

Perspective

Benefits Outweigh Risks in Cardiac Imaging

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Abstract

The debate has intensified regarding the possible risks linked to cardiovascular imaging. This discourse has been triggered by the increased utilization of imaging procedures and modalities including cardiac computed tomography (cardiac CT). Should the risks associated with cardiac CT discourage the physician or patient from having the procedure performed? Is the increased cost (due to the imaging procedures) balanced by the benefits to the doctor and for the patient for such services? The risks, particularly radiation, are there; but the benefits of improved diagnosis and earlier, more effective treatment seem to outweigh the risks.

Keywords: Cancer Risk; Cardiovascular, Computed Tomography; Imaging; Latency; Revascularization

Abbreviations

CT : computed tomography

mSv : millisievert

Introduction

The main contention of cardiac imaging has focused on a single risk factor: radiation. However, several procedures have risks beyond radiation: contrast agents, stressors, and invasive properties. For any or all of these reasons, many patients are concerned about or fear undergoing these procedures. However, the diagnostic benefits gained from these procedures appear to outweigh the risks. With that said, it is fundamental for the patient to consent to these procedures without acute concern for their comfort or safety as any risks are minimized by improvements in and protection during the procedures.

Discussion

Cancer risks resulting from medical imaging, in particular, cardiac CT are not based on actual epidemiological observations; instead, they are determined by the extrapolation of risk approximations to low radiation levels based on the Ionization Radiation's Biological Effects report (National Research Council, 2016) [1]. Diagnostic cardiovascular procedures are commonly associated with radiation doses below 100 mSv. The extrapolation

of the radiation risks based on these relatively low radiation levels is problematic. Such determinations are based, fundamentally, on the assumption that the risk of cancer increases linearly to the increase in radiation dose. According to Meinel et al. (2016), the linear no-threshold model presently represents a logical, conservative compromise; hence, it is commonly utilized in radiation protection policy. It remains unclear whether such a model gives an accurate reflection of the biological effect of low-level radiation, and if it is appropriate for forecasting cancer risks originating from the medical imaging.

Whenever generation approximations of radiation are applied to cardiovascular imaging tests, the patient population characteristics as well as the cardiovascular disease spectrum should be considered. The majority of cardiovascular imaging examinations are carried out on patients above the age of fifty years. The possible harm resulting from radiation to such individuals is considerably lower than young adults and children. There is reduced susceptibility to radiation in mature tissues (in advanced age), and there is a reduced life expectancy which limits the time for the manifestation of cancers.

Meinel et al. (2014) pointed out that known or suspected peripheral, cerebrovascular or coronary artery disease; aortic pathologies; and pulmonary embolism (all being disorders with considerable mortality and morbidity) were identified for cardiovascular imaging examinations. Radiation risks resulting from such examinations or tests must be evaluated against the risks of delaying appropriate treatment for, or misdiagnosis of, these conditions; or failing to assess severity or distribution accurately.

Even among the younger patient population, the risk of death resulting from fundamental morbidity exceeds the risk of death from long-term cancer induced by radiation (Meinel et al. 2014). Hence, such consideration is potentially more pertinent in older patients having suspected or known cardiovascular disease [2].

Cardiovascular imaging examinations have the diagnostic precision for detecting pathologies. Failing to carry out a cardiovascular imaging examination, when indicated, puts the patient at significant risk by limiting helpful or essential diagnostic information. Moreover, the latency period of radiation-induced malignancies can stretch over several decades while suspected cardiovascular disease constantly poses an impending danger to the patient.

The lifetime risk from cardiovascular imaging procedures for fatal occurrences is small compared to the general risk of cardiac events caused by coronary artery disease both in symptomatic and asymptomatic populations. Knuuti et al. (2014) note that, even though the risk of aspirin therapy showed no apparent connection with imaging risks, it had been used in research concerning a variety of risks. Aspirin had been widely postulated as a safe therapy for patients with coronary atherosclerosis, and was liberally utilized in patients with asymptomatic and mild coronary artery disease. Knuuti et al. (2014) found that the greatest risk associated with imaging examinations was below 1/7 of the lifetime risk of severe bleeding caused by aspirin. Moreover, the risk linked to revascularization was greater than any diagnostic or medical intervention; however, when utilized appropriately, the interventions were documented beneficial [3].

The risks linked to cardiac imaging are also small compared with other risks that the imaging is utilized to address. Thus, the relative risk originating from the natural course of this condition is high compared with the risks from imaging for such. Moreover, the relative low risk of imaging is further exemplified when comparing imaging test's risks with those risks of day-to-day activities; risks from imaging being on par with risks linked to bicycling or swimming.

Conclusion

Risks associated with stochastic radiation do exist irrespective of how small. Therefore, exposure to radiation should be kept to

the lowest level possible without compromising the quality of diagnostic data obtained from the imaging test or tests. Fear of radiation should not inhibit a patient from submitting to a medically essential imaging test. The benefit of imaging, in suspected and known coronary artery disease, is undeniable; however, the pros and cons of such procedures are still being debated.

The development of a diagnostic and treatment algorithm for coronary artery disease is needed. The economic impact of the growing utilization of cardiac imaging procedures versus treatment outcomes needs to be studied. Fundamental research should include the risks associated with imaging procedures and the benefits of improved diagnosis and more immediate and effective treatment. Also, more accurate diagnosis using cardiac imaging can even benefit those patients who do not have any disease by relieving their anxiety about possibly having such disease when they do not.

There are risks with CT cardiac imaging. The debate about the benefits, risks, and cost-effectiveness is ongoing. However, from the social, global, and economic perspectives, it seems that the benefits outweigh the risks.

Conflict of Interest Statement

The authors declare that this paper was written in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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