

[ESC Press Statement - ESC supports 'appropriate' use of nuclear imaging technology](#)

Cardiac nuclear imaging and computed tomography angiography (CCTA) still have an important role to play in cardiac disease diagnosis, say experts from the [European Society of Cardiology \(ESC\)](#).

Following the recent publications ^(1,2,3) highlighting potential dangers of ionising radiation resulting from imaging testing, the ESC experts feel that it is important to voice support of the technology. “We want to reassure the public that for individual patients the benefits of receiving an accurate diagnosis are likely to far outweigh the small potential risks involved in having a scan,” said Professor Juhani Knuuti, of the ESC Working Group on Nuclear Cardiology and Cardiac CT, from Turku University Hospital (Turku, Finland). “The most fundamental question that clinicians need to ask themselves is whether a test is appropriate for the individual patient, and whether that patient will derive benefit from it.”

It needs to be remembered, he added, that tests like CCTA are used to select patients for invasive procedures that themselves carry risks. “Any procedure is a balance of risks and benefits. What has been overlooked in recent publications is the risk of cardiovascular disease going untreated, which can even result in immediate sudden death. The potential risks of imaging tests are small relative to the diagnostic information obtained,” said Knuuti.

“We have real concerns that following the publicity around the papers, the public may avoid these tests out of fear and that authorities might create unjustified recommendations for imaging use. They need to appreciate that radiation is a single aspect of the risks involved, and that these are really useful tests for cardiologists. Everything needs to be considered in the wider context,” said Knuuti.

Papers highlighting the risks

Last year the problems of radiation exposure in patients undergoing medical imaging procedures were raised in three papers in major journals.

A Science Advisory statement from the American Heart Association Committee on Cardiac Imaging wrote that between 1980 and 2006 the collective dose from medical uses of radiation received by the US population increased by more than 700%. The paper, published in *Circulation*, added that in 2006 CCTA accounted for around 50 % of the collective dose⁽¹⁾.

A *NEJM* paper, by Reza Fazel and colleagues, from Emory University School of Medicine (Atlanta, Georgia), reviewed the radiation exposure of nearly one million US adults, aged 18 to 64⁽²⁾. The investigators found that 69 % of participants had undergone at least one imaging procedure associated with radiation, and that the mean cumulative dose was 2.4 mSv per subject per year. “Our finding, that in some patients worrisome radiation doses from imaging procedures can accumulate over time, underscores the need to improve their use,” wrote the authors, adding that strategies for optimizing and ensuring appropriate use of the procedures in general should be introduced.

A paper in *JAMA* by Jorg Hausleiter and colleagues, from Klinik an der Technischen Universitat, (Munich, Germany) reviewed the radiation dose of CCTA from 50 study centres⁽³⁾. Results revealed an estimated median radiation dose corresponding to 12mSv, and furthermore found a six fold difference in the dose delivered between the highest and lowest centres. “Improved education of physicians and technicians performing CCTA on these dose-saving strategies might be considered to keep the radiation dose 'as low as reasonably achievable' in every patient undergoing CCTA,” concluded the authors.

Radiation exposure risks put in context

It is important”, said Knuuti, for the public to try to achieve an understanding of exactly what the potential increased cancer risk might involve. “The difficulty involved here is that the risks are so small that you'd never be able to detect them in clinical trials unless you recruited millions of subjects and followed them for the rest of their lifetimes,” said Knuuti, adding that the current risk estimates have been derived from studies of atomic bomb survivors.

One study that helps put the risk of imaging into perspective suggests that living with a smoker (i.e. being a passive smoker) causes a 20 times higher risk of fatal cancer⁽⁴⁾ than undergoing one CCTA scan (10 mSv). Another study suggests that the risk of having a fatal pedestrian traffic accident is three times higher than the risk of developing fatal cancer after one CCTA scan⁽⁵⁾.

Cancer risks also need be considered in relation to the patient's age at the time of undergoing the investigation. "For patients with chest pain over the age of 60 years the radiation risks involved are unlikely to have consequences since it takes anyway decades to develop potential adverse events," said Knuuti, adding that the estimated risks would be greater for younger patients.

The way forward, said Knuuti, is to introduce strategies that reduce the radiation dose received by patients undergoing investigations. The PROTECTION 1 study, for example, showed that reducing the tube voltage from 120 kV to 100 kV resulted in a 53 % reduction in the median radiation dose for CCTA⁽⁶⁾ "In the last five years the radiation dose from CCTA has been reduced from 20 to 30 mSv to 1-5 mSv. So the current dose is much lower than these papers are leading us to believe," he added.

Furthermore, additional efforts need to be undertaken to ensure appropriate use of imaging tests in different patient populations. "Studies undertaken in the US have suggested that one third of tests are being undertaken in patients where there is not a good indication," said Knuuti.

NOTES: Imaging Technology background

In the late 1990s cardiac computed tomography angiography (CCTA) emerged as a non invasive diagnostic test for coronary artery disease. The technology involves an x-ray source and detectors rotating in synchrony on the far side of the patient. The idea is that having multiple rows of detectors operating side by side allows many slices (currently up to 320) to be imaged simultaneously, with the data processed by computer to produce a series of three-dimensional views of the target organ without the patient needing to undergo invasive angiography.

The technology offers many advantages including the elimination of the risk and discomfort associated with invasive coronary artery catheterization. CCTA can provide insights into the extent and nature of coronary plaque formation with or without any narrowing of the coronary arteries.

Studies comparing the accuracy of CCTA with invasive coronary angiography in thousands of patients have documented very high negative predictive values above 95 %. "CCTA scans are commonly used for patients with low to moderate pre-test likelihood of coronary artery disease complaining of chest pain. The idea is to exclude coronary artery disease because if you have a normal CCTA scan the likelihood of having disease is almost zero, allowing patients to avoid unnecessary invasive procedures," said Professor Knuuti, adding that this means patients can be worked up for other causes of their chest symptoms.

A positive result, however, is considered less conclusive and will be confirmed (and possibly treated) with subsequent functional imaging tests or invasive angiography.

Symptomatic patients with higher pre-test likelihood of coronary artery disease are more commonly considered for a functional test, such as nuclear perfusion imaging, which involves injecting a small amount of radioactive contrast agent (often technetium) into the arm vein and then monitoring its progress with a Gamma camera. By comparing the heart's blood flow at rest and during exercise, cardiologists can see if the heart muscle is receiving enough blood during stress.

References:

1. Gerber TC, Carr JJ, Arai AE, Dixon RL, Ferrari VA, Gomes AS, et al. Ionizing radiation in cardiac imaging: a science advisory from the American Heart Association Committee on Cardiac Imaging of the Council on Clinical Cardiology and Committee on Cardiovascular Imaging and Intervention of the Council on Cardiovascular Radiology and Intervention. *Circulation*. 2009 Feb 24; 119:1056-65.

2. Fazel R, Krumholz HM, Wang Y, Ross JS, Chen J, Ting HH, et al. Exposure to low-dose ionizing radiation from medical imaging procedures. *N Engl J Med*. 2009 Aug 27; 361:849-57.
3. Hausleiter J, Meyer T, Hermann F, Hadamitzky M, Krebs M, Gerber TC, et al. Estimated radiation dose associated with cardiac CT angiography. *Jama*. 2009 Feb 4; 301:500-7.
4. Committee on Passive Smoking, Board on Environmental Studies and Toxicology, National Research Council. *Environmental Tobacco Smoke: Measuring Exposures and Assessing Health Effects*. Washington, DC: National Academies Press; 1986. Insert 4.
5. National Safety Council (NSC). Odds of death due to injury, United States, 2005. Available at: <http://www.nsc.org/research/odds.aspx>.
6. Bischoff B, Hein FN, Meyer F et al. Impact of reduced tube voltage on CT angiography and radiation dose: Results of the PROTECTIONI Study. *J Am Coll Cardiol Imaging* 2009; 2:940-6.

Notes:

The [European Society of Cardiology \(ESC\)](#) represents more than 62,000 cardiology professionals across Europe and the Mediterranean. Its mission is to reduce the burden of cardiovascular disease in Europe.

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