The Benefit of Neck CT Compared To Its Harm (Risk of Cancer)
Keiko Hikino, MD,1,2, Loren G. Yamamoto, MD, MPH, MBA, FAAP, FACEP2
1Section of Pediatric Critical Care, Department of Pediatrics, University of Chicago
2Department of Pediatrics, University of Hawaii John A. Burns School of Medicine, Kapiolani Medical Center For Women And Children

Background

The National Emergency X-Radiography Utilization Study (NEXUS) group demonstrated a cervical spine injury (CSI) incidence rate of 1% in the pediatric population less than 18 years of age, compared to 2.5% in the adult population. Despite this low incidence, the serious consequences of a missed CSI has prompted many clinicians to rely on radiographic imaging to exclude serious CSI.

The BEIR (biological effects of ionizing radiation) 7 Phase 2 report committee supports a significant linear, no-threshold dose-response relationship between ionizing radiation dose and development of cancer in humans. "No-threshold" means that even small doses of radiation are harmful. It estimates a lifetime risk of all solid tumors and leukemia and associated death that increase with lower age and exposure to ionizing radiation.

To our knowledge, there are no studies that compare the benefit and harm of neck CT scanning for children with trauma, using the same denominators.

Objectives

The purpose of this study is to compare the benefit of neck CT’s for identifying important CSIs with its harm of radiation exposure and cancer risk.

Methods

A search of the MEDLINE database was performed using PubMed for review. MEDLINE medical subject headings and keywords “neck trauma plain radiography,” “neck trauma CT,” “neck radiation dose CT cancer” “neck CT thyroid cancer risk” “cervical CT trauma exposure cancer risk” “cervical trauma CT decision” or “cervical spine blunt trauma” resulted in 2270 matches. The titles and abstracts of these articles were reviewed. All articles focusing on diagnosing cervical spine injuries, radiation dose of CT scanning, and cancer risk from radiation were included.

Additional references were retrieved from the reference lists of these articles, including periodical surveys and literature reviews of UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation), BEIR 7, ICRP (International Commission on Radiological Protection) and NCRP (National Council on Radiation Protection & Measurements).

The incidence of CSI was estimated from 9 relevant articles 1-8. Three studies further defined their CSIs as clinically important 10-12. Cancer risk was estimated from five articles and one web site (Table 1). For every 100,000 neck CT scans performed, additional cancer cases occur in a low end estimate of a thyroid cancer cases (age 0 to 6 years) to a high end estimate of 100 male and 700 female cancer cases (any kind of cancer, age 3 years).

Results

We used nine published trauma studies to estimate the number of CSIs (Table 1). Out of 100,000 trauma patients, neck CT scans were obtained in 3767 to 26,785 patients. Out of 100,000 patients with trauma in whom a neck CT scan was performed, a CSI was identified in 2470 to 33,898 patients. 3 studies further defined clinically important CSI that ranged from 4,724 to 27,119 per 100,000 CT scans.

Table 1. Out of 100,000 patients with trauma, how many have abnormal C-Spine injury?

<table>
<thead>
<tr>
<th>Article</th>
<th># of patients</th>
<th># of CSI</th>
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<th># of additional cancers</th>
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Cancer risk was estimated from five articles and one web site (Table 2). For every 100,000 neck CT scans performed, additional cancer cases occur in a low end estimate of a thyroid cancer cases (age 0 to 6 years) to a high end estimate of 100 male and 700 female cancer cases (any kind of cancer, age 3 years).

Table 2. Out of 100,000 patients who get a neck CT, how many additional cancers occur?

<table>
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Discussion

CT’s benefit of identifying important CSIs in the published studies (reflective of current trauma center practice) exceeds its cancer risk harm.

Limiting neck CT scanning to a higher risk group would increase the gap between benefit and harm, while performing CT routinely on low risk cases approaches a point where it’s harm equals or exceeds its benefit.

References

9) Hana JA, Blackmore CC, MiNe FA, Wilson AJ. Cervical spine injury a clinical decision rule to identify high risk patients for incidental CT screening. AJR 2011;206:257-262
12) Michele Macnab, Antonia Testaide, John Daniels, Nicholas Geroumpotos. Thyroid dose from head and neck CT examinations in children is there an excess risk for thyroid cancer induction. Euro Radiol (2007) 17:1300-1307