SPONTANEOUS INTRACRANIAL HEMORRHAGE

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HEMORRHAGE LOCATIONS

- 50% deep
- 35% lobar
- 10% cerebellar
- 6% brain stem

GENERAL OUTCOMES

- ICH causes 10-15% of initial strokes
- 30 day mortality 35-52% with half of these deaths occurring within the first 2 days of onset
- 50% of deaths occur in first 48 hours
- Death by location at 12 months
  - 51% for deep
  - 57% for lobar
  - 42% for cerebellar
  - 65% for brain stem
- 20% of all ICH victims are independent at 6 months

OUTCOME PREDICTORS

- Predictors for death at 30 days
  - Large Hematoma volume
  - Hydrocephalus
  - Non-cortical location
  - High fibrinogen levels
  - Poor GCS

OUTCOME PREDICTOR

- Strongest predictor of 30-day mortality is hematoma volume
- Volume >60cc and GCS <8
  - 30-day mortality is 91%
- Volume <30 cc and GCS >9
  - 30-day mortality is 19%
- Volume greater than 30 cc predicts inability to function independently at 30 days

CLINICAL PRESENTATION

- Focal neurologic deficit
- Headache
- Emesis
- Elevated blood pressure
- Headache

INITIAL EVALUATION

- Clinical Information
- Signs and symptoms
- Time of onset
- Patient age
- Past medical history
- Medications (anticoagulation)
- Family history
- Illicit drugs (cocaine, stimulants, IVDA)

INITIAL EVALUATION

- Physical examination
- Imaging
  - CT
  - MRI
  - Angiography
- Laboratory testing
  - Cell counts (platelet count)
  - Coagulation studies (PT, PTT, INR)
  - Toxicity screens
  - Pregnancy test

USEFUL SCALES AND SCORING SYSTEMS

- ABC/2 Formula
  - Permits estimation of hematoma size if CT scanner software cannot do calculation
- Intracerebral Hemorrhage (ICH) Score
  - Estimates mortality in ICH

OVERALL TREATMENT GOALS

- Reduce or eliminate bleeding
- Remove blood if necessary
- Control intracranial pressure
- Supportive care
  - Oxygenation
  - Maintain CPP
  - Nutrition
  - Prevention DVT
  - Seizure control
  - Electrolyte regulation
  - Pressure sore prevention
  - Management of infection
  - Fluid management
  - Therapy with early mobilization

MEDICAL MANAGEMENT

- Steroids
  - No benefits in randomized studies
- Recombinant Activated Factor 7
  - Stimulates thrombin formation and activates factor X on platelets. Thrombin converts fibrinogen to fibrin which stabilizes clot.
  - Dose 90 micrograms/kg
  - Half-life 2.6 hours
  - Randomized studies have shown improved survival and outcomes in those treated with F7

MEDICAL MANAGEMENT

- Blood Pressure Management Questions
  - Does elevated blood pressure cause increased bleeding or result from increased bleeding?
  - Does pharmacologic reduction of elevated blood pressure detrimentally reduce cerebral perfusion pressure (MAP – ICP = CPP)?

MEDICAL MANAGEMENT

- Blood Pressure Management
  - For primary ICH there is minimal evidence for specific blood pressure levels
  - General goal is to keep CPP >60-70 mm Hg

MEDICAL MANAGEMENT

- Hyperosmolar Treatment
  - No evidence that use of mannitol improves outcomes

Medical Management

- Intracranial Pressure (ICP) Management
  - IV Hyperosmolar agents (mannitol, urea)
  - Hyperventilation (reduces $PaCO_2$ which reduces arterial dilatation and cerebral blood flow (CBF)and cerebral blood volume (CBV)
  - BP reduction
  - Barbiturates (reduce metabolic brain activity which reduces CBF)
  - Systemic cooling (reduces metabolism and CBF)
  - Each of these methods has benefits and detriments
  - Elevation of the head of bed (improves venous drainage)
  - Cerebrospinal fluid drainage
  - Pharmacologic paralysis
- NO RANDOMIZED STUDY HAS DEMONSTRATED THE EFFICACY OF MONITORING ICP AND CPP IN THE SETTING OF ICH

Medical Management

- High blood glucose upon presentation predifts an increased risk of 30 day mortlaity
- Unclear if elevated glucose is cause or effect
- May increase brain edema and cell death

Medical Management

- Seizures
  - 28% incidence of seizures (convulsive and non-convulsive) in first 30 days
  - Seizures more common with lobar hemorrhage
  - Prophylaxis with antioconvulsants should be considered

Medical Management

- Temperature Management
  - Aim for normothermic temperatures
  - No clear evidence that hypothermia is beneficial

RECOMMENDATIONS BASED ON EVIDENCE

- Class I
  - Benefits >>> Risks
  - Treatment/Procedure should be performed
  - “should; is recommended; is indicated; is useful/effective/beneficial”
- Class IIa
  - Benefits >> Risks
  - Reasonable to provide treatment but additional studies needed
  - “is reasonable; can be useful/effective/beneficial; is probably recommended or indicated”
- Class IIb
  - Benefits $\geq$ Risks
  - Procedure may be considered. More data needed
  - “may be considered; may be reasonable; effectiveness in uncertain”
- Class III
  - Risks $\geq$ Benefits
  - No additional studies needed
  - “is not recommended; is not indicated; is not useful; may be harmful”

EVIDENCE SUPPORT

- Class I
  - Early recognition improves outcomes
  - Patient should be managed in an ICU
  - Treat clinical seizures
  - Fever should be treated
  - Early mobilization is beneficial
  - Use intemittent compression stockings to help prevent DVT in those with hemiparesis/hemiplegia
  - Treat hypertension to avoid recurrent bleeds
  - Protamine used be used to reverse heparin associated ICH
  - Warfarin should be reversed with IV vitamin K, FFP and other factors as indicated

EVIDENCE SUPPORT

- Class IIa
  - Treat elevated ICP and monitor BP to maintain CPP > 70 mm Hg
  - Persistent hyperglycemia >140 mg/dL during first 24 hours of stroke is associated with poor outcomes and should be treated

EVIDENCE SUPPORT

- Class IIb
  - Administer Factor 7 within first 3-4 hours to slow progression of bleeding
  - May use low dose subq heparin in patients with hemiplegia 2-3 days after cessation of bleeding
  - Inset IVC filter in patients with DVT or PE
  - Long term antithrombotic therapy may be used several weeks after the bleed taking into consideration likelihoood of a recurrent bleed based on underlying etiology and risks
  - Reversal factors other than FFP may be benefdicial but increase the risk of thromboembolism
  - For patients with high risk of rebleeding, antipltelets may be better option than warfarin.
  - For patients at a very high risk of thromboembolism, may restart warfarin 7-10 days after the bleed

SURGICAL MANAGEMENT

- Class I
  - Cerebellar hematomas >3 cm diameter should have surgery ASAP if they are deteriorating, have brainstem compression, have hydrocephalus

SURGICAL MANAGEMENT

- Class II
  - Use of thrombolytics into the clot cavity to ease evacuation is not of benefit due to risks of rebleeding
  - Usefulness of minimally invasive approaches to clot evacuation are of unproven benefit
  - Lobar clot evacuation via craniotomy especially in patients that are worsening might be of benefit and/or hematomas that are within 1 cm of the cortical surface (may speed recovery)
  - Surgical evacuation is best done within 12 hours although ultraearly surgery may have a higher risk of rebleeding
  - Decompressive craniectomy is of unknown benefit

SURGICAL MANAGEMENT

- Class III
  - Routine evacuation of supratentorial hematomas within 96 hours of bleed is not recommended (evacuation is best based on exam)
  - Delayed clot evacuation by craniotomy offers little if any benefit and may worsen outcome by further damaging functional or recovering brain

PREVENTION OF RECURRENCE

- Class I
  - Treat hypertension
  - Eliminate smoking, heavy alcohol use, cocaine use