TRIAGE CT IN THE CIRCULATORY UNSTABLE PATIENT

Bertil Leidner, MD

Triage CT

- Challenging today´s routine in blunt trauma!
- Why?
- How to do it?

Triage CT – Why?

- **GOAL: Immediately find life threatening injuries**
  - – Airways
  - – Breathing
    - pneumothorax, hemothorax, hemopericard
- Main focus:
  - » Circulation – identify fluid = source of bleeding
  - » Thorax, abdomen, retroperitoneum
- D – includes head examination

Radiology in multitrauma

- Cirkulatory UNSTABLE patient
  - » ATLS First survey –ABC –ER radiology
    - – Chest
    - – Pelvis
    - – FAST
- Quality/accuracy
  - » Chest & Pelvic X-ray
    - – Highly varying image quality; less accurate cf CT
  - » FAST
    - – Varies highly with examiner experience
    - – Less accurate cf CT – 70% sensitivity for fluid

Radiology in multitrauma

- Cirkulatory UNSTABLE patient
  - » ATLS First survey –ABC –ER radiology
    - – Chest
    - – Pelvis
    - – FAST
- Time factor: How long time does the patient spend in the Emergency Room?
  - » M = 36 min (range 18 - 61 min) (Karolinska Solna 2005)
  - » + transportation to & loading time in CT suite
    - – highly variable time

Triage CT

- Why?
- cf traditional work-up
  - » Primary CT → Saves time
    - – Quicker investigation
    - – Patient directly to CT table – one less patient transfer
  - » Primary CT → More accurate than chest/pelvis/FAST
  - » Primary CT → More coverage ABCD
- How to do it?

Triage CT

- **Critical Issue**
- Emergency Room equipped with MDCT
- or CT suite with ER equipment

Triage CT

- Non-contrast scan
- Thighs to head
- Total time from amulance trolley to scan completition & patient ready for clinical work-up = 90 sec

New Scenario

- Airways secured
- Patient transferred directly to the scanning table from the prehospital care
  - » - same procedure as transfer to examination table
- Immediate scanning – no clinical measures
  - » Load and scan
  - » No patient preparation before scanning
  - » Still with clothes on, no change of patient position
  - » No new iv lines

Triage CT

- Non-contrast CT survey
  - » Immediately identifiy life threatening injuries
    - –**A**irways
    - –**B**reathing - chest status
- Main goal: **C** – identify source of bleeding
  - » Thorax, abdomen or in retroperitoneum
- Substitutes – chest, pelvic x-rays + FAST
  - » quicker & more accurate information

Clinical work-up

- Out of the gantry
  - » Full body access as scanned feet first
- Full clinical resuscitation & work-up on the CT table
  - » More iv lines if necessary – fluids etc
  - » E - Undress patient
- Or ... if the more conveniant – back to the trauma room

Clinical work-up

- Knowledge of bleeding compartment from the primary scan
  - » ATLS - prioritize measures according to ABCDE
  - » Better possibility to parallell address all critical injuries
  - » Possible to plan definitive measures

Clinical work-up

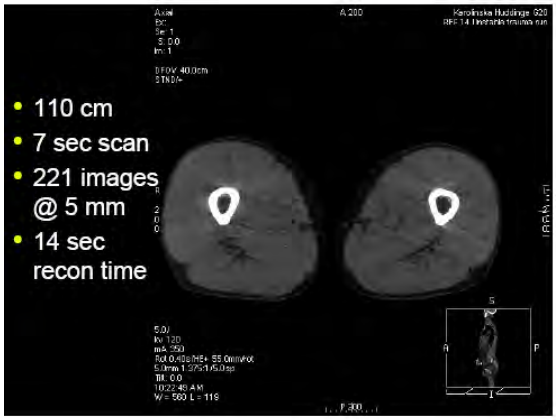
- Circulatory stabilized or not
- Still bleeding – unstable
  - » Operating Room or Angio-embolization
  - » (→ recon sub-mm images for spine evaluation
    - – limited quality due to artifacts)

Clinical work-up

- Stabilized
  - » Standard Whole Body Trauma CT incl iv contrast
  - » Why?
    - – Non-contrast exam does NOT exclude serious organ injuries
    - – I.V. Contrast Information
      - Aorta/ angiographic evaluation
      - ongoing bleed/pseudoaneurysm
    - – Some artifacts in primary scan may obscure information
    - – Full spine evaluation + extremities

Triage CT - scan details

- Load and scan directly
- Feet first
  - » X-long table allows 190 cm helical scan
- Scan parameters
  - » 4 cm coverage per rotation
  - » 0.4 s rotation time
  - » Pitch 1.4 → 14 cm/s (140 cm → 10 sec)
  - » 200 mA → Effective mAs 100
  - » 5 mSv + (~ 14 mSv)



- 110 cm
- 7 sec scan
- 221 images @ 5 mm
- 14 sec recon time

Triage CT - survey - result

- Substitutes – chest + pelvic x-rays + ultrasound
- Geared to answer the same questions + head status
- Airways
  - » Injury? Airway threat?
  - » Correctly intubated?
- Breathing
  - » Pneumothorax, hemothorax, hemopercarium, diaphragm
- Circulation – source of bleeding to stop
  - » Thorax, abdomen, retroperitoneum (pelvic fx)
- Disability – BRAIN STATUS
  - » Unique information cf standard evaluation
  - » Intracranial hematoma to evacuate
  - » Immense value in the intubated/unconscious patient

Discussion

- CT suite & ER combined
- Only critically injured, i.e. circulatory unstable patients
  - » Don´t tie up the scanner
  - » Don´t waste radiation
    - – Additional radiation (+ 1/3)
- Limited amount of patients
  - » Karolinska trauma center
    - – 1 - 2 patients/week

Discussion

- Only critically injured & circulatory unstable patients
- Secure the total trauma work-up
  - » Equipment localization (ER/CT)
  - » Logistics
    - – Two pathways – unstable / stable
  - » Too few / too many critical patients - problem

Discussion

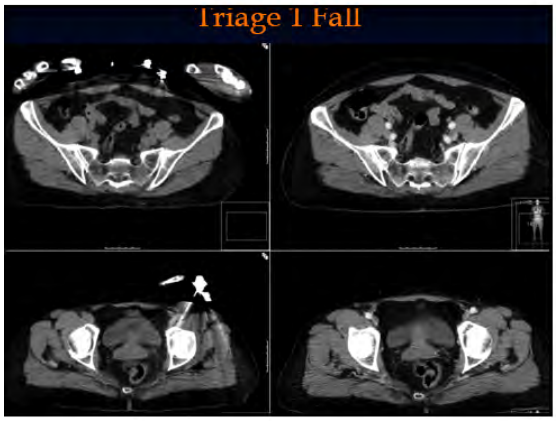
- Only critically injured & circulatory unstable patients
- Secure the total trauma work-up
- Part of the future
  - » Challenges the traditional ATLS routine
  - » Needs to be implemented with the whole trauma team

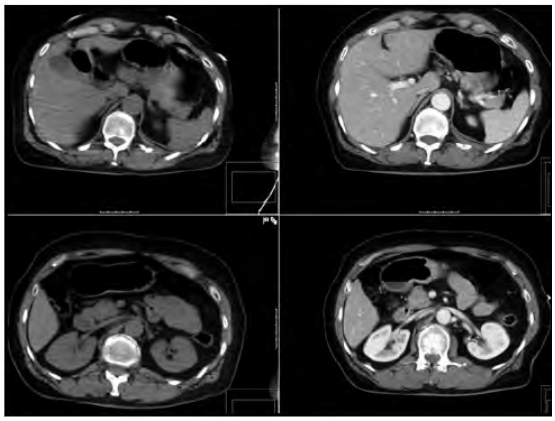
Pilot @ Karolinska

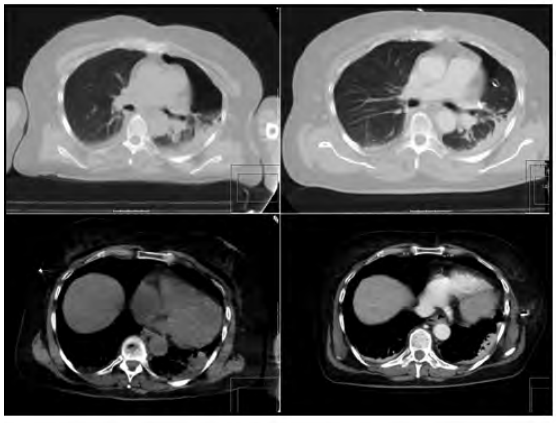
- Trauma Center in Karolinska Solna
- Start November 2007
- Outline
  - » Identifying logistic problems
  - » Secure routines
  - » Define criteria for patient selection
- Goal
  - » Detect bleeding source & treat critical injuries faster

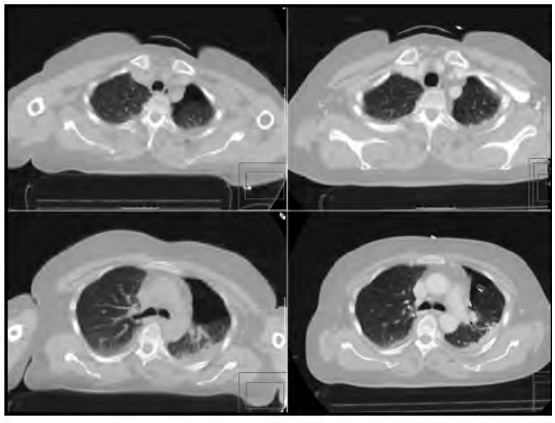
Pilot @ Karolinska

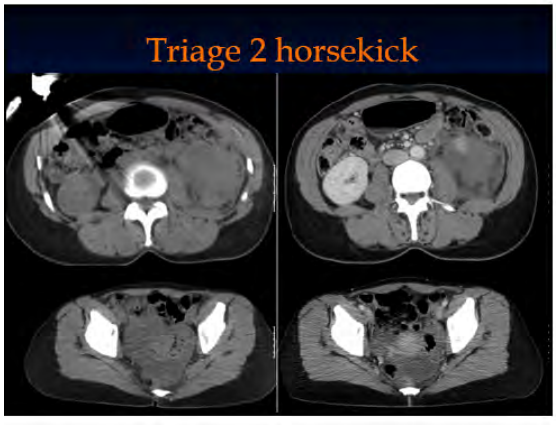
- Inclusion criterias
  - » Single patient arrival
  - » Blunt trauma
  - » Secured airway
  - » Systolic BP < 90 mm Hg and/or HR >120
  - » At the discretion of the trauma leader
- Back to the trauma room

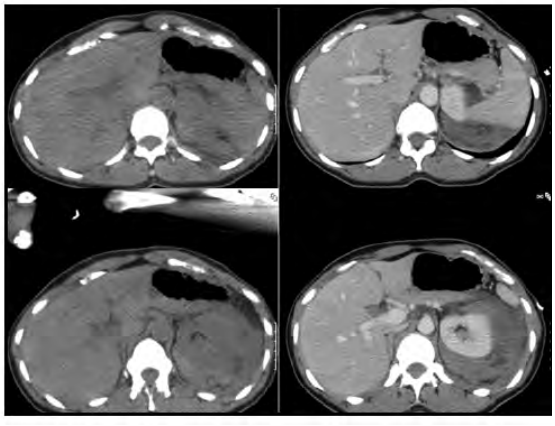

Triage 1 Fall



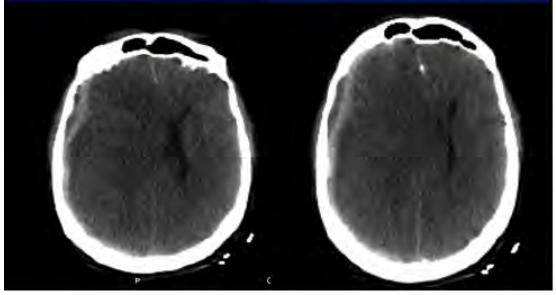




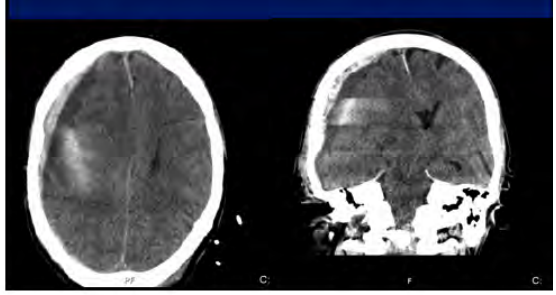

Triage 2 horsekick



Triage 2,5
GCS 4



Hyperacute sdh



Solna pilot timing

- Standard:
  - » ambulance trolley → trauma trolley = 2 min
- Triage CT:
  - » ambulance trolley → triage CT → trauma trolley = 4.5 min

Summary

- 64 channel MDCT
  - » offers new possibilities
- Work in progress
  - » Emergency room CT resource
  - » ***Triage CT*** - Non-contrast scan as primary survey

Summary

- 64 channel MDCT
  - » offers new possibilities
- Work in progress
  - » Emergency room CT resource
  - » Non-contrast fast scan as 1st survey
  - » 90 seconds from trolley to diagnosed bleeding source
- ER + CT suite joint resource organization
- ONLY circulatory unstable patients
  - » Injured by blunt trauma
- Clinical resus & work-up on CT-table
  - » Still unstable → OR / angio-embolization
  - » Stabilized → Rescan with i.v. contrast