EVIDENCE ON MINOR HEAD INJURY IN GERIATRICS

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Definition: Minor head injury

• 1 Minor HI – GCS 15, LOC, amnesia or confusion
  Minimal HI – GCS 15, no LOC, amnesia or confusion

• 2. Blunt trauma to the head resulting in loss of consciousness, amnesia,
  witnessed disorientation with GCS 14 or 15.
  (Uccella, World Neurosurgery 2016).

• 3. Minimal: represents patients with a GCS of 15 and no risk factors
  Mild: a GCS of 14 or 15 with risk factors (such as amnesia or loss of

• 4. A patient with an initial GCS score of 14-15 on arrival at hospital following
  acute blunt head trauma with or without a definite history of loss of
  consciousness or post traumatic amnesia  ITIM, NSW 2011
Problem of HI in the elderly

- In U.S. patients >65 = 10% ED visits and 30% admissions for TBI (EmDocs, Jan 28, 2016), 2i5h 50% deaths

- The CRASH study - data used to create an on line prognostic tool for outcomes
  - For a 70 yr old male in the U.S. with a GCS of 14 after TBI, with bilaterally reactive pupils, no major extra-cranial injuries, and a negative CT, the risk of 14 day mortality = 6.7%, and the risk of “unfavorable outcome” at 6 months (“dead, vegetative state, or severe disability as defined by the Glasgow Outcome Score} = 35%.

- Increased fall risk – majority of falls are from a standing height
  - CDC 1/3 patients >65 experienced fall in 2011, 30% had a moderate injury
  - Cerebral atrophy- bridging veins
  - Comorbidities including poor balance
  - Anticoagulation – increased mortality
Questions to be answered

• Patients >65 with minor head injury – CT all these patients? Guidelines?
  If the CT is positive for patients on anticoagulants?
  How to treat?
• If the initial CT is negative in patients on anticoagulants, what should be the approach?
• What is the risk of a delayed ICH in patients on anticoagulants
  • If on warfarin
    • INR therapeutic, CT negative, observe or discharge –
      • Withhold warfarin?
    - INR supratherapeutic – CT negative, observe or discharge - withhold or reverse?
    - If on NOAC – CT negative, observe or discharge – withhold NOAC?
Patients >65 with minor HI- Guidelines

• Should CT head be done for minor HI?
  • Canadian CT rule - not required unless > 65 years, could not be included if coagulopathy
  • New Orleans rule – not required unless >60 years
  • Nexus II - >65 years, coagulopathy
  • ACEP/CDC rule 2008 >65 years, coagulopathy – Level B evidence
  • NICE guidelines 2014 – >65 years, on warfarin (within 8 hours)
  • ITIM NSW 2011 - >65, known coagulopathy
Guidelines: any exceptions?

• Scandanavian working group
  Could not recommend older age (>60 or >65) or antiplatelet medication as individual risk factors - unacceptable CT increase, with only moderate predictive abilities. Combine into one risk factor, age ≥65 years and antiplatelet medication

  • Retrospective, >65 years, all CT
  • 2149 patients – 47 findings – 3 required surgery
    • 65-79 pathological findings 0.665% cases
    • >80 3.33% acute pathology
    • 617 patient on antiplatelets – 22/617 = 3.72% pathological finding
  • Conclusion: no difference from general population so not necessary up to 80 years – manage as younger patients
Fell on way from Leagues Club: severe headache, vomiting x 5/7, falling asleep at table, GCS on arrival 14/15. On ASA
How much are anticoagulated patients at risk of ICH?

- CDC, National Center for Injury Prevention and Control, Atlanta 2010
  - Increased ICH in those on OAC compared to those not (8% vs 5.3%)
  - Increased mortality in those on OAC compared to those not (21.9% vs 15.2%)
  - Independent predictor of mortality – those who die, most significant injuries were skull fractures and intracranial haemorrhage
Incidence of ICH in anticoagulated patients

  • Analysis of studies 1998 -2008
    • 6.2% of 144 (Li et al),
    • 8% of 504 (Fabri et al)
    • 12% of 32 (Reynolds et al)
    • 7.8% of 89 (Cattleman et al),
Evidence of ICH in anticoagulated patients

- Annals of EM 2012: 59 Nishijima DK et al.. Immediate and delayed traumatic ICH in patients with head trauma and preinjury warfarin or clopidogrel use.
  - Prospective, observational study (2 trauma, 4 community hospitals)
  - 1064 patients (1000 had CT)
  - Mechanism – ground floor fall (83%), blow (5.6%), MVA (4.8%)
  - >60% had GCS 15
  - 70/1000 had immediate ICH – 12% clopidogrel, 5.1% warfarin

  - July 2006-June 2008,
  - 176 patients – mean age 79, 157 had CT, 28 had ICH
  - Minimal HI – 62, minor HI - 114
  - 21 % of minor HI, 4.8% of minimal HI had ICH (28 total)
  - LOC, headache, confusion higher in those with ICH compared to those without.
How do warfarin and NOACs compare

- JAMA Jan 2018: Inohara, T et al. Association of intracerebral haemorrhage among patients taking non vitamin K antagonists vs vitamin K antagonist oral anticoaualnts with in hospital mortality
  - Retrospective study of 141,311 patient Oct 2012-Dec 2016
  - 16,036 on warfarin, 4918 on NOACs
  - Prior use of warfarin or NOACS associated with higher in hospital mortality compared with no OACs
  - In hospital mortality 32.6% warfarin, 26.5% NOACs
- The American Surgeon. 2015. Pozzessere A. Dabigatran use does not increase intracranial haemorrhage in traumatic geriatric falls when compared with warfarin.
  - Retrospective single centre study – Dec 2010 to Mar 2014
  - 247 patients- 176 after matching for prehospital risk factors
  - Included those with INR 2-3 so total of 176 patients (128 warfarin, 48 dabigitran)
  - Incidence of ICH = (31) 12.5%, mortality rate (7) 16.1%
  - No difference in rate of ICH, LOS, ICU LOS, mortality between 2 groups but small numbers
The CT is abnormal in the anticoagulated patient – what is the next step?

- Eastern Association for the Surgery of Trauma
  - All elderly patients taking warfarin with post traumatic ICH need to have INR corrected towards normal range (<1.6) within 2 hours of admission

- EmDocs 2016, Jan 28
  - Consider reversal before CT if patient’s exam abnormal, patient altered.
CT is abnormal in the anticoagulated patient – what is the next step?

- Victorian State Trauma System: Major Trauma Guidelines and Education
- Needs admission
- Need reversal of anticoagulant:
  - Anticoagulation should only be restarted after discussion with Neurosurgeons.
  - Clopidogrel
  - Aspirin
  - Warfarin
    - PCC (35-50 units/kg IV – will reverse in 15 mins)
    - Add FFP 150-300 ml IV if life threatening bleeding,
      - if no prothrombinex 15 ml/kg IV FFP – need blood type, time to thaw.
    - Vitamin K 5-10 mg IV
- NOAC
  - Dabigatran – specific agent – Idarucizumab- monoclonal antibody fragment which binds free and thrombin-bound dabigatran and neutralises its activity, get complete reversal of the anticoagulant effect immediately and lasts for 24 hour. The complete dose of 5g should be given as two consecutive IV infusions over 5-10 minutes each
  - Apixaban, rivaroxiban – can use PCC
CT is normal. How to proceed?

- Need to address reason for fall, other injuries, risk of further falls and plan for prevention, safe discharge plan

- Options with reference only to the CT – all other factors OK -Questions asked in multiple publications
  - Discharge home with close observation?
  - Admit to observation unit for up to 24 hours?
  - If neurologic exam at end of observation period OK, either repeat CT or just discharge
  - If on warfarin and level was supra therapeutic, admit, withhold or reverse warfarin, repeat INR before discharge
Guidelines for discharge vs admission?

- Italian guidelines 1999 – admit for 24 hrs, repeat CT
- European Federation of Neurological Societies 2012
  - 24 hour clinical observation
- Up to Date 2018
  - Colwell, C et al: Geriatric trauma: initial evaluation and management
  - Suggest 12 hour period of observation for patients with reassessment (including focused neurological exam every 2 hours). If remain clinically stable can be discharged. (referenced Menditto and Nishijima as major sources)
Risk of delayed ICH?

  - 66 year old male, GCS 15, INR 2.5, CT normal, discharged at 8 hours: returned at 48 hours with SDH
  - Admits that rate of DICH is very low but::
  - Recommendation: hospitalize all with negative CT for 24 hours then repeat CT but if >65 and INR >2.5 keep 48 hrs
Admission or discharge?

  - Reviewed 18 papers from 1999 to 2012
  - Very few of the DICH occurred within 24 hours
  - Reasonable to discharge patients with INR <3 and normal CT as long as robust and clear instructions – perhaps even telephone followup.
Admission or discharge?

  • 4 observational studies – Kaen, Peck, Menditto, Nishijima
    • Kaen: prospective, 2/137 DICH, warfarin + antiplaelett, LOC= no rx
    • Peck: retrospective, 6 hrs obs, 4/289 on warfarin +, no intervention
    • Menditto: prospective, 5/87 DICH, 1 needed intervention
    • Nishijima: 4 warfarin patients had DICH – 2 intervention, 2 died
  • Incidence of death or intervention 0.10 - 1.1%
  • Not support mandatory admission for all anticoagulated patients after minor head injury – need further studies to identify higher risk patients- may be warranted in supratherapeuticc INR, antiplatelet rx
  • Comments: No comparison or control group, selection bias, no discussion of cost implications of admission and repeat CT etc.
Admission or discharge?

  - 294 articles: 5 cohort studies selected for review – 1,257 patients on preinjury warfarin +/- antiplatelets
  - Kaen (135), Menditto (97), Nishijima (687), Peck 314), Reynolds (24) during period 2003-2012
  - Total of 17 DIH (2, 7, 4, 4, 0) – only 1 intervention, 1 mannitol, 1 FFP – Menditto’s patients were older
  - INR not seem to be associated with DICH – other factors not helpful in assessing risk of DICH.
  - Advise care with elderly patients – other medical problems, social situation – currently observe patients on warfarin – not state for how long.
Admission or discharge? Repeat CT?

• Is a repeat CT necessary after admission to detect delayed ICH?
  • Systematic review and meta analysis
  • 7 publications – 1594 patients rescanned after normal 1st CT within 24 hours – observational studies – no cohort control
    • Kaen, 2010 – prospective, single – 2/137 (both antiplatelets) – D/C
    • Peck 2011 – retrospective, single – (CT at 6 hrs) 4/289 – D/C
    • Menditto 2012 – prospective, single -5/87 (80% high vel) – 4 D/C, 1 NS
    • Nishijima 2012 – prospective, multiple - 1/687 within 24 hrs - D/C -
    • Taylor 2012 – retrospective, multiple – 1/58 - ? Outcome
    • Schonman 2014 – retrospective, single -1/211 – 1 NS, died
    • McCammack 2015 – retrospective – single – CT 6 hrs – 0/125
Chauny et al. results

- Pooled results for ICH on 2\textsuperscript{nd} CT 24 hrs later was 0.6\% (primary outcome); need for neurosurgical intervention or death (secondary outcome) 0.13\%
- Conclusion – 2\textsuperscript{nd} CT scan not necessary – can justify discharging patients if first CT negative
- However special care- keep for supplemental period-
  - i.e. physician judgment
  - Serious mechanism of injury
  - Signs of neuro deterioration
  - Excessive anticoagulation – supratherapeutic INR
  - Antiplatelet co-medication
  - Patients living alone, unable to return to ED, unable to understand discharge instructions
Incidence of delayed ICH?

  • 1st Jan 2005 – 31st Dec 2014, retrospective study
  • Department protocol – all have CT, admission for observation regardless of clinical presentation
  • 91.6% had fall
  • All patients on warfarin – initial CT negative for all.
  • 298 patients, 295 admitted, 3 AMA
  • Decision for repeat CT, length of stay at discretion of physician (NS)
    • 1/11 with repeat CT had abnormal CT (therapeutic INR) (done day 2-4)
  • 293 no neurological deterioration
  • Clinical monitoring before repeat CT – 1 decr. LOC, 1 vomiting
  • No predictive factors for delayed ICH
  • Median LOS 3 days, 3 deaths (nosocomial pneumonia)
Role of delayed CT when on anticoagulants

• European J of Trauma and Emergency Surgery: Scantling et al. Dec 2017, Vol 43, 741-748
  • Hypothesis: repeat CT at 12 hours would **not** identify significant new hemorrhages or change management
  • Retrospective 2010-2012 >=65 years
  • 234 patients – 2 had DICH (0.88%) 1 on ASA, 1 ASA+clopidogrel (0.85%) – no change in management
  • 2 patients on NOAC – no bleed
  • None of warfarin patients had DICH
  • Could not predict who would suffer DICH
Cost of admission and repeat CT

  - 2 studies – Kaen and Menditto – only 2 patient needed evacuation of SDH after performing 2nd scans on 224 anticoagulated patients, all admitted at least 24 hours
  - For U.S. patients cost would be $1 million to save 1 patient cf to Spain 157,696 and Canada $105,380
    - Costs for other interventions:- pneumococcal vaccine, isoniazid, mammograms etc – highest $298,000
  - Still need to initially scan all anticoagulated patient as 1/6 at risk for ICH
  - If negative CT, discharge but all get telephone call next day
Guidelines for discharge

• ITIM guidelines: Discharge of patients with mild head injury
  • Recent literature emphasizes that patients can be safely discharged for home observation if structured clinical assessment reveals no clinical risk factors indicating the need for CT scanning or following a normal CT scan if indicated.
  • Deterioration of mild head injury patients following a normal CT scan is rare. Caution is advised for patients with known coagulopathy and elderly patients where the risk of delayed subdural is increased.
Discharge using Westmead PTA Scale – total score should be 18

- Orientation questions: 5 on the verbal part of GCS
  - 1. What is your name? Must provide full name
  - 2. What is the name of this place? Specific hospital
  - 3. Why are you here? Why there were brought to hospital
  - 4. What month are we in? Specific month required
  - 5. What year are we in? Specific year

- Picture recognition
  - Show 3 cards for 5 seconds, ensure can repeat names of each card - retest in one hour – for each correct answer add 1 to GCS
What about warfarin?

  - Survey of N.Am.surgeons –74% would reverse INR even if normal CT
  - In his study, 57 (19.3%) had warfarin stopped
    - 16 of 94 patients who were sub therapeutic
    - 28 of 158 patients who were therapeutic (4 had FFP, VitK)
    - 13 of 43 patients who were supratherapeutic (3 had FFP, Vit K)

  Concluded that patients with therapeutic anticoagulation do not require aggressive reversal with blood products or Vitamin K
CT for all patients over 65 with a head injury?

- **UK** - NICE guidance followed although it lowers scan threshold rather than mandates scan everyone. =There is considerable room for interpretation and as always seniority helps! Not all oldies with any injury get scanned.
- **U.S.** - Try to follow the Canadian head CT rule combined with gestault.
- **Australia** - Yes

If on ASA, antiplatelets

- **UK**. If on ASA or clopidogrel, CT negative – UK - Just discharge if home circumstances adequate in terms of someone to observe, normally copes well etc and can return if needed
- **U.S.** - Discharge. Of course, by this point they have already been in my ED for 2+ hours and longer since the incident
- **Australia** - Observe, if passes PTA testing, D/C
Summary of responses UK, US, Australia

If on warfarin, INR therapeutic, CT negative,
  U.K. Home and advice to watch for signs
  • U.S. - I have a shared decision making conversation with the patient. I have kept patients overnight and I have sent others home -- assuming the injury occurred the same day the patient arrives in the ED.
  • Australia – If passes PTA testing and no other factors of concern, D/C

If on warfarin, INR > 3, CT negative,
  • UK- admit overnight, omit a dose of warfarin then retest INR
  • U.S. - Would not reverse without bleeding. Observe overnight
  • Australia – admit
Summary of responses UK, US, Australia

- If on NOAC, CT negative,
  - UK  Discharge
  - U.S. No EBM here, shared decision usually resulting in overnight observation. However, some of us discharge.
  - Australia – admit to ward or EMU and observe, continue NOAC

- If the incident occurred yesterday with GCS 15/15 and they are on a. Aspirin  b. Clopidogrel  c. Warfarin  d. NOAC and GCS is 15/15
  - UK - No assuming as well as GCS15 everything else is intact e.g. no clinical features of skull fracture or other new or subtle neurology etc
  - U.S. .Why did they come to the ED? Worsening headache -- scan
Summary

1. Generally most scan all patients >65 years.
2. Scan all patients >65 years on anticoagulants.
3. If positive ICH, rapid reversal of agent.
4. If CT negative, INR therapeutic and all other factors OK, D/C home after at least 4 hours observation and after Westmead PTA test passed. Need to be observed by a responsible adult. Continue warfarin.
5. If CT negative, INR supra therapeutic, bring INR down to normal level, admit for observation.
6. Rescan only if change in neurological status.
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Repeat CT for delayed ICH

- Kaen et al 2010. The Journal of Trauma. The Value of sequential CT scanning in anticoagulated patients suffering from minor head injury.
  - GCS 14-15, all on warfarin (3 also on ASA) – total of 137 patients admitted to unit – all had negative CT, mean INR = 3.8
  - All hospitalized 24 hrs, neuro obs q 4-6 hrs repeat CT at 20-24 hrs
  - 2/137 (0.5%) had new ICH (both on warfarin + ASA), no clinical consequences
  - Limitations – observational, non randomized, no control group.
  - Not need admission but if warfarin + antiplatelet and LOC consider period of observation up to 24 hours
Repeat CT for delayed ICH

  - Inclusion anticoagulants = warfarin (not if <1.3), clopidogrel, heparin, enoxaparin, dipyridamole) – not ASA alone
  - 500 patients, 424 negative scan, 62 refused 2nd scan = 289 patients
  - Scan done at 6 hours
  - 4/289 (1.4%) had delayed ICH (all were on warfarin)
  - All 4 discharged home
Need for repeat CT

  - July 2010 to Feb. 2012, on ACAPT, repeat CT within 48 hrs
  - 159 patients, only 1 had delayed ICH (2%)
  - Not need repeat CT, rather period of observation
Risk of delayed ICH

  • Prospective case series Jan 2007 – Mar 2010
  • If normal CT, admit for 24 hours and repeat CT
  • 97/116 patients had a negative CT - 10 refused 2nd scan
  • 5/87 (6%) developed ICH at 24 hours (2 had INR >3) – 1/5 needed neurosurgery
  • 2 admitted day 2 and day 8 with delayed ICH on 3rd CT (both INR >3) – not need surgery
  • Conclusion that should have 24 hour obs and repeat CT( but based on 6% and should be only 1%.as only one had surgery)
Risk of delayed ICH

  - Prospective, observational study – 2 trauma centres, 4 community hospitals – Apr 2009 to Jan 2011 – 1064 patients (1000 had CT)
  - 83% ground level fall, 87% had GCS 15
  - Initial ICH: 70/1000 - Warfarin 37/724 (5.1%), clopidogrel 33/276 (12%)
  - Of those with normal CT
    - Hospitalized, repeat CT at discretion of physician
      4/687 (0.6%) on warfarin – 2/4 inoperable, died; 2 no intervention
      0/243 on clopidogrel
Risk of delayed ICH

  - Retrospective, single centre study Jan 2007- Oct 2011
  - 365 patients had abnormal CT
  - 211 patients normal CT, INR not corrected if in therapeutic range, if supratherapeutic corrected to within normal range
  - Per protocol all admitted and CT at 24 hours
  - 1/211 SDH after 15 hrs (patient died – 1st CT probably showed SDH), 4/211 symptomatic 2-28 days (1 needed evacuation)
  - Study does not support recommendation of 24 hours observation