Malignancies Occurring During CT Follow-Up Of EVAR: It Is A Real Risk? What To Do About It?

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Is it a problem?

Ionizing radiation is carcinogenic in humans and teratogenic in fetuses.

There is, by definition, no safe dose to administer for human testing.

Experimental human study designs are unethical, and information from animal studies is limited due to their dissimilar genome and physiology compared with those of humans.

Samartzis et al reviewed threshold exposures for the development of radiation-induced bone sarcoma = 0.85 Gy using Poisson regression.

Disclosures

None

Adult Effective Doses for Various CT Procedures

<table>
<thead>
<tr>
<th>Examination</th>
<th>Effective Dose (mSv)</th>
<th>Range in Literature (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>2</td>
<td>0.9–4.0</td>
</tr>
<tr>
<td>Neck</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td>7</td>
<td>4.0–10.0</td>
</tr>
<tr>
<td>Chest for pulmonary embolism</td>
<td>15</td>
<td>13–40</td>
</tr>
<tr>
<td>Abdomen</td>
<td>8</td>
<td>3.5–25</td>
</tr>
<tr>
<td>Pelvis</td>
<td>6</td>
<td>3.3–10</td>
</tr>
<tr>
<td>Three-phase liver study</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Spine</td>
<td>6</td>
<td>1.5–10</td>
</tr>
<tr>
<td>Coronary angiography</td>
<td>16</td>
<td>5.0–32</td>
</tr>
<tr>
<td>Calcium scoring</td>
<td>3</td>
<td>1.0–12</td>
</tr>
<tr>
<td>Virtual colonoscopy</td>
<td>10</td>
<td>4.0–15.2</td>
</tr>
</tbody>
</table>

The exposure to radiation levels from a CT scan is considerable and variable.

An abdominal CT scan delivers 500 times the radiation than a routine anterior-posterior (AP) chest x-ray.

Multiphase abdominal and pelvic CT angiogram routinely doubles that amount of radiation.
Dose distribution in a patient following CE CT scan for TAA

The blue, orange, and red regions on (B) correspond to 50%, 75%, and 95% isodose areas

Radiation exposure of vascular surgery patients beyond endovascular procedures
Wei Zhou, MD, Stanford, Calif.

Methods: Radiation exposure associated with computed tomography (CT) angiography and coronary intervention is reviewed.

Results: Vascular surgeons are often involved in the decision-making process in roughly 30% of CT scans performed that are believed to be unnecessary. Society for Vascular Surgery (SVS) practice guidelines for patients with abdominal aortic aneurysms recommended eliminating a 6-month contrast surveillance CT if no endoleak was observed at 1 month after endovascular aneurysm repair (EVAR). Ultrasound and aortic duplex can help eliminate some of the CT scans.

Conclusion: Vascular surgeons must remain vigilant in monitoring radiation exposure for their patients who have potential for coronary and vascular imaging with radiation. Judicious use of alternative imaging modalities when possible and maintaining the dose as low as reasonably achievable (ALARA) is the responsibility of vascular surgeons.

Estimating the risk of solid organ malignancy in patients undergoing routine computed tomography scans after endovascular aneurysm repair

Raghu Motaganahalli, MD, FRCS,a Angela Martin, MD,a BeeJay Feliciano, MD,a Michael P. Murphy, MD,a James Slaven, MS,b and Michael C. Dalsing, MD,a Indianapolis, Ind

Objective: Computed tomography (CT) scans are routinely used for graft surveillance in patients who have had endovascular repair (EVAR) of an abdominal aortic aneurysm. There is a growing concern regarding radiation exposure from medical imaging. We calculated the excess relative risk (ERR) of a patient acquiring a solid organ malignancy secondary to radiation exposure from contrast-enhanced EVAR surveillance CT imaging. The risk of a patient acquiring a solid organ malignancy secondary to radiation exposure was calculated using the Biological Effects of Ionizing Radiation (BEIR VII) model created by the U.S. National Institute of Science and National Research Council.

Methods: Our study estimated the ERR of a patient acquiring a solid organ malignancy secondary to radiation exposure from contrast-enhanced EVAR surveillance CT imaging. The ERR of a patient acquiring a solid organ malignancy secondary to radiation exposure was calculated using the Biological Effects of Ionizing Radiation (BEIR VII) model created by the U.S. National Institute of Science and National Research Council. The ERR of solid organ malignancy, as given by the BEIR VII model, is \[ s_D \exp\left\{\frac{e^*}{a}\right\} \] where \( s \), \( a \), and \( e^* \) are data-derived parameters, \( e \) is age at exposure, and \( e^* = (e-30)/10 \) for \( e \leq 30 \) and zero for \( e > 30 \). The risk was stratified by age groups, sex, and use of two different radiation doses (15 or 31 mSv) per CT scan. Statistical analysis used the paired t test.

Results: There was no significant difference between the ERR of solid organ malignancy in those patients who underwent surveillance CT scans at all time points vs those who underwent surveillance CT scans at some time points (P = .19). The ERR of a patient acquiring a solid organ malignancy secondary to radiation exposure was highest in those exposed to contrast-enhanced CT scans, younger people, and males. The ERR of cancer risk was highest in patients aged 50 to 55 years and lowest in patients aged > 80 years. The cumulative ERR of cancer risk was highest in patients aged 50 to 55 years and lowest in patients aged > 80 years.

Conclusions: Patients undergoing routine CT scans for surveillance surveillance after EVAR are at risk for acquiring solid organ malignancy due to radiation exposure. The risk is highest in younger patients, women, and those exposed to multiple contrast-enhanced CT scans. The median question time for radiation surveillance CT scans after EVAR is the absence of endoleak or a change in aneurysm morphology, based on an increased malignancy risk.

Case 1

Case 2

What can we do about it?

Modification of CT Utilisation patterns

Physician awareness

Low dose CT optimisation