CT Related Radiation Exposure in Pediatric Trauma Patients

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Disclosures

- Adam Brinkman, Ankush Gosain, Charles Leys – None

- Kara G. Gill – Lead pediatric investigator for CT protocols supplied to General Electric
Increasing use of CT scans in US (4-7 million)

CT imaging assists with early traumatic injury identification
- Most sensitive and specific

Protocols exist to limit radiation exposure
- ALARA

Few studies have evaluated the adherence to limited radiation exposure in pediatric trauma patients
Purpose

Evaluate referring facilities (RF) compliance with American College of Radiology guidelines to minimize radiation exposure in pediatric trauma patients
Materials/Methods

- Retrospective review of all blunt pediatric trauma patient admissions at a Level 1 Pediatric Trauma Center (PTC)

- January 1, 2010 – December 31, 2011

- Demographics, means of arrival, injury severity score and disposition were analyzed.
CT images (including doses) for patients transferred from a RF and at the PTC were reviewed.

Ionizing radiation doses for CT scans at RF and PTC were compared:
- Head
- Chest
- Abdomen/Pelvis

Dose Length Product (DLP) = radiation dose of a single slice x number of slices for a given study.
N=697 Patients (mean age 10.5 years)

321 (46%) Patients presented to PTC
- 87 (27%) underwent CT imaging
  - 84/87 (97%) pediatric dosing at PTC

376 (54%) Patients presented to RF
- 90 (24%) underwent CT imaging
  - 11/90 excluded
  - 79/90 data available for analysis
    - 61/79 (77%) standard dosing at RF
    - 18/79 (23%) pediatric dosing at RF

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79/90 data available for analysis
61/79 (77%) standard dosing at RF
84/87 (97%) pediatric dosing at PTC
## Patient Demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>PTC N(%)</th>
<th>RF N(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, year, +/- SD</td>
<td>10.5±1.2</td>
<td>10.9±1.4</td>
<td>0.32</td>
</tr>
<tr>
<td>Sex % male</td>
<td>64%</td>
<td>64%</td>
<td></td>
</tr>
</tbody>
</table>

### Means of Arrival

<table>
<thead>
<tr>
<th>Means of Arrival</th>
<th>PTC N(%)</th>
<th>RF N(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance</td>
<td>188 (59)</td>
<td>264 (70)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Private Vehicle</td>
<td>94 (29)</td>
<td>33 (9)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Helicopter</td>
<td>39 (12)</td>
<td>79 (21)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

### Disposition

<table>
<thead>
<tr>
<th>Disposition</th>
<th>PTC N(%)</th>
<th>RF N(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor</td>
<td>237 (74)</td>
<td>255 (68)</td>
<td>0.1</td>
</tr>
<tr>
<td>PICU</td>
<td>77 (24)</td>
<td>114 (30)</td>
<td>0.07</td>
</tr>
<tr>
<td>Discharge from ER</td>
<td>7 (2)</td>
<td>7 (2)</td>
<td>0.8</td>
</tr>
<tr>
<td>ISS, mean +/- SD</td>
<td>8±2.1</td>
<td>7.1±2</td>
<td>0.42</td>
</tr>
</tbody>
</table>

P < 0.05 statistically significant
## CT Dosing Results (mGy-cm)

<table>
<thead>
<tr>
<th></th>
<th>RF</th>
<th>PTC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head CT</td>
<td>864±79 (26)</td>
<td>588±78 (28)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Chest CT</td>
<td>1980±287 (23)</td>
<td>768±147 (21)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Abdomen/Pelvis CT</td>
<td>911±189 (51)</td>
<td>260±41 (67)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Need for repeat CT imaging

- After transfer 8 children required additional CT imaging

- 6 required repeat head CT
  - Follow SDH and SAH

- 2 required repeat abdominal/pelvic CT scans
  - Change in abdominal examination
Limitations

- Retrospective analysis
- Does reports incomplete/absent for 12% of children imaged at RF
- CT imaging at the PTC were only those obtained while patients were in the ER
Conclusions

- Increased ionizing radiation doses place children at higher potential risk for malignancy.

- CT imaging is often included in the work-up of children following blunt trauma.

- Easy image transfer between RF and PTC can minimize need for repeat CT imaging.

- CT imaging for children should be performed with weight/age-based protocols to minimize radiation exposure.
Summary

- Radiation dosing information is readily available for children transferred from a RF.

- Pediatric trauma patients transferred from RF undergo CT scanning with higher than recommended ionizing radiation doses.

- Adherence to ACR radiation dose guidelines is better achieved at a PTC compared to a RF.
Future Work

- Community and statewide education program development underway:
  - ALARA principles
  - Avoiding duplicate studies
  - Imaging only when results will change clinical care
  - Easy image transfer between facilities

- Extrapolate data to other areas of clinical care that depend on CT imaging
  - Oncology