

Emergency Management and Transfer Cranial Cases

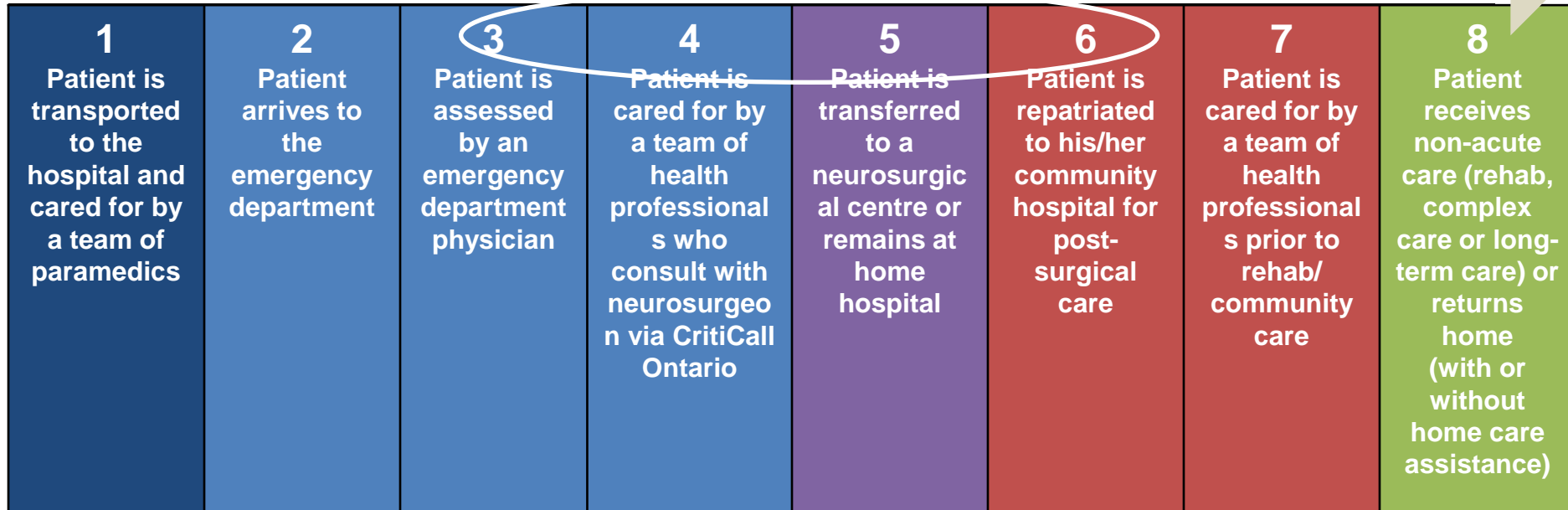


CCSO Critical Care Services Ontario

For questions please email tanya.mohan@uhn.ca

Neurosurgical Patient Flow Model – Urgent/Emergent Cases

PNO system goals, and the principle of patient-centered care, apply across the continuum



Neurosurgical Centres in Ontario

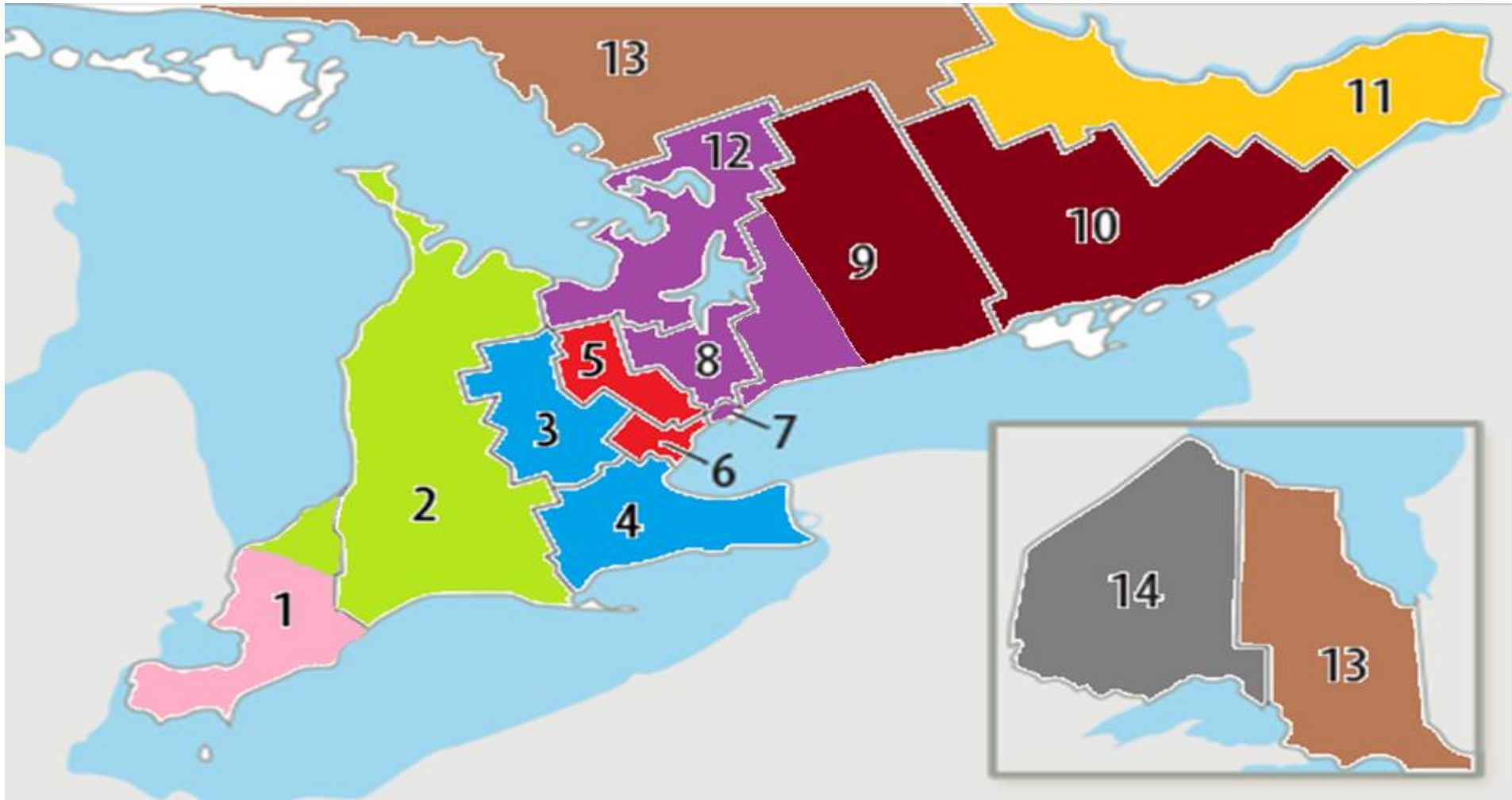
All neurosurgical centres have been designated as Level 2 or Level 3:

	Level 2 Neurosurgical Centre	Level 3 Neurosurgical Centre
Services	May not provide certain neurosurgical services (i.e. coil embolization)	Provides all neurosurgical services
Coverage	Generally do not provide 24/7/365	Provide 24/7/365 coverage

Provincial Neurosurgical and Spine Roster, facilitated by CritiCall Ontario, creates access to neurosurgical services (consult, transfer) for non-neurosurgical sites:

Level 2 Centre	Level 3 Partner
Health Sciences North	Toronto Collaborative (SMH, SHSC, UHN)
Kingston General Hospital	The Ottawa Hospital
Thunder Bay Regional Health Sciences Centre	Hamilton Health Sciences
Trillium Health Partners	Toronto Collaborative (SMH, SHSC, UHN)
Windsor Regional Hospital	London Health Sciences Centre





	Windsor Regional Hospital – Quellerie Site		Trillium Health Partners (Mississauga)		The Ottawa Hospital
	London Health Sciences Centre		Toronto Collaborative (SMH, SHSC, UHN)		Health Sciences North
	Hamilton Health Sciences Centre		Kingston General Hospital		Thunder Bay Regional Health Sciences Centre



Acute Neurosurgical Consultation Guidelines

- Developed by Dr. James Rutka, Dr. Sunjay Sharma, Dr. Michael Fehlings and Dr. Avery Nathens, in collaboration with Provincial Neurosurgery Ontario and distributed electronically in December 2013.
- Purpose:
 - a) Enables ED physicians to identify cases that require urgent or emergent transfer.
 - b) Provides CritiCall's number for emergency referral service.
- Guidelines can be downloaded by accessing CritiCall's website :
<http://criticall.org/webconcepteur/web/criticall/>



Acute Neurosurgical Consultation Guidelines

Developed by Dr. Sunjay Sharma, Dr. Avery Nathens, and Dr. James Rutka for Provincial Neurosurgery Ontario



In all cases, ABC's should be evaluated and treated prior to the application of these guidelines.



If criteria in first step are satisfied, there should be a reasonable expectation of discussion regarding patient transfer.

1 Identify patients eligible for acute transfer

Acute transfer is most often required if a patient meets **at least 1 clinical and 1 imaging criteria** from the lists below:

Clinical criteria

- Penetrating head injury
- Seizures
- Altered LOC not attributable to intoxicants
- Focal Neurological Deficit (cranial nerve or motor deficit)
- High ICP (nausea, vomiting, headache) with altered LOC
- Lateralizing signs (e.g. pupillary dilatation, hemiparesis)

Imaging criteria

- Traumatic intracerebral, acute subdural, or epidural hematoma
- Penetrating cranial object
- Brain contusion
- Hydrocephalus
- Non traumatic subarachnoid hemorrhage
- Non traumatic brainstem or cerebellar intracerebral hemorrhage (ICH) (Non traumatic cortical ICH if a vascular malformation is suspected)
- Mass Lesion (posterior fossa lesion, midline shift >3mm, hemorrhage within tumor or significant peri-lesional edema in lesion >3cm)

Unique circumstances that might mandate transfer in absence of access to imaging

- Lateralizing signs & GCS ≤ 8 in institution without access to CT scan
- LP proven subarachnoid hemorrhage (presence of xanthochromia)

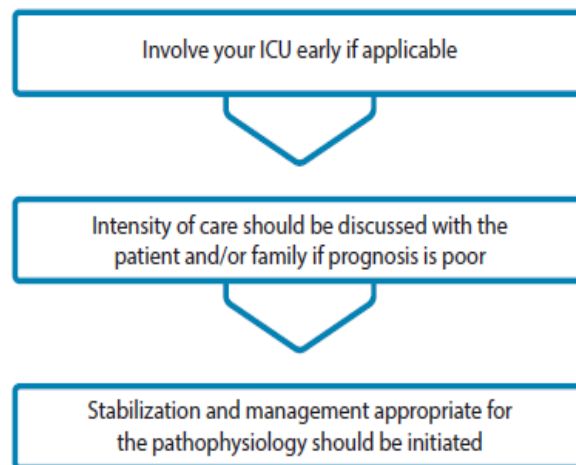
2 Stabilization and management

For all pathology, in preparation for transfer:

- Attend to ABC's
- Consider medical therapy for elevated ICP
- Reverse coagulopathy (INR <1.5)
- Judicious use of sedation (short acting drugs preferred)
- Perform neurovitals frequently (q1h)
- Intubate if GCS ≤ 8 or for transport if GCS ≤ 10
- Treat hypotension & hypoxia

3 Consultation

At this stage **contact CritiCall at 1-800-668-4357** for all patients where physician requires a neurosurgical opinion.



4 Disease specific management

Traumatic brain injury

- Give Dilantin 15-20mg/kg if documented seizure or GCS ≤ 8
- Do not use steroids for raised ICP
- Give Mannitol 1.5g/kg for suspected raised ICP
- Assume C-Spine injury and maintain spine precautions
- If penetrating object, stabilize but do not remove

Subarachnoid hemorrhage

- Keep patient normotensive, avoid a SBP ≤ 120 or SBP ≥ 160 (use pressors or antihypertensives as necessary)*
- Consult neurosurgeon prior to giving Mannitol

Brain tumors

- Dilantin 20mg/kg for documented seizures
- Decadron 10mg IV[†] followed by 4mg IV q6h

Intracerebral hemorrhage

- Dilantin 20mg/kg for documented seizures
- Discuss with neurosurgeon via ENITS the appropriateness of transfer using CT and clinical criteria
- Manage and set target BP in consultation with neurosurgeon

* Age-specific blood pressure values apply to paediatric patients. 6

† Adjust dosage for paediatric patients.

Life or Limb Policy

Guiding Principles:

- The Life or Limb Policy is in effect when a patient is life or limb threatened and therapeutic options exist, which are needed within 4 hours
- A patient's life or limb threatening condition is a priority and the identification of beds is a secondary consideration
- No patient with a life or limb threatening condition will be refused care
- LHIN geographic boundaries will not limit a patient's access to appropriate care in another LHIN
- Repatriation within a best effort window of 48 hours once a patient is deemed medically stable and suitable for transfer is key to ensuring ongoing access for patients with life or limb threatening conditions
- Consulting physician is to respond to pages from CritiCall Ontario regarding a provisional life or limb case within 10 minutes and will provide medical consultation to determine if the patient is life or limb threatened and recommend course of action (e.g. provide recommendations regarding management of life or limb patient to include stabilization, no transfer required, appropriate for urgent transfer)



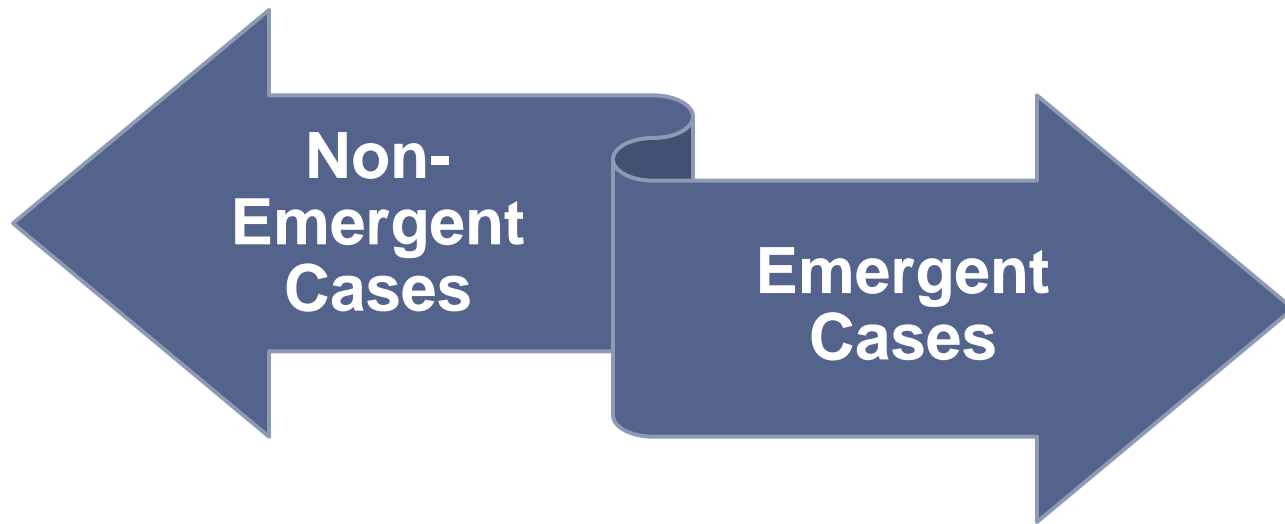
Objectives

1. To identify cases that require emergent transfer to a neurosurgical center.
 - Review the initial steps and changes in care guidelines for these patients.

2. To identify cases that may require transfer or may be appropriately managed at non-neurosurgical centers.
 - Discussion of the dynamics of patient care/management and the role of the ICU.



Outline



Emergent Cases



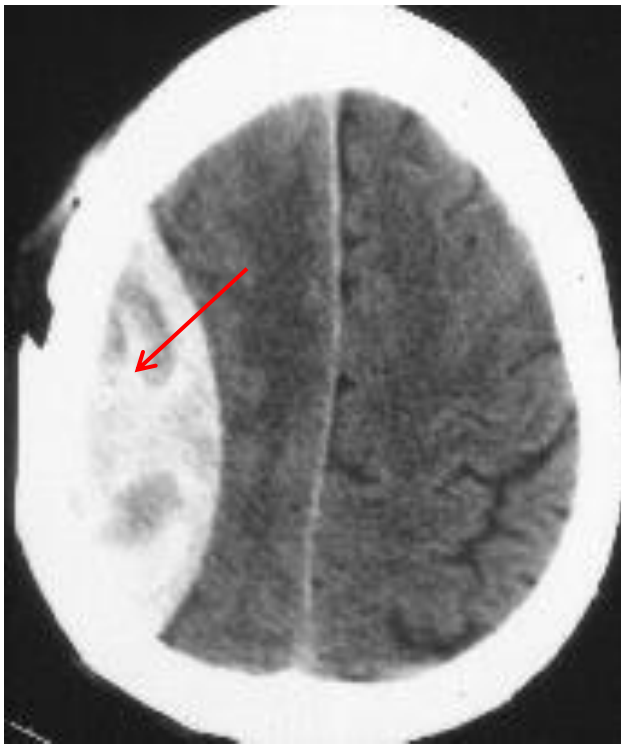
Case #1

- 34 year old male.
- History: Struck in head by golf club earlier in day. Severe headache and mildly confused.
- On Exam: GCS 14 (E4M6V4), PERL. Agitated. While waiting in ER patient deteriorates to GCS 11 (E3M5V3).
- Next Steps?
 - Urgent CT Scan (MD should accompany patient or be close by- may deteriorate further and require definitive airway management).

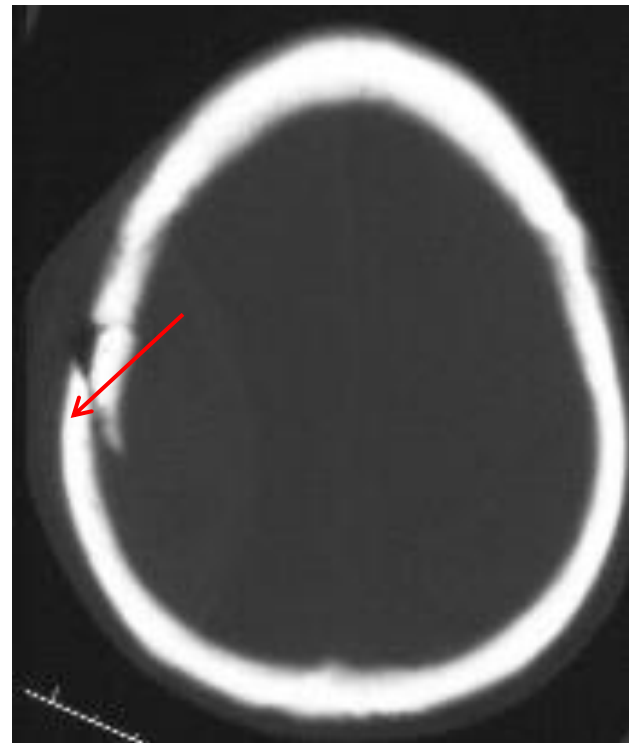


Case #1: CT

Brain Window



Bone Window



Epidural hematoma = lens or lenticular shaped lesion



Case #1: Epidural Hematoma

- This patient is an emergent transfer.
- Do not expect “lucid interval”.
- EDH can deteriorate extremely quickly and requires immediate transfer.
- Timely surgical management ensures optimal outcome
- Management
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Normalize coagulation ($INR \leq 1.4$)
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes (no role for steroids)
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension
 - Q1H vitals and high intensity monitoring
 - Co-ordinate closely with neurosurgeon

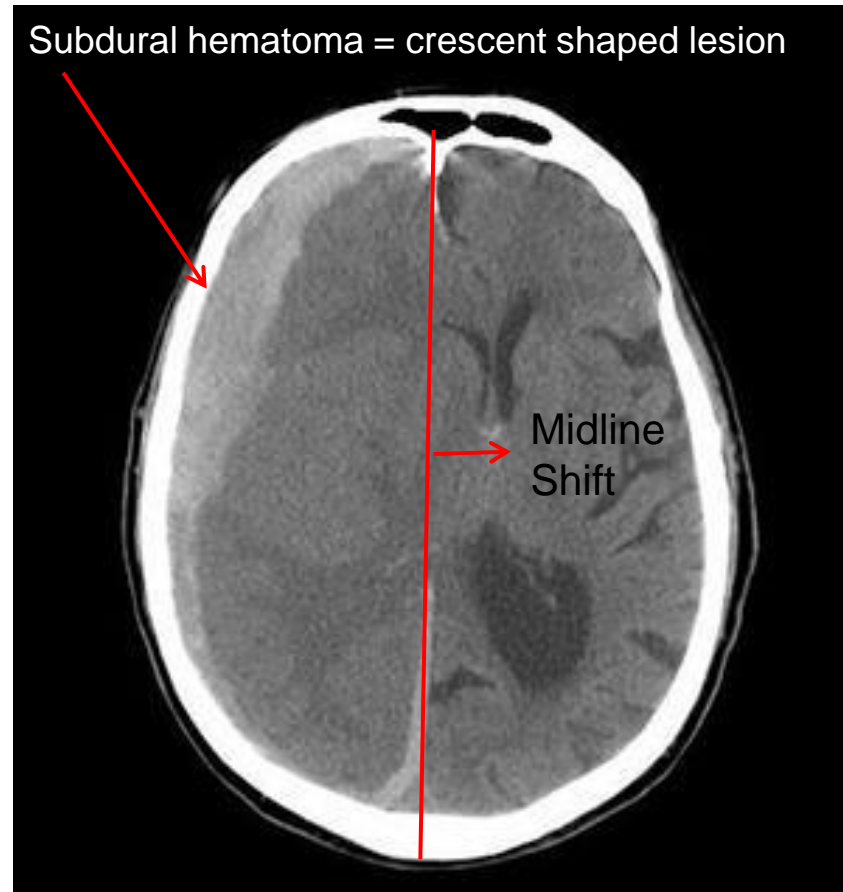


Case #2

- 56 year old female.
- History: Fell down stairs at cottage. Found with LOC.
- On Exam: GCS 9 (E2M4V3), L pupil sluggish but reactive. Vitals Stable. No other significant injuries.
- Next Steps?
 - Intubate as patient has lateralizing signs and low GCS
 - Urgent CT: MD should accompany patient or be close by
 - Maintain C-Spine precautions



Case #2: CT



Case #2: Acute Subdural Hematoma

- Acute SDH in a patient with significantly altered mental status requires immediate surgical attention.
- ASDH can expand quickly and cause herniation leading to death.
- If no clear history of trauma, patient requires CTA to rule out vascular etiology
- Management :
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes (no role for steroids)
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension
 - Q1H vitals and high intensity monitoring
 - Co-ordinate closely with neurosurgeon
 - Discuss goals of care with family. Particularly important in those age 65 or greater



Case #3

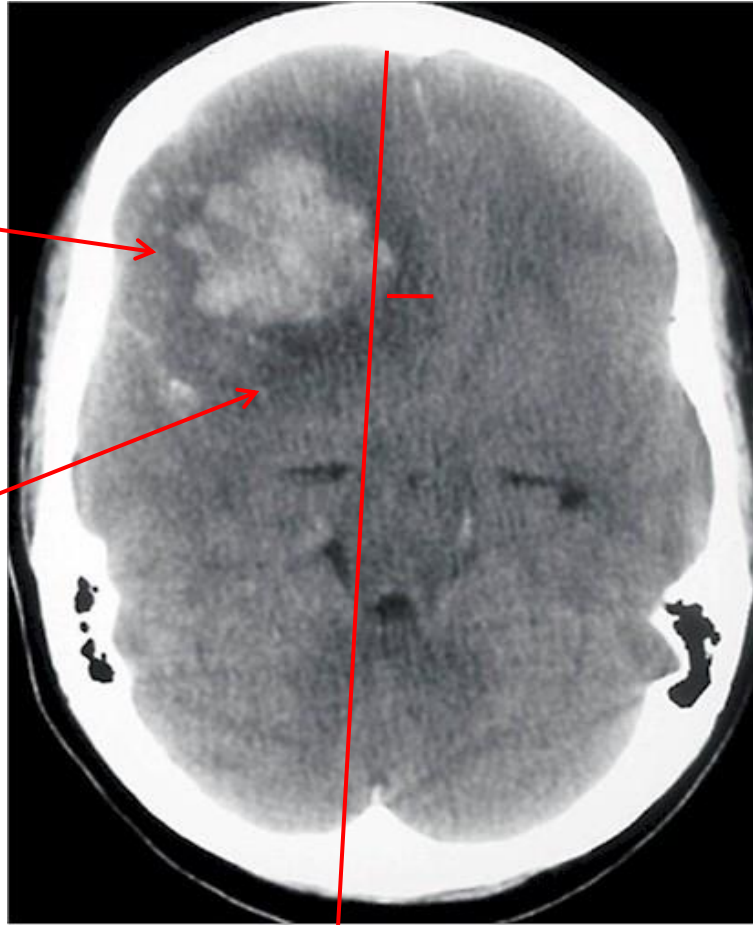
- 47 year old male.
- History: Patient had seizure at home and now altered level of consciousness.
- On Exam: GCS 13 (E3M6V4), PERL. No further SZ but weak on R side.
- Next Steps?
 - 1st Seizure (no need for Dilantin until diagnosis known)
 - Cannot rule it as 'post ictal' until after CT head



Case #3: CT

Acute Hemorrhage,
well defined border

Perilesional Edema,
Mass effect with shift.



Case #3: Spontaneous Intracerebral Hemorrhage

- Spontaneous intracerebral hemorrhage caused by structural lesion with clinical signs requires immediate treatment.
- Rule out non structural cause with **your radiologist**.
- Management:
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension.
 - Q1H vitals and high intensity monitoring
 - Edema related to tumor Decadron 10mg/IV (Discuss with neurosurgeon)
 - Discuss goals of care with family



Case #4

- 63 year old female.
- History: Sudden, severe headache and nausea.
- On Exam: GCS 15, PERL. No focal deficit.
- Next Steps?
 - CT Head
 - Normalize vital signs
 - Ensure no history of trauma



Case #4: CT

Subarachnoid
Hemorrhage.
Basal, Sylvian Fissure



Case #4: Spontaneous Subarachnoid Hemorrhage

- Even though patients with SAH may appear well, sudden life threatening complications may develop: hydrocephalus, re-bleed (these carry high risk of death).
- SAH patients need to be at a neurosurgical center for management of these complications and definitive management of lesion.
- Management
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex
 - Use IV antihypertensives or pressors as necessary
 - If signs of high ICP: discuss with neurosurgeon prior to hyperosmolar therapy
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension
 - Q1H vitals and high intensity monitoring
 - Co-ordinate closely with neurosurgeon



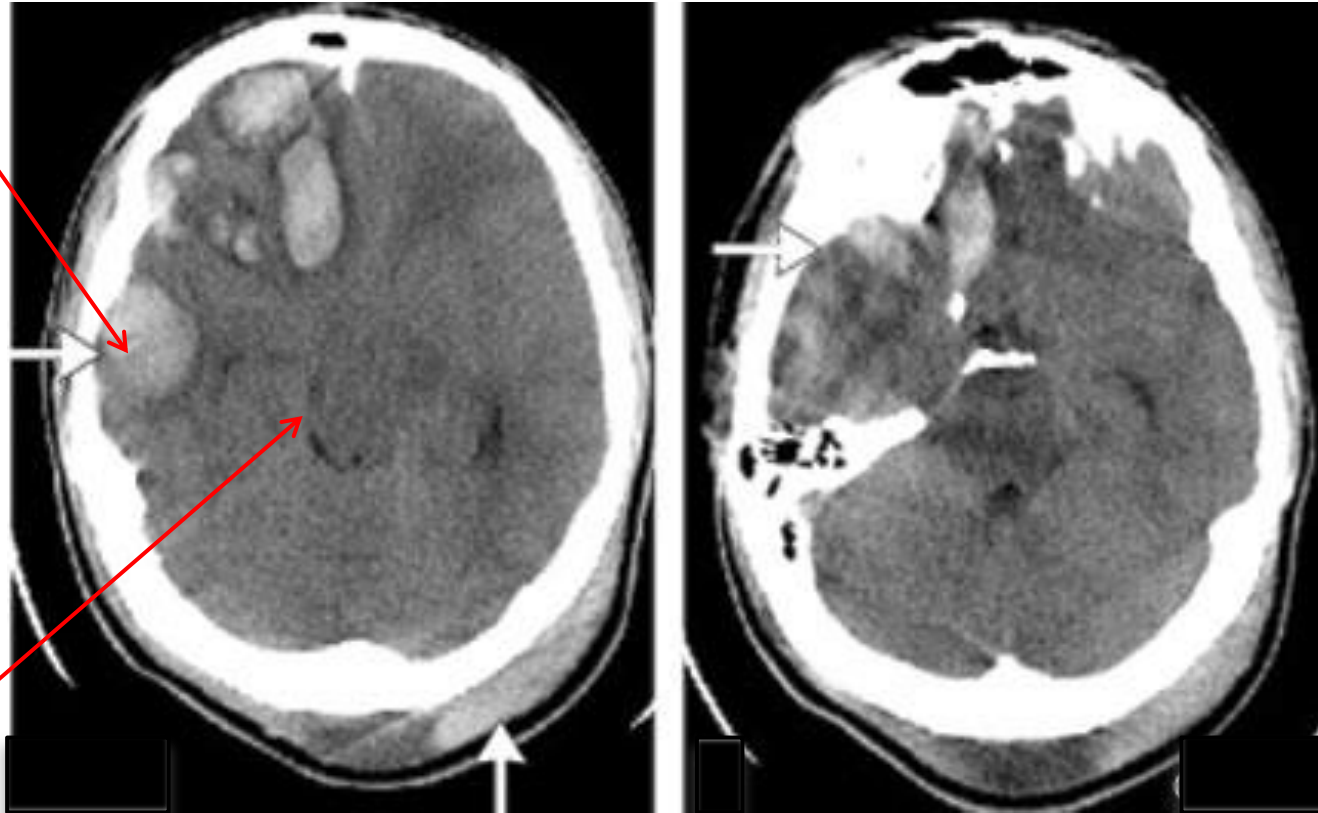
Case #5

- 22 year old male.
- History: High speed MVA, belted driver. Rollover.
- On Exam: GCS 8 (E1V3M4), PERL. Extensive cranial soft tissue injury. No other systemic injury.
- Next Steps?
 - ABC- intubate (Anesthesia if facial trauma).
 - C-Spine precautions
 - Stabilize and CT (MD should accompany patient)



Case #5: CT

Well circumscribed
Mass. Temporal Lobe.



- Uncus shifted by mass effect.
- Brainstem compression.

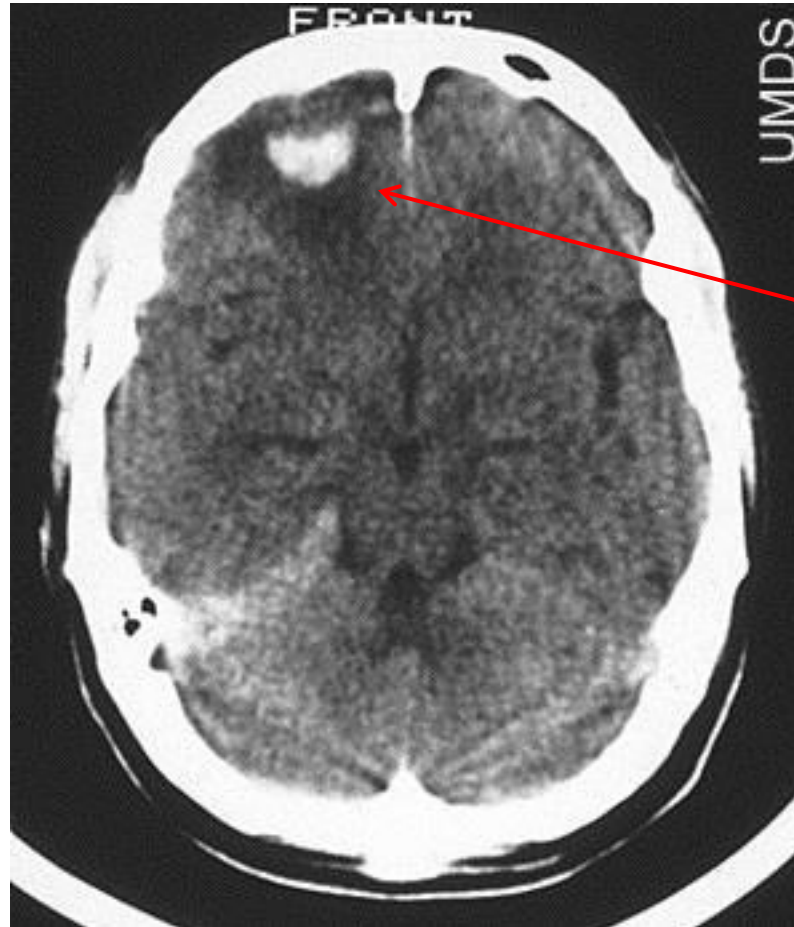


Case #5: Cerebral Contusions

- Patients with multiple contusions can deteriorate rapidly.
- If isolated contusion is temporal and large, small increase in size can result in brainstem compression.
- If patient is clinically unwell, ENITS should be used to get neurosurgical opinion early.
- Patients with significant contusions require emergent transfer
- Management:
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex.
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes (no role for steroids)
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension.
 - Q1H vitals and high intensity monitoring.
 - Co-ordinate closely with neurosurgeon.
 - Discuss goals of care with family. Particularly important in those age 65 or greater.



Case #5: CT



- High cortical lesion.
- Minimal mass effect.
- Isolated

Case #5: Cerebral Contusions

- Factors that increase risk with contusion:
 - Multiplicity
 - Age (younger)
 - Location (temporal)
 - Other injury
- For isolated contusions, in patient that is well, there are some that do not require neurosurgical transfer.
- Isolated cerebral contusions may be managed at non-neurosurgical center in conjunction with intensive care.
- These lesions are unlikely to expand in patients with good clinical status.
- Need monitoring for 12 hrs. to ensure no change.
- If clinical change, notify neurosurgeon. If no change, rescan 12 hours post injury and if CT stable then D/C home with neurosurgical follow-up.
- If any concerns, review patient through ENITS with neurosurgeon.



Case #6

- 30 year old male.
- History: Awoke with headache. Presents to ED with nausea and vomiting.
- On Exam: GCS 14 (E4V4M6), PERL. No focal signs.
- Next Steps?
 - CT Scan



Case #6: CT



Case #6: Acute Hydrocephalus

- Patients with clinical signs of increased ICP and radiographic evidence of hydrocephalus need immediate neurosurgical transfer.
- Delays can result in brain death.
- Finite window (1-2hrs). Complete pre-operative investigation while awaiting transfer.
- Cause can be multifactorial and requires neurosurgical evaluation.
- Management:
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex.
 - If signs of high ICP: discuss with neurosurgeon.
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension.
 - Q1H vitals and high intensity monitoring.
 - Co-ordinate closely with neurosurgeon.



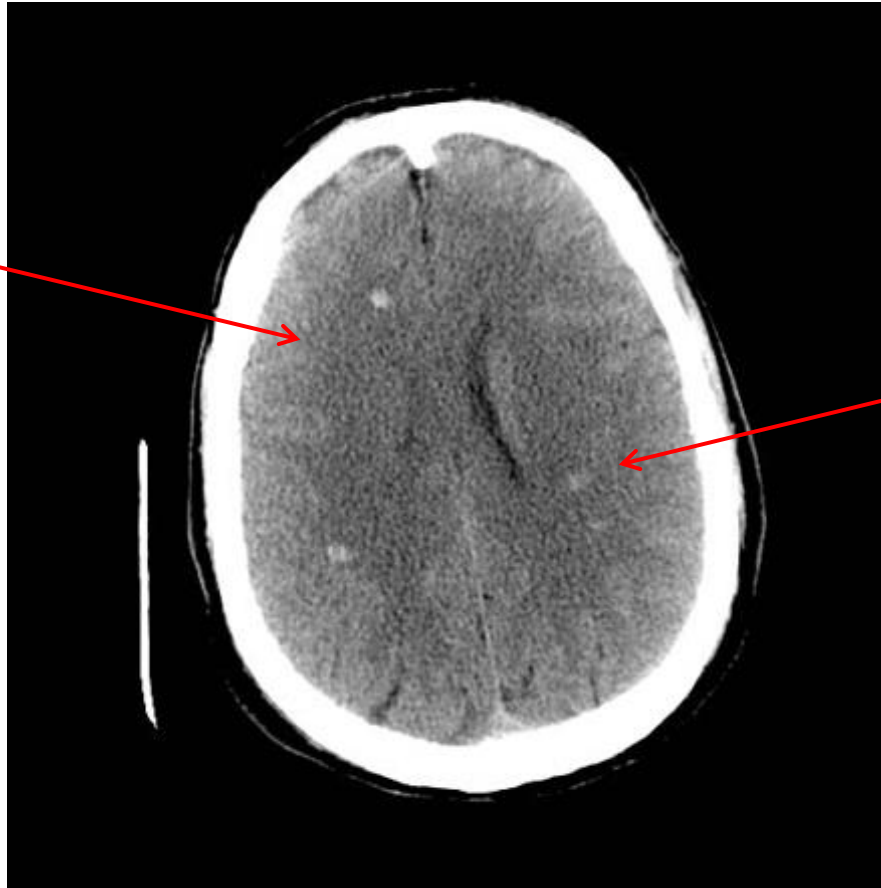
Case #7

- 29 year old female.
- History: High speed MVA.
- On Exam: GCS 7(E2V2M3), PERL. C-Spine collar. No other injuries.
- Next Steps?
 - ABC's
 - Ensure C Spine precautions
 - Maintain SBP>90 and SpO2>92%. A transient drop in either number drastically affects outcome.
 - Intubate early.
 - CT Head



Case #7: CT

Small petechial
hemorrhage.
Diffuse injury.



Loss of grey/white.



Case #7: Severe Traumatic Brain Injury (TBI)

- Patients with severe head injuries need urgent transfer to a neurosurgical center even if no surgical lesion.
 - Enhanced outcome.
 - Multimodal monitoring.
- Management in the first hours post TBI greatly modulates secondary injury and ultimately outcome.
- Management
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex.
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes (no role for steroids)
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension.
 - Q1H vitals and high intensity monitoring.
 - Co-ordinate closely with neurosurgeon.
 - Discuss goals of care with family. Particularly important in those age 65 or greater.



Case #8

- 65 year old female.
- History: Sudden onset nausea, vomiting and unsteady gait.
- On Exam: GCS 15, PERL. Ataxic, cerebellar signs (impaired finger-nose, impaired heel-shin, + Rhomberg).
- CT Scan Ordered



Case #8: CT

Brainstem Compressed
By mass effect.

Compression of
Fourth ventricle.
May lead to
Hydrocephalus.



Case #8: Management

- Posterior fossa hemorrhage is an emergency as compression of 4th ventricle can lead to acute hydrocephalus.
- These patients need to be at a neurosurgical center for clot evacuation and to manage potential hydrocephalus.
- Management:
 - A-Intubate $GCS \leq 8$. For transfer intubate if $GCS \leq 10$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140), Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex.
 - If signs of high ICP: Mannitol 1.5g/kg or 250cc 3% saline over 15 minutes (no role for steroids)
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Non-Emergent Cases



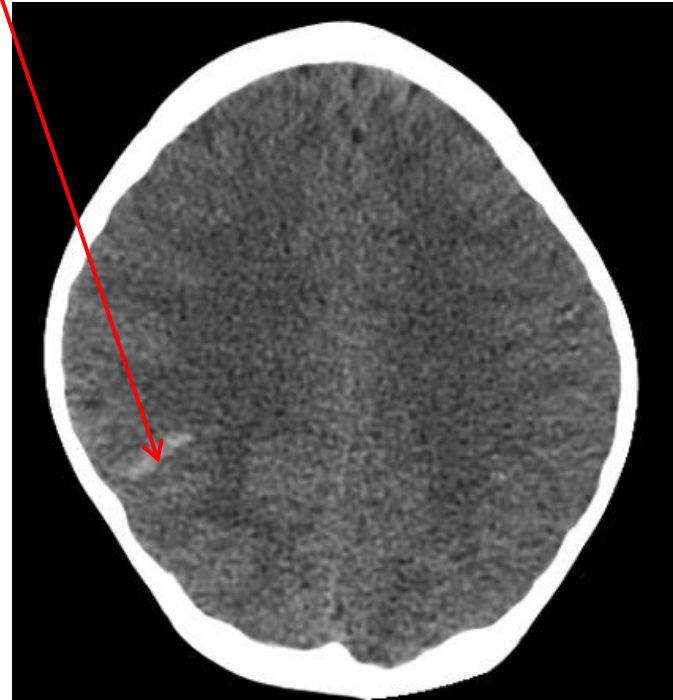
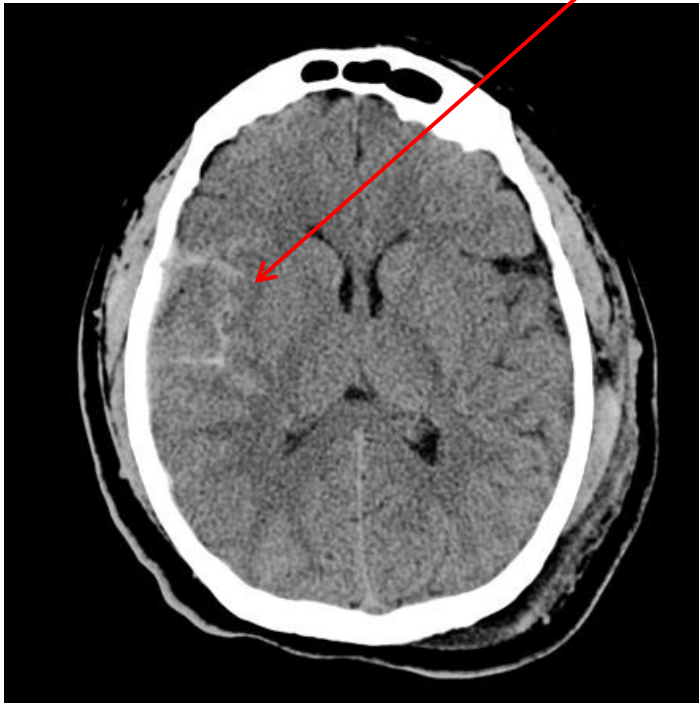
Case #1

- 54 year old male
- History: Presenting with severe headache and nausea. Clear history of head trauma.
- On Exam: GCS14 (E4M6V4). No focal deficit.
- Next Steps?
 - Undifferentiated headache (severe) -> CT head.



Case #1: CT

Blood in sulci.
Cortical, not basal.



Case #1: Traumatic Subarachnoid Hemorrhage

- These patients need to be observed.
- tSAH should be confirmed with radiologist at referring hospital.
 - Treat as spontaneous SAH until confirmed by radiologist.
- tSAH extremely unlikely to develop hydrocephalus or vasospasm.
- tSAH requires neurosurgical follow-up through GP if no acute neurosurgical issues that need to be addressed.
- These patients require observation overnight in high intensity setting with Q1H vitals to ensure no clinical deterioration.
 - Reverse coagulopathy (INR<1.4)
- If deteriorate, then consult/re-evaluate with neurosurgeon.
- Otherwise, CT Head in AM and if radiologist confirms no change then follow-up with regional head injury clinic. (Local neurosurgeon through GP if not available)
- Neurosurgeon/head injury clinic to advise on restarting anticoagulation if required.



Case #2

- 73 year old female
- History: Sudden headache and difficulty mobilizing.
- On Exam: GCS 12 (E3M5V4). PERL. SBP 210, R hemiplegia.
- Next Steps?
 - Reduce SBP to prevent encephalopathy (use labetalol prn).
 - CT head to assess cause.
 - Given patients neurological status, be prepared for airway collapse.



Case #2: CT



Focus of hemorrhage
in basal ganglia.
Extending out.



Case #2: Hypertensive Hemorrhage

- Needs to be confirmed as hypertensive hemorrhage by physician/radiologist in conjunction with history.
- Neurosurgical input only required if patient has
 - a) Hydrocephalus
 - b) Impending herniation (as demonstrated by clinical status).
 - C) GCS 9-12
- STICH trial:
 - Craniotomy at day 1 or longer after onset not better than initial conservative medical treatment +/- later craniotomy for patients who have deterioration.
- Should be managed by ICU in conjunction with medicine/neurology at outside center.
- Discussing goals of care in this population are very important as they tend to be advanced age with multiple co-morbidities.



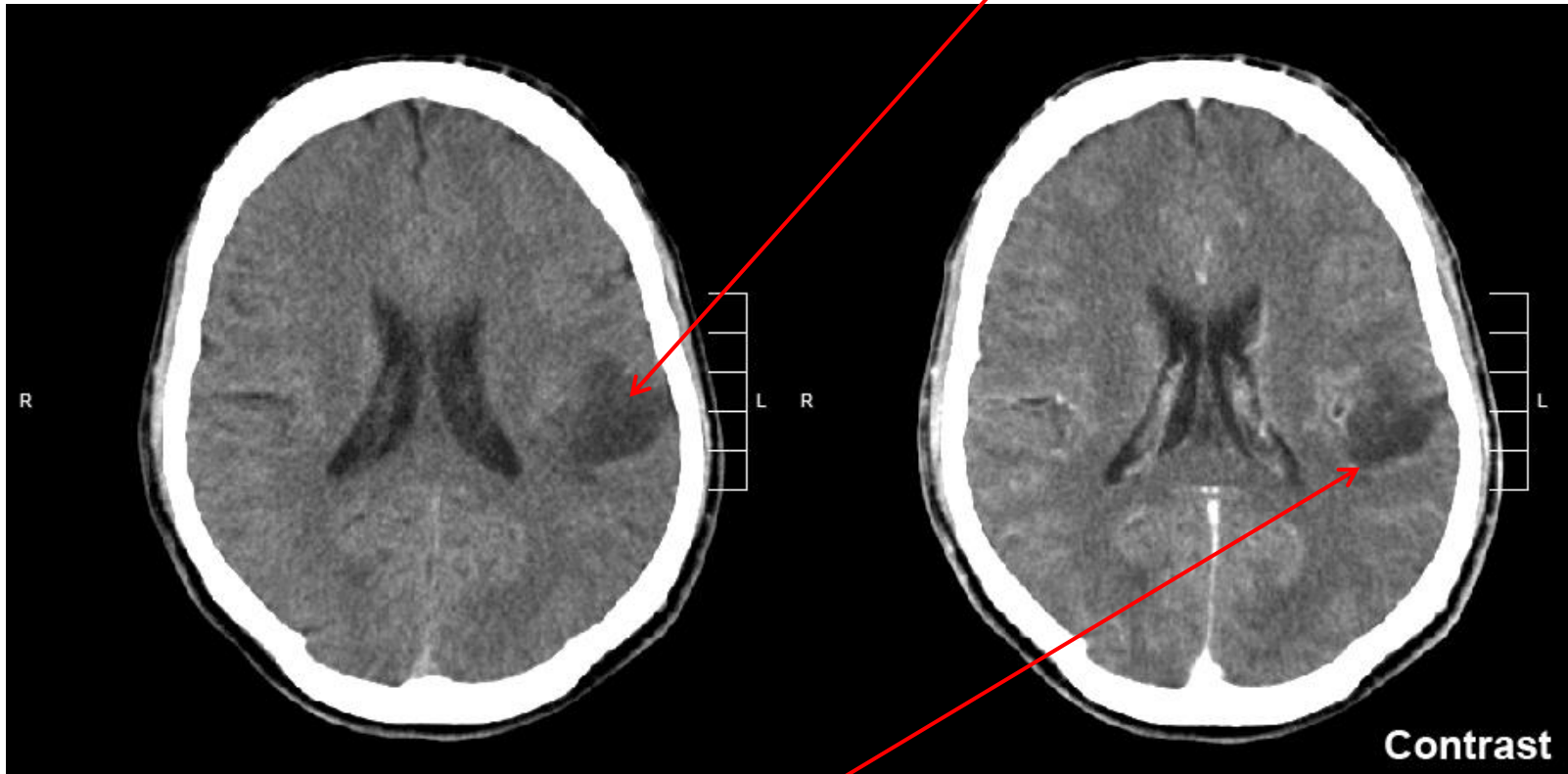
Case #3

- 34 year old female
- History: 2 week history of progressive headache. Otherwise well.
- On Exam: GCS15, PERL. No focal deficit.
- Next Steps?
 - CT Scan



Case #3: CT

Undifferentiated Lesion.
No significant mass effect.
Safe location.



Contrast delineates
'rim' of lesion.



Case #3: Brain Tumor

- Patients with incidental brain tumor do not require transfer.
- These patients do not require neurosurgical transfer or after-hours neurosurgical consultation.
- Patient can be referred to neurosurgeon through GP.
- If there are concerns about the patients clinical status or the level of mass effect then neurosurgical consultation should be initiated.
- If the center has neurology then they should be consulted.
- Manage edema with Decadron 10mg po x1 followed by 4mg po qid. Reasonable to discuss with neurosurgeon or neurologist if required.
- Further imaging with an MRI + Gadolinium is recommended prior to outpatient referral



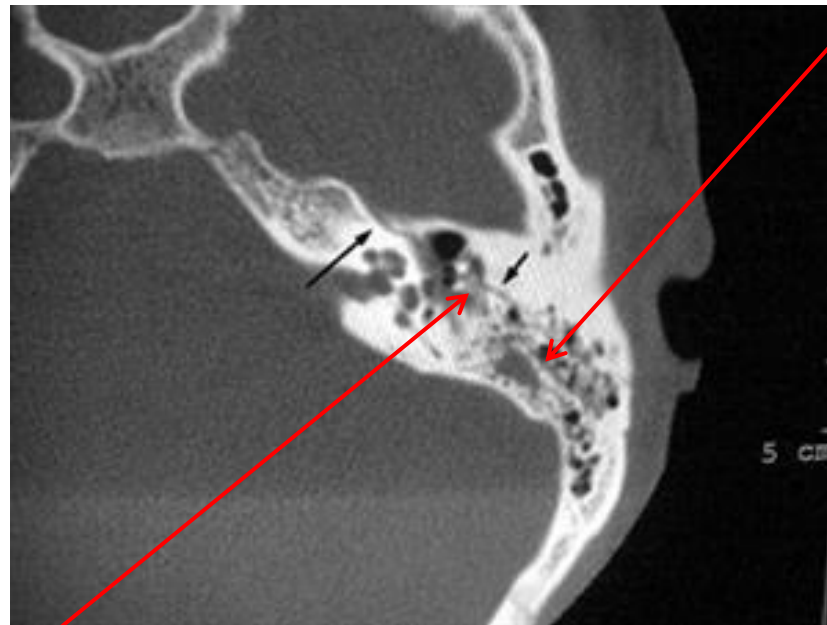
Case #4

- 21 year old male.
- History: Assaulted at bar. Transient LOC but awake when EMS arrived.
- On Exam: GCS 15, PERL. Soft tissue injury and facial laceration. Battle's sign and otorrhea.
- Next Steps?
 - CT Scan



Case #4: CT

Fluid in mastoid air cells.



Temporal bone fracture.



Case #4: Traumatic CSF Leak

- Basal Skull Fracture
 - No evidence for antibiotic prophylaxis
- Patients can be managed at non-neurosurgical center
 - Bed rest (lie flat)
 - Good hydration
 - ENT consultation to guide management.
- These patients benefit most from ENT follow-up.
- No necessity for neurosurgical follow-up.



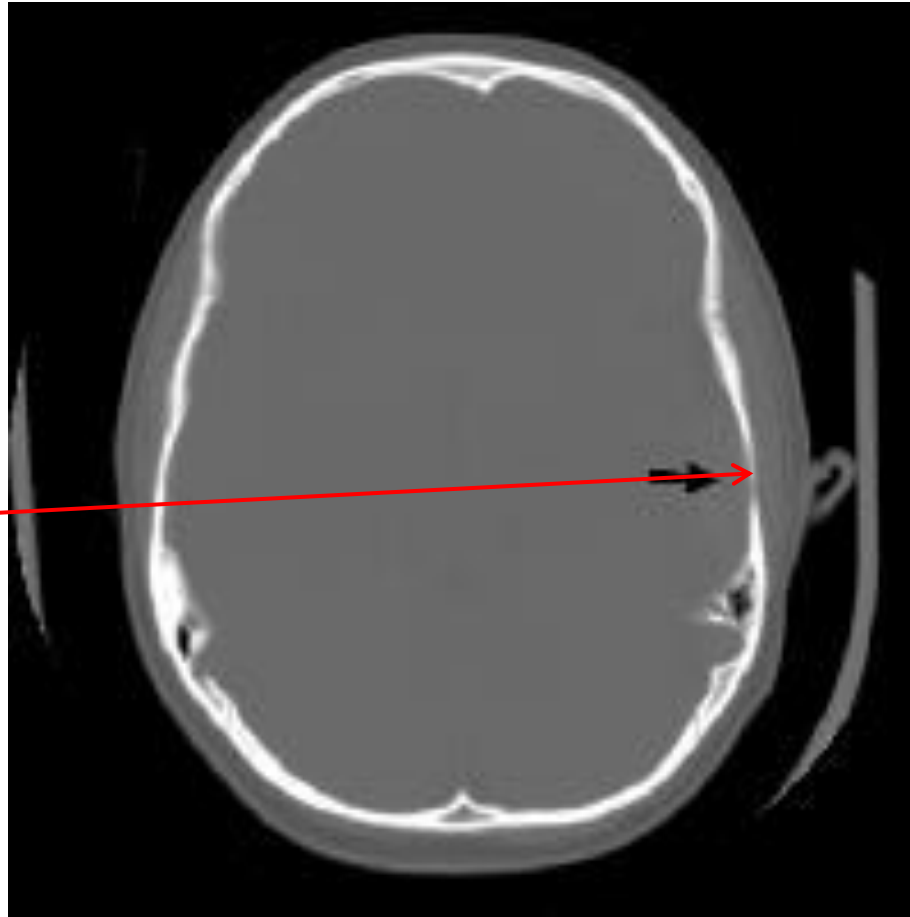
Case #5

- 55 year old male
- History: Hit in head by falling wrench while working on car. Comes to ED complaining of significant headache and soft tissue scalp swelling.
- On Exam: GCS15 PERL. Significant soft tissue hematoma. No other injuries.
- Next Steps?
 - CT Scan



Case #5: CT

Small fracture.
Un-displaced.
No underlying
Brain contusion.



Case #5: Management

- Patients with non displaced skull fracture do not require neurosurgical transfer or consultation.
- Patient should be admitted to floor and CT should be repeated 12 hrs. post initial CT.
- Reverse any coagulopathy ($\text{INR} < 1.4$).
- If no change may be discharged home and anticoagulation may be restarted as required.
- If specific concerns, review with neurosurgeon in conjunction with ENITS.
- If no change or hemorrhage on follow-up scan, patient may be discharged home and anticoagulation may be restarted as required.



Case #6

- 63 year old female.
- History: Slipped on ice and fell. No LOC. Bad headache.
- On Exam: GCS14 (E4M6V4), PERL. No focal deficit. R soft tissue injury on scalp.
- Next Steps?
 - CT Scan



Case #6: CT

Small aSDH.
No shift.
No significant mass effect.



Case #6: Acute Subdural Hematoma

- Small acute subdural hematoma's in the well patients (i.e.. GCS 14-15 no deficit) can be observed.
- These patients are highly unlikely to receive any operative intervention.
- Management would include observation in ICU with repeat imaging 12 hrs. post injury. If the subdural is stable and the patient is well, they may be discharged with neurosurgery follow-up
- For small aSDH it is reasonable to defer neurosurgical consultation to occur between 0800-2200.
- If any change in clinical status or CT appearance, alert neurosurgery.
 - Management A-Intubate $GCS \leq 8$.
 - B-Prevent $SpO_2 < 90\%$
 - C-Keep BP normal (110-140),Rapidly normalize coagulation ($INR \leq 1.4$)
 - To normalize INR if patient on Coumadin use Octaplex.
 - If signs of high ICP: discuss with neurosurgeon.
 - If seizure: 20mg/kg Dilantin over 30 min, do not allow hypotension.
 - Q1H vitals and high intensity monitoring.



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In all cases, ABC's should be evaluated and treated prior to the application of these guidelines.



If criteria in first step are satisfied, there should be a reasonable expectation of discussion regarding patient transfer.

1 Identify patients eligible for acute transfer

Acute transfer is most often required if a patient meets **at least 1 clinical and 1 imaging criteria** from the lists below:

Clinical criteria

- Penetrating head injury
- Seizures
- Altered LOC not attributable to intoxicants
- Focal Neurological Deficit (cranial nerve or motor deficit)
- High ICP (nausea, vomiting, headache) with altered LOC
- Lateralizing signs (e.g. pupillary dilatation, hemiparesis)

Imaging criteria

- Traumatic intracerebral, acute subdural, or epidural hematoma
- Penetrating cranial object
- Brain contusion
- Hydrocephalus
- Non traumatic subarachnoid hemorrhage
- Non traumatic brainstem or cerebellar intracerebral hemorrhage (ICH) (Non traumatic cortical ICH if a vascular malformation is suspected)
- Mass Lesion (posterior fossa lesion, midline shift >3mm, hemorrhage within tumor or significant peri-lesional edema in lesion >3cm)

Unique circumstances that might mandate transfer in absence of access to imaging

- Lateralizing signs & GCS ≤ 8 in institution without access to CT scan
- LP proven subarachnoid hemorrhage (presence of xanthochromia)

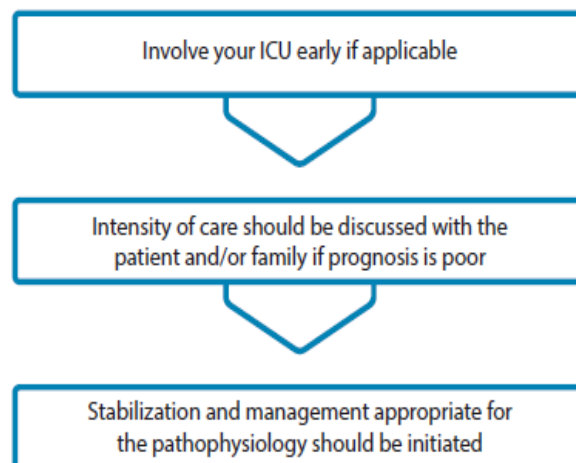
2 Stabilization and management

For all pathology, in preparation for transfer:

- Attend to ABC's
- Consider medical therapy for elevated ICP
- Reverse coagulopathy (INR <1.5)
- Judicious use of sedation (short acting drugs preferred)
- Perform neurovitals frequently (q1h)
- Intubate if GCS ≤ 8 or for transport if GCS ≤ 10
- Treat hypotension & hypoxia

3 Consultation

At this stage **contact CritiCall at 1-800-668-4357** for all patients where physician requires a neurosurgical opinion.



4 Disease specific management

Traumatic brain injury

- Give Dilantin 15-20mg/kg if documented seizure or GCS ≤ 8
- Do not use steroids for raised ICP
- Give Mannitol 1.5g/kg for suspected raised ICP
- Assume C-Spine injury and maintain spine precautions
- If penetrating object, stabilize but do not remove

Subarachnoid hemorrhage

- Keep patient normotensive, avoid a SBP ≤ 120 or SBP ≥ 160 (use pressors or antihypertensives as necessary)*
- Consult neurosurgeon prior to giving Mannitol

Brain tumors

- Dilantin 20mg/kg for documented seizures
- Decadron 10mg IV[†] followed by 4mg IV q6h

Intracerebral hemorrhage

- Dilantin 20mg/kg for documented seizures
- Discuss with neurosurgeon via ENITS the appropriateness of transfer using CT and clinical criteria
- Manage and set target BP in consultation with neurosurgeon

* Age-specific blood pressure values apply to paediatric patients
† Adjust dosage for paediatric patients.

THANK YOU!

Questions?

Please email tanya.mohan@uhn.ca

