Imaging of Acute Cerebral Trauma

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46 y/o Female s/p Trauma

- Unrestrained? MVC requiring Med Flight
- Facial bruising/swelling
- DEEP COMA
- SEIZURES

What is the imaging modality of choice?

CT is the Modality of Choice for Acute Head Trauma

Advantages:

- **FAST** - start w/o contrast
- Ability to change window allows simultaneous scanning of bone/soft tissue
- Traumatic concerns are easily visualized
  - Fxs are often evident on bone window
  - Acute bleeds are hyperdense
  - Even subtle shifts are obvious
- Easier access if pt. decompensates

PACS, BIDMC

40/80 Window

400/2000 Window
Normal Brain Appearance on CT

- Preservation of grey/white matter interfaces (white matter is DARKER than grey on CT)
- CSF in the ventricles is very dark grey
- No shift of midline structures
- Prominent sulci
Axial Anatomy of the Superior Cortex

http://www.indiana.edu/~m555/axial/axial.html
Meninges

- Dura mater
- Arachnoid
- Pia mater
- Falx cerebri

DDx Traumatic Cranial Bleeds

- **Epidural**
  - Well-contained by cranial sutures, can cross midline
  - Often “Bi-convex” shape
  - Associated with skull Fxs

- **Subdural**
  - Contained by falx cerebri and tentorium
  - Often “Crescent” shape
  - Can have venous OR arterial blood

- **Subarachnoid**
  - Extends into CSF space
  - Fluid on CT best seen in the cisterns and sulci

Also on the DDx:
- Tumor
- Abscess
- Focal Contusion
- Hydrocephalus

Our Patient

- Loss of demarcation of the fissures/sulci
- Loss of grey matter/white matter differentiation
- Blood in the third and lateral ventricles
- Mild shift of the septum pellucidum to the left

What’s the Dx?
Subarachnoid AND Subdural Hemorrhages
Connecting the Dots

- The amount of subarachnoid blood was out of proportion to the external injuries.
- The presence of both a subarachnoid bleed and a subdural hemorrhage might be due to two separate events.
- EMS reports indicated that patient had struck a parked truck without breaking or swerving.

Follow-up CTs and angiography were ordered...
Day Two - Evolving Infarction
CT Angiography

We now see a small aneurysm in the Circle of Willis...
Aneurysm is located at the intersection of the R Interior Carotid and the R Posterior Communicating Arteries, directed laterally and inferiorly.
Patient Follow-Up

Perhaps an aneurysm ruptured, causing the MVC and subsequent trauma.

Sadly, the injuries were incompatible with life. Patient was pronounced brain dead and removed from life support on day two.
Companion Patient 2 - Subdural Hemorrhage

- 66 Year-old man, unconscious, unknown traumatic history

http://www.vh.org/adult/patient/neurosurgery/braininjury/images/epihemat.gif
Companion Patient 2 - Subdural Hemorrhage

May be classified as

1) hyperacute (HYPOdense) if less than 12 hours

2) acute (HYPERdense) if less than few days

3) subacute (ISOdense) from a few days to 2-3 weeks

4) chronic (HYPOdense) if more than 3 weeks

We need to put this together with clinical observations and Hx to tell for certain if this is hyperacute or chronic.
Companion Patient 3

46 y/o man s/p motorcycle crash

- Bi-convex, very large
- Mostly contained within L parieto-occipital region along sutures
- Crosses midline?
- Associated Fx
- Hyperdense

What’s the Dx?

http://www.szote.u-szeged.hu/radio/neuro1/a1neu11b.htm
Companion Patient 3

Acute Epidural Hemorrhage

http://www.szote.u-szeged.hu/radio/neuro1/a1neu11b.htm
Companion Patient 4 - Hemorrhagic Contusion

39 y/o male s/p 15-foot fall

- No shift of structures
- Focal blood/edema
Traumatic Brain Injury (TBI)

• 1.6 million people/year in the U.S. have a TBI.
• 150,000 of those suffer “severe” (comatose) head injury.
• 50,000 people/year die from TBI.
• CT radiology is the standard for rapid evaluation of the post-trauma brain.
• The most common causes of TBI are MVCs, bicycle/pedestrian accidents, falls, and violence.
• Gunshot wounds are a small percentage of TBI’s, but account for half of the fatalities.
• Intracranial pressure monitoring is key in comatose patients.
References

• “Acute Epidural Hemorrhage” www.szote.u-szeged.hu/radio/neuro1/a1neu11b.htm
• “Axial Brain Sections” www.indiana.edu/~m555/axial/axial.html
• “BrighamRAD” http://brighamrad.harvard.edu
• “The Brain Trauma Foundation” www.braintrauma.org
• “Traumatic Brain Injury” www.head-trauma-resource.com
• “Virtual Hospital” www.vh.org
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