FROM HEAD TO TOE CT:

CLINICAL IMPROVEMENT OR RADIATION RISK?

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Basics of initial trauma care

- **Is life saving (damage control) surgery necessary?**
  = *time sensitive*
  - Clinical evaluation
    - level of shock
    - Signs of injuries
  - Imaging (limited)
- **Total sum of injuries**
  - Clinical evaluation
  - imaging

Pan scan: different concepts

- **Location**
  - Outside ED
  - Inside ED
  - Inside resuscitation room
- **Protocol driven**
  - Liberal
  - selective

Pan Scan: pro 's

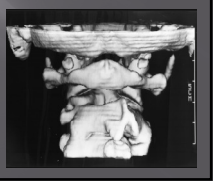
- Less transport = less risks & time lost
- Better resolution
- Faster switch from diagnosis to therapy
  - Improved efficiency of care
- Better outcome
- Absence of occult injuries = less admissions

Pan Scan: Con 's

- Too much info or meaningless findings
  => wrong therapeutic decisions
- Radiation risks
- Cost
- All lesions?
  - Hollow viscous injuries or diffuse axonal injury?

Pan Scan: Con 's

Victims
Of
Modern
Imaging
Technology



Pro: less transport – risk - time

- (small) Prospective controlled study (n= 87 vs 81)
- **Hypothesis:** *trauma management can safely be optimized by the implementation of the all-in-one concept*
- **Inclusion:** ISS > 16 & primary admission
- **Outcome parameters:**
  - Time interval: arrival - first CT
  - Number of in-hospital transfers
  - Staff satisfaction
- **Results:**
  - Time interval arrival - first CT: average of 13 min earlier ($p < 0.001$)
  - Transfers: 2 vs 4 ($p< 0.001$)
  - Increase in satisfaction ($p = 0.009$)
  - No difference in 30 day mortality

Gross T et al. Impact of a multifunctional image-guided therapy suite on emergency multiple trauma care. British Journal of Surgery 97 : 118-127, 2010

Pro: better outcome

- Retrospective German Trauma Society registry
- **Inclusion criteria:**
  - Blunt trauma - ISS > 16
  - Primary admissions
  - Available info on pan-CT in resus-room
- **Study population:**
  - 9259 patients - 4621 met inclusion criteria
  - 1494 (32 %) whole-body CT during early resuscitation phase

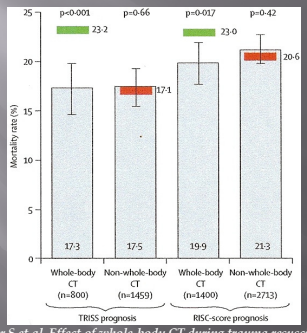
Huber-Wagner S et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet 373: 1455-61, 2009

Pro: better outcome

- **Whole-body CT group**
  - Significantly higher ISS
  - Recorded mortality << predicted TRISS mortality ($p<0.001$)
  - *TRISS:*
    - Relative risk reduction of 25 %
    - Number needed to scan = 17
  - *RISC (revised injury-severity classification)*
    - Relative risk reduction of 13 %
    - Number needed to scan = 32
- **Non-whole-body CT group**
  - Recorded mortality > predicted TRISS mortality ($p<0.66$)

Huber-Wagner S et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet 373: 1455-61, 2009

Pro: better outcome



Huber-Wagner S et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet 373: 1455-61, 2009

Pro: better outcome

- **Discussion:**
  - Increased probability of *survival*
  - Pan CT without effective structured & targeted resuscitative treatment will not increase survival rate
  - Prospective studies needed

Huber-Wagner S et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. Lancet 373: 1455-61, 2009

Pro: better outcome

- **Bias in discussion**
  - *Retrospective* study
  - Too much *missing data* for TRISS & RISC calculations
  - *No clear definition* for indications of whole-body CT
  - *Differences* in care & in grading ISS between centers
- **Remarks in letters to the editor**
  - REACT 2 study (1078 patients - Prospective)
  - Patients who died before CT were assigned to no CT group
  - Trauma care better in facilities with whole-body CT scan

Radiation risk

- Effects of radiation:
  - Stochastic risks of chance mutations
  - Deterministic risks (radiation syndrome)
- Degree of radiation:
  - Background radiation = 1 – 3 mSv
  - Occupational radiation exposure: 20 mSv/year
  - Exposure to 100 mSv = lifetime cancer risk of 1/100
  - Organ-specific CT = 5 mSv
  - Whole-body CT = 20 mSv
    - Cance r risk between 1/80-1250
  - Trauma team < 0.2 mSv/year

Hui C et al. Radiation dose from initial trauma assessment and resuscitation: review of the literature. Can J Surg 52(2): 147-152, 2009

Cost = ?

- Increased cost = CT
- Decreased cost
  - Better outcome
  - Lower invalidity
  - Less admissions
- Balance = ??

Clinical question

What is the mortality reduction through injury identification & (early) treatment?

versus

induced radiation mortality

How to reduce radiation?

- Optimisation
  - Image quality vs lowest possible dose
    - ALARA = "as low as reasonably achievable"
    - Practical aspects
      - Reference values
      - Benchmarking of delivered doses + control
  - Teaching doctors & X-ray technicians
- (Justification)

How to reduce radiation?

- (Optimisation)
- Justification
  - Indicated exam: symptomatic vs asymptomatic patient
  - Maximizing Benefit-to Risk Ratio
    - Using protocols
      - Canadian CT head or C-spine rules = reduction of 37 – 67 %
      - Individual choose

symptomatic vs asymptomatic patient

- Prospective Observational study
  - 1000 trauma patients
  - Significant mechanism
  - No visible evidence of chest or abdom injury
  - Hemodynamically stable
  - Normal abdom exam or unevaluable due to unconscious

Arch Surg 2006;141:468-475

symptomatic vs asymptomatic patient

- **Changes in therapy:**
  - 3.5 % of head
  - 5.1 % C spine
  - 19.6 % chest but 50 % false positive rate for aortic injury
  - 7.1 % abdomen

Arch Surg 2006;141:468-475

Selective indication?

- **Prospective, observational study:**
  - Level 1 trauma center - during 6 months in 2007
  - Liberal CT use
  - EP vs TS
- **Patient population:**
  - 443 patients
  - 284 underwent pan-CT = 1136 CTs
  - Median ISS = 13

Tillou A et al. Is the use of Pan-computed tomography for blunt trauma justified? A prospective evaluation. J Trauma 67(4): 779-787, 2009

Selective indication?

- **Results:**

TABLE 1. Proportion of Unsupported CT Scans in 284 Patients With Blunt Trauma

	Percentage of Unsupported Scans (No. Unsupported/Total Scans)*	
	Emergency Medicine	Trauma Surgery
Head	23% (62/274)	1% (3/257)
Neck	18% (50/276)	0% (1/257)
Chest	42% (116/276)	3% (8/257)
Abdomen/pelvis	30% (83/276)	1% (3/257)
All scans	28% (311/1102)	1% (15/1028)

* Denominator varies because forms were not completed for all 284 scans of each body part.

Selective indication?

- **Results: abnormal CT scans**
  - by indication
  - Unsupported

	Supported, N (%)				
	Signs of Injury		Risk of Injury		
	EM	TS	EM	TS	Unsupported, N (%) EM
Head	48/147 (33)	49/135 (36)	5/65 (8)	7/119 (6)	5/62 (8)
Neck	12/70 (17)	12/72 (17)	9/156 (6)	5/184 (3)	2/50 (4)
Chest	43/67 (64)	36/59 (61)	33/93 (35)	63/190 (33)	33/116 (28)
Abdomen/pelvis	35/76 (46)	35/67 (52)	36/117 (31)	44/187 (24)	12/83 (14)
Total	138/360 (38)	132/333 (40)	83/431 (19)	119/680 (18)	52/311 (17)

Tillou A et al. Is the use of Pan-computed tomography for blunt trauma justified? A prospective evaluation. J Trauma 67(4): 779-787, 2009

Selective indication?

- **Results:**
  - **2/52 (unsupported 17 %) required immediate intervention**
    - Paralysis after surfing accident: T8 # + C-spine # => T8 stabilisation
    - Subarachnoid hemorrhage: platelets for chronic aspirine use (?)
  - 31 chest injuries
    - 11/31 seen on normal chest X-ray
- **Discussion:**
  - Limited missed
  - Missed or delayed diagnosis in literature: 1.3 % to 39 %

Tillou A et al. Is the use of Pan-computed tomography for blunt trauma justified? A prospective evaluation. J Trauma 67(4): 779-787, 2009

Conclusions

- CT scans help to detect (life treatening) injuries
  - Sensitivity - specificity
- Time benefit
  - Location of CT
  - Time between imaging & results
- CT scan outside the ED:
  - Patient = haemodynamic stable
  - CT scan can not be used in initial assessment
- Radiation risk is underestimated by clinicians

=> Selective use

- Selective use needs further to be defined

The European Society for Emergency Medicine (EuSEM)
and The American Academy of Emergency Medicine (AAEM),
along with the Hellenic Society for Emergency Medicine (HeSEM)

have the pleasure to announce

The Sixth Mediterranean Emergency Medicine Congress (MEMC VI)