

RADIOLOGY

Estimating the Cancer Risk of CT Scans

Computed tomography (CT) scans performed in the United States in 2007 could lead to approximately 29,000 future cancers, according to results of a recent retrospective, cross-sectional study. In this study, researchers from several institutions (the National Cancer Institute, Bethesda, MD; Johns Hopkins University School of Medicine, Baltimore, MD; Kyung Hee University, Gyeonggi-do, Korea; American College of Radiology, Reston, VA; and New Mexico VA Healthcare System, Albuquerque) used Medicare claims data and results from a recent IMV Medical Information Division survey to estimate a total of 72 million CT scans performed in 2007. From that number, they subtracted scans performed in patients with an estimated life expectancy of five years or less and those related to a diagnosis of cancer, which left 57 million scans to be included in their analysis.

The researchers arrived at the estimate of 29,000 future cancers associated with those 57 million scans based on risk models developed by the Biological Effects of Ionizing Radiation (BEIR) committee of the National Research Council, with minor modifications. They further projected that, assuming approximately 50% mortality among the patients who develop CT-related cancers, the 29,000 future cancers could be expected to result in about 14,500 cancer deaths.

Using a large, national commercial insurance database to estimate the age and sex distribution for each CT scan type, the researchers found that the projected number of incident cancers

generally decreased with increasing age at exposure. They also found that two thirds of the cancers were estimated to occur in women (due to the higher frequency of use and higher breast and lung cancer risks from scans that expose the chest to radiation). The largest contributions to future cancer were from the types of CT scans performed most frequently (abdomen and pelvis, chest, and head) and from the type that emits the highest dose of radiation (chest CT angiography).

A related study—involving some of the same researchers, along with investigators from University of California, San Francisco (UCSF) and University of Washington, Seattle—examined the cancer risks associated with radiation doses used for 1,119 adults undergoing diagnostic CT scans at four institutions in the San Francisco Bay Area between January and May 2008. These scans were limited to the 11 most common types (determined by examining March 2008 CT data from a UCSF database). The researchers quantified radiation exposure using the “effective dose,” which accounts for the amount of radiation to the exposed organ and for the organ’s sensitivity to radiation-related cancer. One of the most frequently reported measures, the effective dose allows for comparison between different types of CT scans and between CT scans and other types of radiologic tests. As with the first study, the researchers used the BEIR report to develop risk projection models.

They found that the radiation doses varied significantly between patients and across institutions, with a mean 13-fold variation between the highest and lowest dose for each scan type. The effective doses tended to be

higher and more variable than what is typically quoted for clinical practice. For example, the median effective dose of abdomen and pelvis CT scans (the most common type of CT scan performed in the United States) was 66% higher than the 8 to 10 mSv often quoted in clinical studies, say the researchers. Some of the variation may be clinically indicated to accommodate patients of different size or the specifics of the clinical question being addressed, the researchers say. They add, however, that the variation was “dramatic and of greater magnitude than widely considered acceptable, particularly considering that the patients were already stratified within relatively well-defined clinical groups.”

The risk of cancer varied depending on the type of scan performed and the patient’s age and gender. The researchers estimated, for instance, that one in 270 women and one in 595 men who underwent CT coronary angiography at age 40 will develop cancer from that scan, compared with one in 8,100 women and one in 11,080 men who had a routine head CT scan at the same age. The risks were twice as high for 20-year-old patients and half as high for 60-year-old patients.

The researchers identify several ways in which cancer risks could be reduced, including cutting down on unnecessary procedures: It has been reported that 30% or more of CT scans currently performed may be unnecessary. They cite the American College of Radiology criteria as an important tool for making appropriate imaging decisions. They also suggest standardizing CT scan protocols and techniques across sites to limit radiation associated with specific scans. Another means of lowering the

risk, they say, may be tracking dose information at the patient level since patients may undergo repeated imaging. The impact of dose reduction would be particularly dramatic among patients who undergo repeated imaging and, consequently, are at higher risk for radiation-associated cancer.

Sources: *Arch Intern Med.* 2009;169(22):2071–2077.
Arch Intern Med. 2009;169(22):2078–2086.

SLEEP DISORDERS

Link Between Obstructive Sleep Apnea and Diabetes

Obstructive sleep apnea (OSA) may be an underrecognized risk factor for type 2 diabetes, say researchers from Yale University School of Medicine, New Haven, CT and the Clinical Epidemiology Research Center at the VA Connecticut Healthcare System (VACHS), West Haven.

In an observational cohort study, they analyzed data from 544 non-diabetic patients (with a fasting blood glucose level less than 126 mg/dL) who were referred to the VACHS Sleep Center for evaluation of sleep-disordered breathing between January 2000 and December 2005. Data on the existence of hypertension and hyperlipidemia were extracted from patients' medical records. Fasting blood glucose levels and body mass index (BMI) were calculated for each patient before an initial polysomnogram and at follow-up.

At baseline, patients underwent overnight polysomnography, which evaluated their arousal index, or number of arousals per hour of sleep; minimum and mean arterial oxygen saturation; percentage of total sleep time with oxygen saturation less than 90% (T90%); and their apnea-hypopnea index (AHI), or sum of apneas and hypopneas per hour of sleep. After the test, patients received positive airway

pressure (PAP) appliances and supplies to use at home during sleep.

Patients were divided into quartiles based on OSA severity as measured by the AHI. Patients in quartile one (mean AHI, 2.9) were deemed the comparison group, while those in quartiles two through four (mean AHI, 41.5) were considered the OSA group. At baseline, the fasting blood glucose level was higher for patients in the OSA group compared with patients in the comparison group (99.4 mg/dL versus 95.3 mg/dL, respectively; $P = .05$). Obesity and hypertension were more prevalent in the OSA group, and this group was older than the comparison group (mean age, 62.9 versus 57.6 years, respectively).

At a mean follow-up of 2.7 years, 61 patients had developed diabetes: 55 in the OSA group and six in the comparison group. The researchers found that OSA was significantly associated with diabetes even after adjusting for age, sex, race, baseline fasting blood glucose levels, BMI, and change in BMI at follow-up. They also found that the risk of diabetes increased as severity of OSA increased.

In a secondary analysis, the researchers found that patients with a higher T90% and patients with a higher arousal index were more likely to develop diabetes. They suggest that "recurrent arousals (and sleep loss) may act through sympathetic activation and subsequent alterations in hypothalamic-pituitary-adrenal axis, leading to altered cortisol levels, decreased pancreatic beta-cell activity, elevated growth hormone levels, and alterations in neuroendocrine control of appetite." When examining patient adherence to the home use of a PAP appliance, they found that regular use of such an appliance was independently associated with a significant reduction in the risk of diabetes, even after adjusting for fasting blood glu-

case levels, BMI, and change in BMI at follow-up.

Losing weight often is considered a critical step in treating OSA and, potentially, in preventing diabetes. In a related study, researchers at Karolinska University Hospital, Stockholm, Sweden studied data from 63 obese men (with BMI ranging from 30 to 40 kg/m²) with moderate to severe OSA (AHI of 15 or higher) who were treated with PAP. A total of 30 patients were assigned randomly to the intervention group and received a very low energy liquid diet for seven weeks to promote weight loss, followed by two weeks of gradual introduction of normal food. The other 33 patients were assigned to the control group and were advised to adhere to their regular diet.

At nine-week follow-up, the mean change in weight from baseline was -18.7 kg in the intervention group and -1.1 kg in the control group. The mean reduction in BMI also was greater for the intervention group compared with the control group (-5.7 versus -0.3, respectively). Mean AHI dropped by 67% in the intervention group, compared with no change in the control group. In fact, five patients in the intervention group were classified as free of OSA at week nine. "An added benefit of the treatment," the researchers say, "was that 73% of patients in the intervention group were no longer classified as obese, whereas all control patients remained obese." ●

Sources: *Am J Med.* 2009;122(12):1122–1127.
doi:10.1016/j.amjmed.2009.04.026.

BMJ. 2009;339:b4609. doi:10.1136/bmj.b4609.