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Patient Safety Tip of the Week

May 13, 2025

CT Scans and Cancer Risk

We've often discussed the risks of radiation, with regard to future development of cancer (see list of prior columns below). And, while any imaging study using ionizing radiation can increase the cancer risk, the major contributor to that risk is CT scanning. The cumulative dose of radiation over a lifetime is critical and children who receive multiple CT scans are most vulnerable.

Rebecca Smith-Bindman, MD has been one of the foremost critics of excessive radiation attributed to CT scanning and has published with her colleagues some of the seminal papers regarding CT scanning and cancer risk. Now, Smith-Bindman and colleagues have again published an important study on the issue (Smith-Bindman 2025).

The researchers used the National Cancer Institute's Radiation Risk Assessment Tool to project future lifetime radiation-induced cancer risk. They concluded that, if current practices persist, CT-associated cancer could eventually account for 5% of all new cancer diagnoses annually.

Note that the estimates are theoretical and are based on cancer risks that were associated with Japanese atomic bomb survivor outcomes.

An estimated 61,510,000 patients underwent 93,000,000 CT examinations in the US in 2023, including 4.2% in children. Using that risk assessment tool, the authors projected approximately 103,000 radiation-induced cancers would result from these examinations (range 80,000 to 127,000). Though children and adolescents are at greatest risk, adults account for most of the radiation-induced cancers, largely because of the greater volume in adults.

They projected that lung cancer, colon cancer, leukemia, and bladder cancer to be the most common radiation-induced cancers (breast cancer would be the second most common cancer in women).

CT scans of the abdomen, pelvis, and chest would be the scans contributing the most to the increased cancer risk.

The authors note that this projected number of radiation-induced cancers is 3 to 4 times higher than an earlier assessment of CT exposure for several reasons: increased CT utilization, better calculation of dose given, and multiphase scanning.

The authors posit that "justification of use and optimization of dose, including consideration of the need for multiphase examinations, are the tenets of CT imaging and must be applied uncompromisingly to mitigate potential harm."

The American College of Radiology (ACR) issued a message in response to publication of the Smith-Bindman study (ACR 2025) noting that the projections are not based on actual patient outcomes and cautioned patients that both the benefits and risks of CT scanning should always be considered. They recommend that patients, before undergoing any imaging study involving radiation, should ask their physician or other medical provider the following questions:

- How will having this exam improve my health care?
- Are there alternatives that do not use radiation which are equally as good (e.g. MRI, ultrasound, etc.)?
- Is this facility ACR Accredited (which ensures high quality standards, including regular surveys of the equipment by medical physicists, certified technologists performing the exams, and interpretation by radiologist physicians who meet stringent education and training standards)?

They also recommend that patients should keep a record of their (or their loved ones') imaging procedures. They also note that the ACR co-founded the Image Gently® and Image Wisely® initiatives to help providers avoid ordering low value imaging and optimize radiation dose used in many scans.

Ensuring that a CT scan is necessary is the first step. Undoubtedly, many CT scans are done as "low value" studies. Use of clinical decision rules, such as the many clinical decision rules for performing head CT scans after minor trauma (see list of columns below) may be helpful. Understanding when alternative imaging studies may provide appropriate diagnosis without ionizing radiation is also important. Many pediatric patients still get CT scans for suspected appendicitis, when ultrasound examinations would likely provide the desired answer. Clinical decision support at the time of order entry is a logical tool to reduce ordering the wrong study but it has yet to demonstrate solid results. And better guidelines for the frequency of "follow up" CT scans would be important.

Closer attention to radiation dose and better protocol design may lower the cancer risk.

Attention to the cumulative dose of radiation is important. A clinician may have no idea how much radiation a patient has had in the past. We like the ACR recommendation that patients keep their own record of prior imaging studies (or that of their children or other loved ones).

Sometimes, good intentions also contribute! A clinician might order a CT scan instead of an MRI scan because he/she thinks that is the more cost-effective approach. Yet, in many such cases, that leads to "layering" where a patient ends up getting both a CT scan and an MRI scan. Sometimes the policies of insurers may also be problematic. For example, some insurers require prior authorization for MRI scans but not CT scans, so a clinician might order the CT scan to avoid the hassle of getting prior authorization.

And a tough nut to crack is patient demand. We still see patients expecting to get an imaging study.

Not only do unnecessary CT scans add to our already bloated healthcare costs, but the Smith-Bindman study is a reminder that the costs of unnecessary CT scans is more than just financial.

Some of our previous columns on the issue of radiation risk:

- February 2, 2010 "The Hazards of Radiation"
- November 23, 2010 "Focus on Cumulative Radiation Exposure"
- March 2010 "More on Radiation Safety"
- June 2011 "Progress in Reducing Radiation from CT Scans"
- April 2013 "Radiation Risk of CT Scans: Debate Continues"
- June 4, 2013 "Reducing Unnecessary CT Scans"
- July 2013 "More on the CT/Cancer Debate"
- January 2017 "Still Too Many CT Scans for Pediatric Appendicitis"
- November 2017 "SCANSMART Program to Use CT Safely in Children"
- June 2023 "Childhood CT Scans and Cancer Risk"

Some of our previous columns on CT scans in minor head trauma:

April 16, 2007 "Falls With Injury"
July 17, 2007 "Falls in Patients on Coumadin or Heparin or Other Anticoagulants"
March 2010 "CATCH: New Clinical Decision Rule for CT in Pediatric Head Trauma"
November 23, 2010 "Focus on Cumulative Radiation Exposure"
June 5, 2012 "Minor Head Trauma in the Anticoagulated Patient".
July 8, 2014 "Update: Minor Head Trauma in the Anticoagulated Patient"
January 2017 "Still Too Many CT Scans for Pediatric Appendicitis"
March 2017 "Update on CT Scanning after Minor Head Trauma"
September 2017 "Clinical Decision Rule Success"
August 21, 2018 "Delayed CT Scan in the Anticoagulated Patient"
September 21, 2021 "Repeat CT in Anticoagulated Patients After Minor Head Trauma Not Cost-Effective"
December 14, 2021 "Delayed Hemorrhage After Head Trauma in Anticoagulated Patients"

August 2022 “CDSS Success for Pediatric Head CT”
February 2024 “Another Canadian Head CT Rule”

References:

Smith-Bindman R, Chu PW, Azman Firdaus H, et al. Projected Lifetime Cancer Risks from Current Computed Tomography Imaging. JAMA Intern Med 2025; Published online April 14, 2025
https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2832778

ACR (American College of Radiology). ACR Statement on JAMA CT Scan Radiation Study (Smith-Bindman, et al). Newswise 2025; April 14, 2025
https://www.newswise.com/articles/acr-statement-on-jama-ct-scan-radiation-study-smith-bindman-et-al

http://www.patientsafetysolutions.com/

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