SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

Section of Neurotrauma
University of Mississippi Medical Center
Jackson, Mississippi
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

I. Acute epidural hematomas (EDH).
II. Acute sub-dural hematomas (SDH).
III. Parenchymal lesions & Cranial Decompression.
IV. Posterior fossa mass lesions.
V. Depressed skull fractures.
VI. Imaging in traumatic brain injury (TBI).
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

I. ACUTE EPIDURAL HEMATOMAS
SURGICAL MANAGEMENT OF ACUTE EPIDURAL HEMATOMAS

Surgical treatment indicated:
>30 cc regardless of GCS

Non-operative treatment possible when:
EDH: MLS<5 mm
  & GCS >8.
  & <15 mm thickness.
  & Non-focal deficits.
SURGICAL MANAGEMENT OF ACUTE EPIDURAL HEMATOMAS

Literature

Surgery:

Sevadei et al.: Factors assoc. with surgery: MLS >5 mm / >15 mm thickness.

Bezircioglu et al.: Temporal lobe location assoc. with delayed surgery. Successful nonoperative treatment for EDH with < 5 mm MLS, < 30 cc & thickness < 2 cm

Chen et al.: Factors assoc with operative treatment: > 30 cc, >5 mm MLS, >15 mm thickness.
SURGICAL MANAGEMENT OF ACUTE EPIDURAL HEMATOMAS

Timing: ASAP for GCS <9 with anisocoria.

Methods: Craniotomy for evacuation.
SURGICAL MANAGEMENT OF ACUTE EPIDURAL HEMATOMAS

Literature

Timing:

Lee et al.: Unable to demonstrate early surgery influences outcome considering all EDH.

Cohen et al.: Signs of brain herniation in comatose patients > 70 min strongly influence outcome.

Haselsberger et al.: Surgery < 2hrs after LOC improves outcomes.
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

II. ACUTE SUBDURAL HEMATOMAS
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Surgical treatment indicated:
1) Either >10 mm thickness or MLS >5 mm.

2) Comatose patient with SDH <10mm or MLS <5mm, and either ICP > 20 mmHg, pupil abnormalities, or deterioration of 2 in GCS.

3) ICP monitoring mandatory for GCS < 9 (Coma).
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Literature:
Surgery:

Wong et al.: MLS > 5 mm = failure of non-op tx.

Matthew et al.: All patient with > 10 mm thickness required surgery.

Servadei et al.: Successful conservative treatment for stable comatose patients, improving since accident, with SDH <10 mm or MLS <5mm, with normal ICP’s.
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Literature:
Timing:

Haselsberger et al.: Surgery < 2hrs after onset of coma improves outcomes.

Seelig et al.: Surgery < 4 hrs from TBI improves outcomes.

Sakas et al.: Surgery < 3 hrs after herniation improves outcomes.
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Literature:
Timing:

Stronger correlation between time from coma onset or deterioration to surgery Vs. Time from TBI to surgery.
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Literature:
Methods:

Hatashi et al.: Better outcomes in patients undergoing craniotomy vs. burr hole trephination.
SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

Timing: ASAP.

Methods: Craniotomy.
Craniectomy + duraplasty.
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

III. PARENCHYMAL LESIONS
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Indications: Clinical & radiologic facts.
1.- Mass-related factor indications.
2.- Location-related indications.


SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Literature:
Surgery:

Bullock et al.: ICP, CT scan & clinical findings should be used in decision making. Related to location.

Gallbraith et al.: All intradural lesions with ICP > 30 required surgery.

Katayama et al.: Frontal lobe contusions with increased ICP’s did better with surgery.
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Literature:
Surgery:

Mathiesen et al.: Pts with GCS 6 & mass > 20cc did better if operated vs. no surgery or after deterioration.
Factor assoc. with deterioration: Mass effect on CT. Pts GCS 10 with temporal contusions & mass effect on CT benefited from surgery. Pts with GCS 6 and mass 50 cc better outcome with surgery early or immediately after deterioration.
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Surgical treatment indicated when:
1) Neurologic deterioration.
2) Medically refractory elevated ICP.
3) Mass effect on CT scan.
4) Mass volume > 50 cc.
5) GCS 6-8 with evidence on CT of frontal or temporal contusions >20 cc with either: MLS 5 mm or Cisternal compression
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Non-operative treatment possible when:

1) No neurologic compromise.
2) Controlled ICP.
3) Non-significant mass effect.
4) Intensive monitoring & serial imaging needed.
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Literature:

Methods:

Polin et al.: Showed benefits from bifrontal decompressive craniectomy, in less than 48 hrs after post-injury in individuals with ICP < 40 mmHg. Multiple other studies favor other decompressive techniques as well.
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Timing: ASAP for evacuation of mass lesion + DC. <48 hrs for decompressive procedures

Methods: Hemicraniectomy. Brifrontal decompressive craniectomy & duraplasty in patients with diffuse injury and cerebral edema with medically refractory elevated ICP.
SURGICAL MANAGEMENT OF PARENCHYMAL LESIONS

Methods:
In patients with diffuse injury/cerebral edema refractory to medical treatment & impending herniation.

Options:
Subtemporal decompression
Temporal lobectomy
Hemispheric decompressive craniectomy.
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

III. POSTERIOR FOSSA MASS LESIONS
SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Literature:

Surgery:

Bozbuga et al., d’Avella et al., Otsuka et al., Wong et al, Vrankovic.: successful non-operative treatment of posterior fossa lesions, with no significant mass effect present on CT, in intact patients.
SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Indications: Clinical & radiologic facts.


SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Surgery indicated:
Neurologic dysfunction/deterioration.
Mass effect: 4\textsuperscript{th} ventricle. Basal cisterns.
Obstructive Hydrocephalus
SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Non-operative management possible:
Absence of neurologic dysfunction or deterioration.

No significant mass effect.
SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Timing : ASAP

Methods:

Operative: Suboccipital craniectomy

Non-operative: Close observation & Serial imaging
SURGICAL MANAGEMENT OF POSTERIOR FOSSA MASS LESIONS

Timing: ASAP

Methods:
Operative: Suboccipital craniectomy
Non-operative: Close observation & Serial imaging
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

V. DEPRESSED SKULL FRACTURES
SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Indications: Clinical & radiologic facts.


SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Surgical treatment indicated when:
Open (compound) fractures depressed greater than the thickness of the skull.
SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Non-operative treatment may be possible in:

Compound fractures without:
  Full thickness depression
  Dural disruption
  Significant underlying hematoma
  Depression 1 cm
  Frontal sinus involvement
  Infection or gross contamination
  Cosmetic deformity.
SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Literature:
Surgery:

Jennett et al.: 10.6% infection rate in open depressed skull fractures. Reduced 57% with surgery. No difference whether bone fragments replaced vs. removed. Higher incidence of late epilepsy if torn dura, focal signs, amnesia > 24hrs and early seizures.
SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Literature:

Surgery:

Heary et al.: Successful non-operative treatment in absence of significant hematoma, dural disruption, depression > 1 cm, sinus involvement, infection or gross contamination or pneumocephalus.

Kriss et al., Braakman, Jennett et al.: No increased infection for replacing bone fragments.

Wylen et al.: No increased rate of infection if bone fragments replaced > 72 hrs from injury.
SURGICAL MANAGEMENT OF DEPRESSED SKULL FRACTURES

Timing:
   Early operation to reduce risk of infection

Methods:
   Elevation and debridement
   Replacement of bone fragments if not infected
   All compound fx’s treatment should include antibiotics
VI. IMAGING IN TRAUMATIC BRAIN INJURY (TBI)
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

Computed tomography:
Imaging modality of choice.
Adequate interpretation includes:
1. - Status of basal/perimesencephalic cisterns.
2.- Mass volumetric measurements, and thickness measurement.
3.- Estimates of midline shift.
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

Computed tomography:

Status of perimesencephalic cisterns:
1. - Open.
2. - Partially closed/Obliterated.
3. - Completely closed/Obliterated.
SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY

Computed tomography:

1.- Mass volumetric measurements in TBI, Ellipsoid method: $A \times B \times C / 2$
   Calculate C according to Appendix

2. Computer derived volume (gold standard).

3.- Thickness measurement.