The Radiation Footprint on the Pediatric Trauma Patient

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BACKGROUND

- Overuse of radiation in patients has recently become an important topic of discussion within the medical community.
- Pediatric patients are most at risk. A recent study has proven the incidence of 1 brain tumor for every 10,000 head computed tomography (CT) scans among patients under the age of 10 in the ten years following a single scan.
- Although there have been attempts to limit radiation dosage, there is no published data on the quantity of imaging done on the pediatric trauma patient.
- The high index of suspicion in trauma has created a paradigm of comprehensive imaging independent of symptoms.
- Our goal was to identify the current amount of radiation used in a pediatric trauma patient for one visit and correlate the levels of imaging with trauma activation status in order to identify the subset of pediatric trauma patients most at risk for over-radiation.

METHODS

- Our study is an IRB-approved retrospective review of pediatric trauma patients at an ACS verified Level I independent children's hospital.
- We reviewed three levels of trauma activation - Stats, Alerts, and Consults – in a total of 1050 patients in a 7 month period from June 2010 to January 2011.
- Our study included the total number of Stats with representative cohorts from Alerts and Consults. 215 patients met inclusion criteria with complete dosimetry data available.
- Charts were analyzed for demographics, injury severity score (ISS), mechanism of injury, imaging modalities, and radiation dosages.

DATA POINTS ANALYZED:

Demographics:
- Age
- Gender

Injury Severity Score

Mechanism of Injury

Imaging and radiation:
- CTs per patient
- X-rays per patient
- Total radiation dose

DEMOGRAPHICS	Consults	Alerts	Stats
Age	median: 5.5 y [<1,16]		
Gender	143 M, 72 F		
ISS SCORE	7.7 [1, 16]	8.8 [1, 17]	17 [3, 31]
MECHANISM OF INJURY			
Fall	37	11	9
MVC	9	43	19
MVC-pedestrian	1	27	7
Sports injury	5	0	3
Struck with object	8	6	6
NAT	9	2	12
Animal bite	4	3	1
GSW	2	0	3
Bike accident	0	9	2
Other	5	9	1

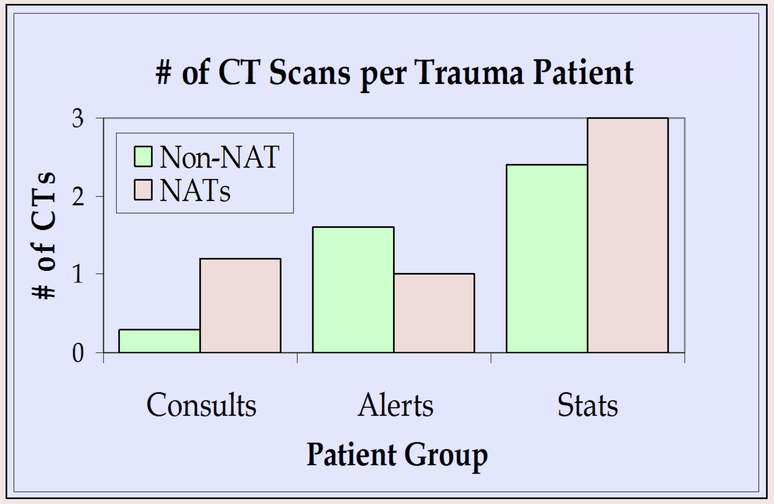
RESULTS

RADIATION EXPOSURE PER TRAUMA PATIENT

Activation Status	N (#)	CT/pt*	CT Dose*†	X-rays/pt*	X-ray Dose*†	Total dose*†
Non-NAT						
Consults	61	0.3	0.79 ± 2.2	5.5	0.27 ± 0.5	1.06 ± 2.4
Alerts	83	1.6	5.34 ± 6.6	8.4	0.83 ± 0.6	6.07 ± 6.6
Stats	48	2.4	8.00 ± 8.4	13.7	0.91 ± 0.8	8.89 ± 8.8
NAT						
Consults	9	1.2	2.83 ± 1.8	28.0	2.03 ± 0.2	4.86 ± 1.7
Alerts	2	1.0	3.28 ± 1.5	27.5	2.4 ± 0.0	5.68 ± 0.6
Stats	12	3.0	9.19 ± 5.0	38.7	2.55 ± 1.8	11.74 ± 6.5

*All values are averages.
† All radiation doses include ± SD and are calculated in milliSieverts (mSv).

- Among Stats, the number of CTs ranged from 0-10 per admission:
  - 2-3 CTs performed in 35%
  - 4-10 CTs performed in 40%
- The studies most often repeated were head CTs (45%), face/sinus CTs (13.8%) and neck CTs (10%).
- The majority (66%) of outside CTs delivered more radiation, of which 50.0% of the doses were at least 2x the dosage delivered at the children's hospital.



CONCLUSION

- This study is *the first* to correlate the amount of radiation exposure with trauma activation status.
- Most of the repetitive imaging was utilized in Stat activations and NATs (non-accidental trauma) using 2-3 times as many CT scans.
- The identified factors associated with the most radiation include suspected NATs, Stat activations, and outside imaging.
- To minimize the radiation footprint, we may need to change the current practice of imaging to identify all possible injuries regardless of symptoms.

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