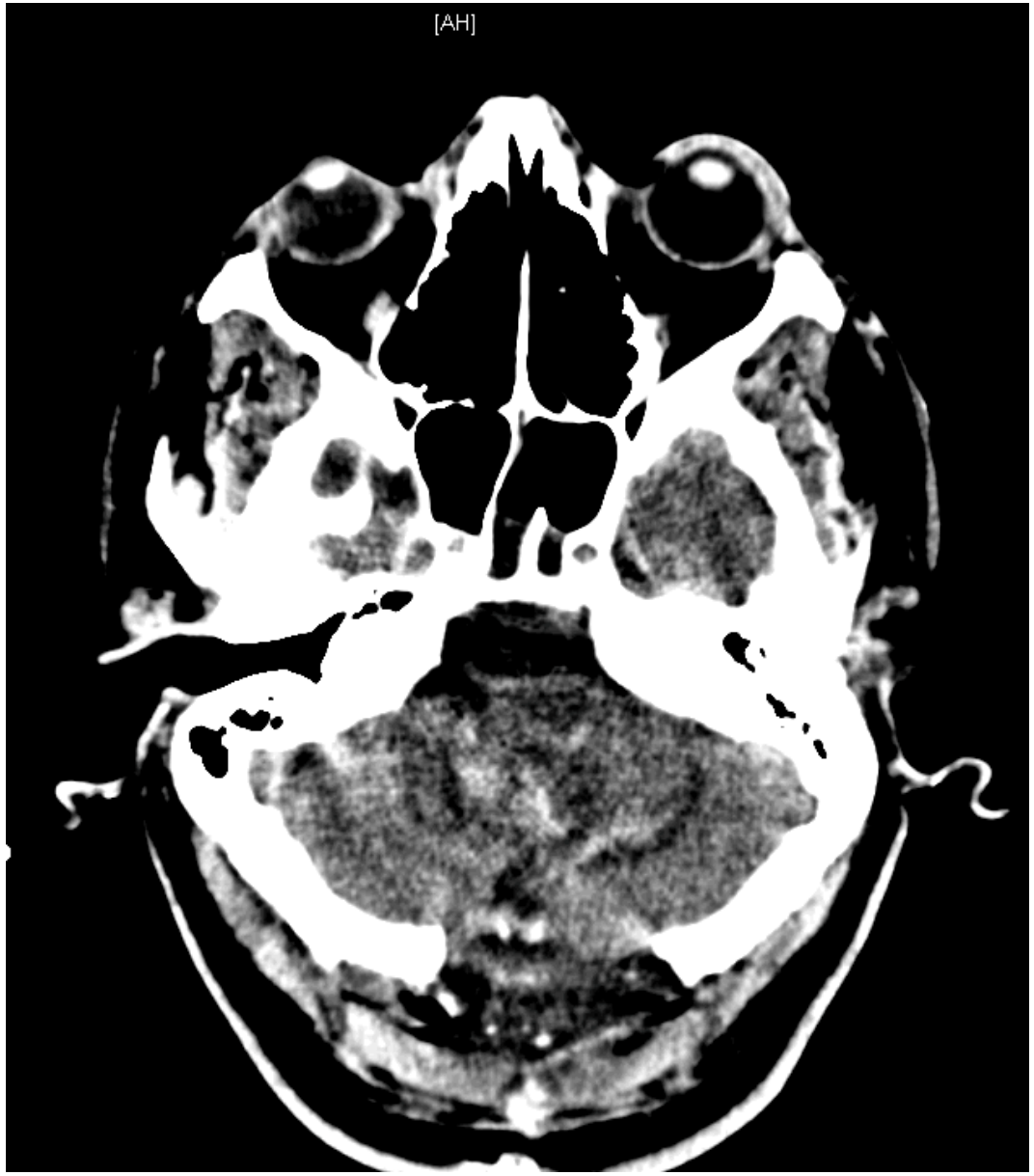
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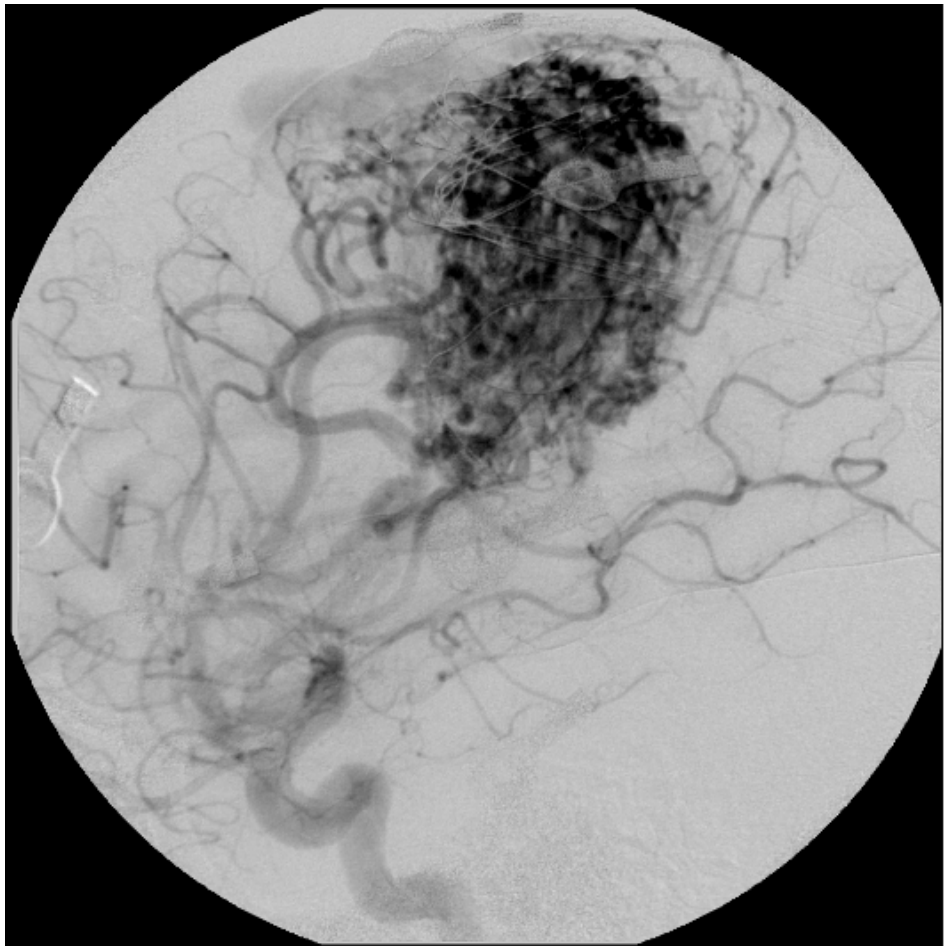
CLEAR IVH Trial

Clear IVH

Cerebral Angiography



Cerebral Angiography

Management

- Intraventricular tPA through the EVD
- Protocol:
    - 1mg TPA Q12
    - Total of 9 injections
- No revisions or replacement of EVD was necessary
- Resolution of casted 4th ventricle

Day 2

Day 3

Day 4

Day 5

Day 6

Day 7

Clinical Follow-up

- Pt initially comatose
- 24h post-hemorrhage: follow commands
- Slow improvement and mobilization
- 12th day: EVD removed
- 13th day: Transferred out of ICU
- 20th day:
  - discharged to rehab facility
  - Pt was alert and oriented
  - Back to neurologic baseline except for left hand (weaker)

Day 19 post hemorrhage

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

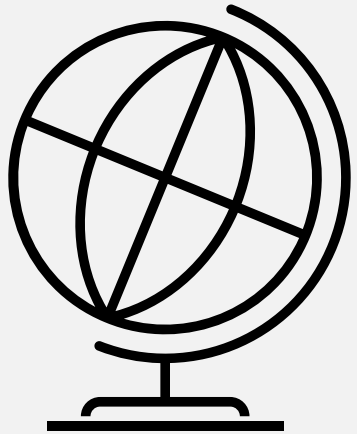
… a baseline severity score might be reasonable to provide a **general framework for communication with the patient and their caregivers**. (2b)

… 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.

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).

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

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

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

Resumption of anticoagulation may be reasonable (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)

benefit<risk

LAA closure may be considered (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.

American Heart Association.

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

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

Conclusion

- ICH score still key determinant of outcome
- Medical management initial step
- Surgery for select patients

Thank you