


Mild Traumatic Brain Injury

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The Case

- Last day of vacation: 20 year old male novice skier
- Several days of lessons: over confident with marginal skills
- Instructors never emphasized the need to wear a helmet
 - Nor did they teach by example

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The Case Cont'd

- At 40 mph, lost control, head first into a tree
- Unconscious for 1 to 3 minutes
- By the time other skiers arrived to help, awake and alert.
- Skied down to the lodge: At the bottom of the mountain, felt well except for a moderate HA
- Family insisted he be seen in the ED before embarking on the 12 hour trip home

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The Case Cont'd

- In the ED, 3 hours after the accident: BP 118/80, P 64, RR 14, T 37, O₂ sat 100% on room air.
- GCS score 15; small hematoma on his scalp without surrounding tenderness or deformity, and a completely normal neurologic examination.
- The examining physician determined no significant injury and discharged him with a prescription for ibuprofen and a head injury sheet.

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Key Questions

- Is a single GCS score predictive of TBI?
- Are there historical or physical findings that predict TBI?
- Is there a role for plain skull radiographs in the evaluation of patients with a MTBI?
- Which patients with MTBI require neuroimaging?
- Can patients with a GCS score of 15 and a normal head CT be safely discharged from the ED without admission to the hospital
- In patients with a GCS of 15, what is the risk of developing the postconcussive syndrome?

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Is a single GCS score predictive of TBI?

- Alteration in mental state at time of the accident
- LOC <30 min
- After 30 min, GCS 13-15
- Amnesia <24 hours

Mild TBI Committee of the American Congress of Rehabilitation Medicine

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Is a single GCS score predictive of TBI?

- Developed for prognosis in severe TBI
- Timing of score is not standardized
- One score not sufficient - perform serial exams
 - Prognosis worse if score does not improve or if it worsens
- Does not account for drugs, seizures, or metabolic problems

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Is a single GCS score predictive of TBI?

- Dx of MTBI does not take into account neuroimaging
- Retrospective study, 215 hospitalized patients
 - Mild TBI without complications
 - Mild TBI with complications (positive CT)
 - Moderate TBI
- Mild TBI patients with positive CT performed on neuropsychiatric testing like moderate TBI
- Moderate group had worse function at 6 months
- Length of LOC or amnesia did not differentiate mild from moderate groups

Williams et al. *Neurosurgery* 1990;27:422.

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Are there historical or physical findings that predict TBI?

- Loss of consciousness and / or posttraumatic amnesia are accepted negative predictors of significant acute traumatic brain lesions
- Focal neurologic deficits increase the likelihood of an intracranial lesion 4-7x
- Memory deficits, nausea, vomiting, headache have not been shown to increase the likelihood of an acute brain lesion (but their absence has been shown to be predictive of no lesion)

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Is there a role for plain skull radiographs in the evaluation of patients with a MTBI?

- Retrospective review
- 207 hospitalized patients with intracranial lesions
- 63% had no skull fracture
- Skull films did not predict intracranial lesion

Cooper P, Ho V. *Neurosurgery* 1983;13:136

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Is there a role for plain skull radiographs in the evaluation of patients with a MTBI?

- Masters 1987 NEJM: Prospective study 7035 pts.
 - Flawed methodology. 63% with + xray had - CT; 50% with +CT had negative xray
 - Skull films have low sensitivity for intracranial lesions
- Hoffman 2000 Lancet: Meta-analysis
 - 20 articles reviewed out of 200 identified
 - Sensitivity .13-.75; PPV of skull fracture in predicting +CT .4
 - Specificity .9-.99; NPV of skull fracture in predicting +CT .94
- Skull films are not recommended in the evaluation of MTBI; although the presence of a skull film increases the likelihood of an intracranial lesion, its sensitivity is not high enough to allow it to be a useful screen

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Which patients with MTBI require neuroimaging?

- Retrospective review 1538 trauma admissions
- GCS > 12; all with history of LOC or amnesia
- 265 (17.2%) had intracranial lesion:
 - GCS 13: 37.5%
 - GCS 14: 24.2%
 - GCS 15: 13.2%
- 58 (3.8% of total 22% of patients with positive CT) required neurosurgery
- No patient with a normal CT deteriorated

Stein S, Ross S. *Ann Emerg Med* 1993;22:1193

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Which patients with MTBI require neuroimaging?

- Prospective study: 712 consecutive ED patients
- GCS 15; history of LOC or amnesia
- Nonfocal neurologic exam
 - 4 object recall and digit span testing
- 67 (9.4%) had a positive head CT
- 2 (.28%) required emergent neurosurgery
- No statistical model could be created to classify 95% of patients into CT normal vs abnormal

Jeret et al. *Neurosurgery* 1993;32:9

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Which patients with MTBI require neuroimaging?

- Haydel 2000 NEJM; Class I study; 2 phases
 - Phase I 520 patients to establish predictive criteria
 - Phase II 909 patients to validate criteria
 - 7 predictors identified with 100% sensitivity for predicting intracranial lesion.
 - Use of criteria would decrease head CT by 22%
 - No follow-up provided after discharge
- A head CT is not recommended in those patients with MTBI who do not have HA, vomiting, age > 60, drug or ETOH intoxication, deficits in short term memory, physical evidence of trauma above the clavicle, or seizure.

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Can a patient with MTBI be safely discharged from the ED if a noncontrast CT shows no evidence of acute injury?

- Stein 1992 J Trauma. Retrospective
 - 1339 patients with negative CT, none deteriorated
- Dunham 1996 J Trauma Infect Crit Care. Retrospective review of a prospectively collected data base
 - 2587 patients, no patient with a negative CT deteriorated; those patients who did deteriorate (without initial CT), did so within 4 hours

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Can a patient with MTBI be safely discharged from the ED if a noncontrast CT shows no evidence of acute injury?

- Nagy 1999 J Trauma Infect Crit Care. Retrospective
 - 1190 patients with CT and admission
 - No patient with a negative CT deteriorated (spectrum bias towards sicker patients)
- Patients with MTBI who are 6 hours out from their injury and who have a head CT that does not demonstrate acute injury can be safely discharged from the ED

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In patients with a GCS of 15, what is the risk of developing the postconcussive syndrome?

- Symptom complex related to TBI
 - Somatic
 - Headache, sleep disturbance, dizziness, nausea, fatigue, sensitivity to light / sound
 - Cognitive
 - Attention / concentration problems, memory problems
 - Affective
 - Irritability, anxiety, depression, emotional lability
- Incidence in MTBI patients:
 - 80% at 1 month
 - 30% at 3 months
 - 15% at 12 months

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In patients with a GCS of 15, what is the risk of developing the postconcussive syndrome?

- Prospective study, 538 patients
- MTBI, hospitalized
- 3 month follow-up
- 79% headaches
- 59% memory dysfunction
- 33% had not returned to work
- Ongoing litigation did not correlate with complaints

Rimel et al. *Neurosurgery* 1981;9:221

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In patients with a GCS of 15, what is the risk of developing the postconcussive syndrome?

- **Best prognosis**
 - Young
 - Male
 - Educated
 - Social support
- **Worse prognosis**
 - Elderly
 - Female
 - Social / physical stressors
 - Substance abuse

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In patients with a GCS of 15, what is the risk of developing the postconcussive syndrome?

- Saunders et al. *Ann Emerg Med* 1986;15:160.
 - 47 consecutive MTBI discharged from the ED
 - No patient could remember more than 2 of the 8 items on the home care discharge instructions
 - 20% denied ever having received instructions
 - Third party involvement improved compliance with instructions to 67%
- Levitt et al. *Amer J Emerg Med* 1994;12:172.
 - 23% of MTBI patients discharged from the ED could not remember any of their discharge instructions
- Studies emphasize importance of involving third parties in discharge process

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Conclusions

- A single GCS score is not predictive of TBI
 - Patients with HI should have serial exams
- LOC and / or PTA suggest the potential for a TBI and drive the need to consider neuroimaging
 - Focal neuro deficit or signs of a BSF are associated with a TBI and need for imaging
- Normal plain skull radiographs do not predict the absence of a significant acute brain injury

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Conclusions

- A head CT is not indicated in patients with a GCS 15 and no LOC /PTA.
- In patients with LOC / PTA a head CT is not indicated if: no headache, vomiting, age > 60, drug or ETOH intoxication, deficits in short-term memory, trauma above the clavicle, or seizure.
- There are no good predictors of which head injured patients with a GCS of 15 are at risk to develop PCS
- Patients 6 hrs post-injury with normal exam and head CT can be safely discharged
 - Patients can be discharged after a shorter period of observation if under the care of a responsible third party.

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Case Outcome

- On the way to the airport, headache become worse; he became confused then lethargic; he vomited twice and then had a generalized tonic clonic seizure.
- Rushed to the ED; arrived with a GCS 6
- An emergent head CT showed a large frontal subdural, and a small occipital intraparenchymal hemorrhage

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Case Outcome

- Frequently has HAs; family claims his personality “is different” though they are unable to better characterize the change.
- MP always wears a helmet now when he skies.

Questions?