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cardiac care provided in a heartbeat

Radiation Dose From Various Coronary Diagnostic Imaging Studies

We live in a world where we are constantly exposed to background radiation doses from cosmic rays and radioactive elements. This is roughly equivalent to 3 mSv per year. By way of understanding this dose of radiation, one chest x-ray is equal to 0.02 mSv. Depending on which part of the world one is in, the dose could be a little lower or a little higher for each individual.

Medical science has advanced considerably and we use diagnostic techniques where necessary to help us in the management of patients. The technology uses x-ray and nuclear material to help pin-point the problems we may be having. In most of these situations, the benefits of the diagnostic ability of these techniques far outweigh the risk from radiation.

We should be aware of how much radiation exposure each procedure gives us because often one investigation leads to a second one and then to a third, where in each of these procedures one is being exposed to cumulative radiation. All this exposure accrues like a growing debt during your lifetime to put you at a risk for cancer.

By way of example, I have put a radiation dose comparison as put forward by the European Commission for regular x-rays involving the chest, the skull, a CT scan, etc.

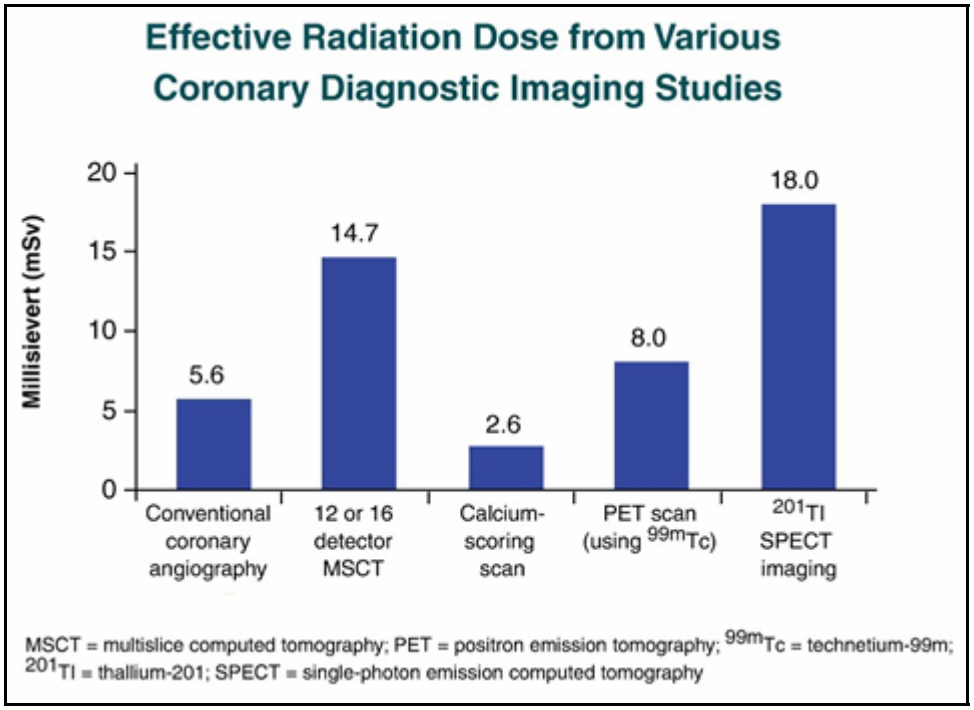
A list of representative diagnostic procedures and associated doses are given that is adapted from a report of the European Commission

Radiation Dose Comparison

Diagnostic Procedures	Typical Effective Dose (mSv)	Number of Chest X rays (PA film) for Equivalent Effective Dose	Time Period for Equivalent Effective Dose from Natural Background Radiation
Chest X ray (PA film)	0.02	1	2.4 days
Skull X ray	0.07	4	8.5 days
Lumbar Spine	1.3	65	158 days
I.V. Urogram	2.5	125	304 days
Upper G.I. exam	3.0	150	1.0 years
Barium enema	7.0	350	2.3 years
CT head	2.0	100	243 days
CT abdomen	10.0	500	3.3 years

1. Effective dose in millisieverts (mSv).
2. Based on the assumption of an average “effective dose” from chest x ray (PA film) of 0.02 mSv.
3. Based on the assumption of an average “effective dose” from natural background radiation of 3 mSv per year in the United States.

As far as cardiac investigations are concerned, the next slide gives us the effective radiation dose from the various diagnostic imaging studies, keeping in mind that one chest x-ray is equivalent to 0.02 mSv. The SPECT imaging Thallium scan has the highest exposure on this basis, which is equivalent to almost 800 to 900 chest x-rays. There are many centers around the world where Thallium is not being used at all.



These numbers may seem alarming but one must keep in mind that these investigations are necessary and once the diagnosis is made and appropriate treatment is given, it outweighs the risk of the radiation. The problem that arises is that once when an individual in certain parts of the world goes to a shopping mall and is exposed to a CT scan or a total body scan, and that subsequently leads to further investigation, e.g., a Cardiolite nuclear test, and to make matters worse, they end up in the cath lab having a coronary angiogram, even though the individual is asymptomatic. This cumulative radiation greatly increases the risk of cancer in that individual's life.

So how does one protect oneself? Once you have seen your family physician and you had your risk assessment done, if you are categorized in the low risk, it is easy, or a high risk, then you can be treated as such. If you fall into the intermediate risk group, there are two ways of investigating this further: a). by looking at the carotid intima media thickness which shows cholesterol deposit. This is by ultrasound, and no radiation is involved. b). you can have a calcium score done with a CT scan, but here radiation is involved, but it is less than for other procedures.

If you have symptoms which could suggest that you do have underlying heart problems, the safest procedure of course would be to do a stress echo. Images of the heart are taken at rest and then at peak exercise. This is a quick method of diagnosing the presence or absence of heart disease, and the answer is almost immediate. A regular stress test without imaging does not give you the same level of sensitivity and specificity of a stress test with an imaging modality.

In the future letters, I will be discussing the value of carotid intima media thickness and stress echo, and what advantages these have.