DETAIL

DEMONSTRATING EXCELLENCE THROUGH ADVANCED IMAGING LEARNING

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Strategies for Reducing Radiation Exposure with PET

"In addition to cardiac PET having improved diagnostic utility compared with SPECT imaging, patient radiation exposure is significantly less with most PET perfusion radiotracers." [7]

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These materials were prepared in good faith by MITA as a service to the profession and are believed to be reliable based on current scientific literature. The materials are for educational purposes only and do not replace either the need for individualized patient diagnosis and treatment planning by qualified physicians based on existing good practices or the need for implementation by qualified radiologists or other qualified healthcare practitioners. Neither MITA nor its members are responsible for any diagnostic or treatment outcomes. MITA, its members, and contributors do not assume any responsibility for the user's compliance with applicable laws and regulations. MITA does not endorse the proprietary products or processes of any one company.

Overview

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- With the increased volume of cardiac diagnostic procedures being performed, collective exposure from medical sources has increased seven-fold since 1992
- Although a powerful tool in the diagnosis and risk-stratification of patients with known or suspected coronary heart disease, careful assessment of the risks and benefits to patients, staff members and the public must be considered
- As compared to SPECT imaging, patient radiation exposure with cardiac PET has been shown to be significantly less

Objectives

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- Review collective exposure from medical imaging sources
- Discuss examples of typical effective doses from sources of radiation
- Review common cardiac imaging procedures and corresponding radiation exposure
- Review ASNC's position statement algorithm designed to minimize radiation exposure

The Increasing Burden of Medical Radiation Exposure

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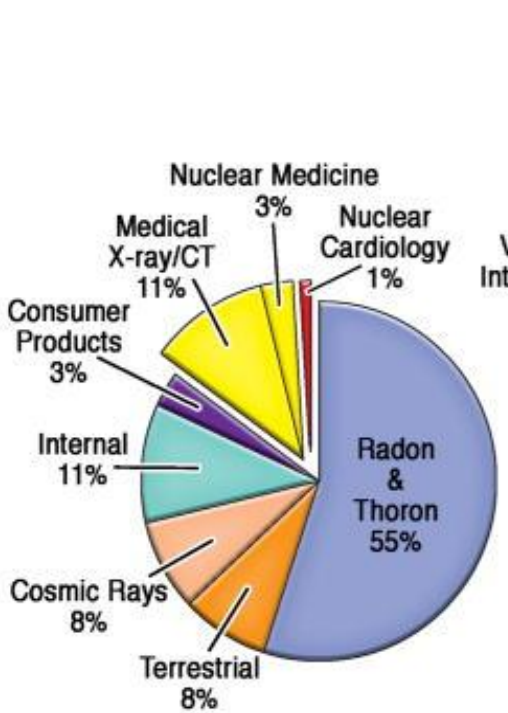
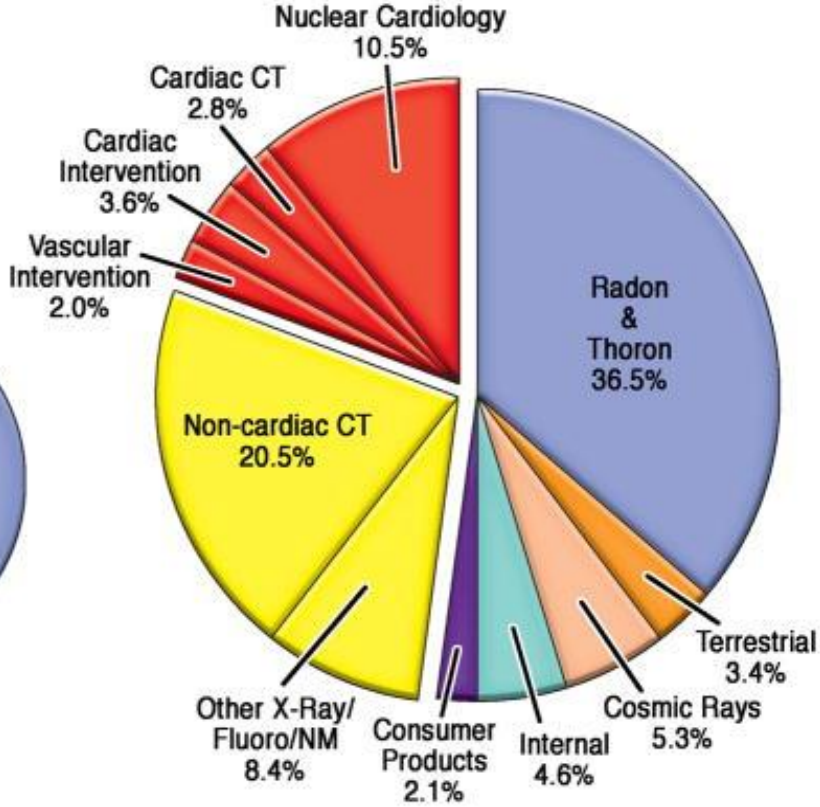
Collective exposure from medical sources has increased over seven-fold since 1982



1980-1982

Medical Radiation: 0.53 mSv per capita per year
Non-medical Radiation: 3.1 mSv per capita per year
Cardiovascular Radiation Collective Effective Dose: 6,700 person-Sv
Medical Radiation Collective Effective Dose: 123,000 person-Sv



2006

Medical Radiation: 3.0 mSv per capita per year
Non-medical Radiation: 3.2 mSv per capita per year
Cardiovascular Radiation Collective Effective Dose: 356,000 person-Sv
Medical Radiation Collective Effective Dose: 899,000 person-Sv

25. Einstein AJ. J Am Coll Cardiol 2012; 59(6):553–565

Comparison of Exposure from Common Sources

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Typical effective doses of common sources of radiation

Source	Typical Dose (mSv)	# of Chest X-rays (Posteroanterior)
Chest X-ray (Posteroanterior)	0.02	1
Chest X-ray (Posteroanterior and Lateral)	0.10	5
Round trip flight, New York to New Orleans	0.02	1
Backscatter scanner for airport screening	0.001	1/20
Mammogram	0.7	35
Head CT	2	100
Background radiation to public (annual)	3	150
Abdominal CT	10	500
Average annual occupational dose limit* (ICRP) (6)	20	1000
Dual isotope MPI or Helical Coronary CTA	25	1250
Highest doses received by Fukushima workers	180	9,000

25. Einstein AJ. J Am Coll Cardiol 2012; 59(6):553–565

Exposure from Commonly Used Cardiac Imaging Procedures

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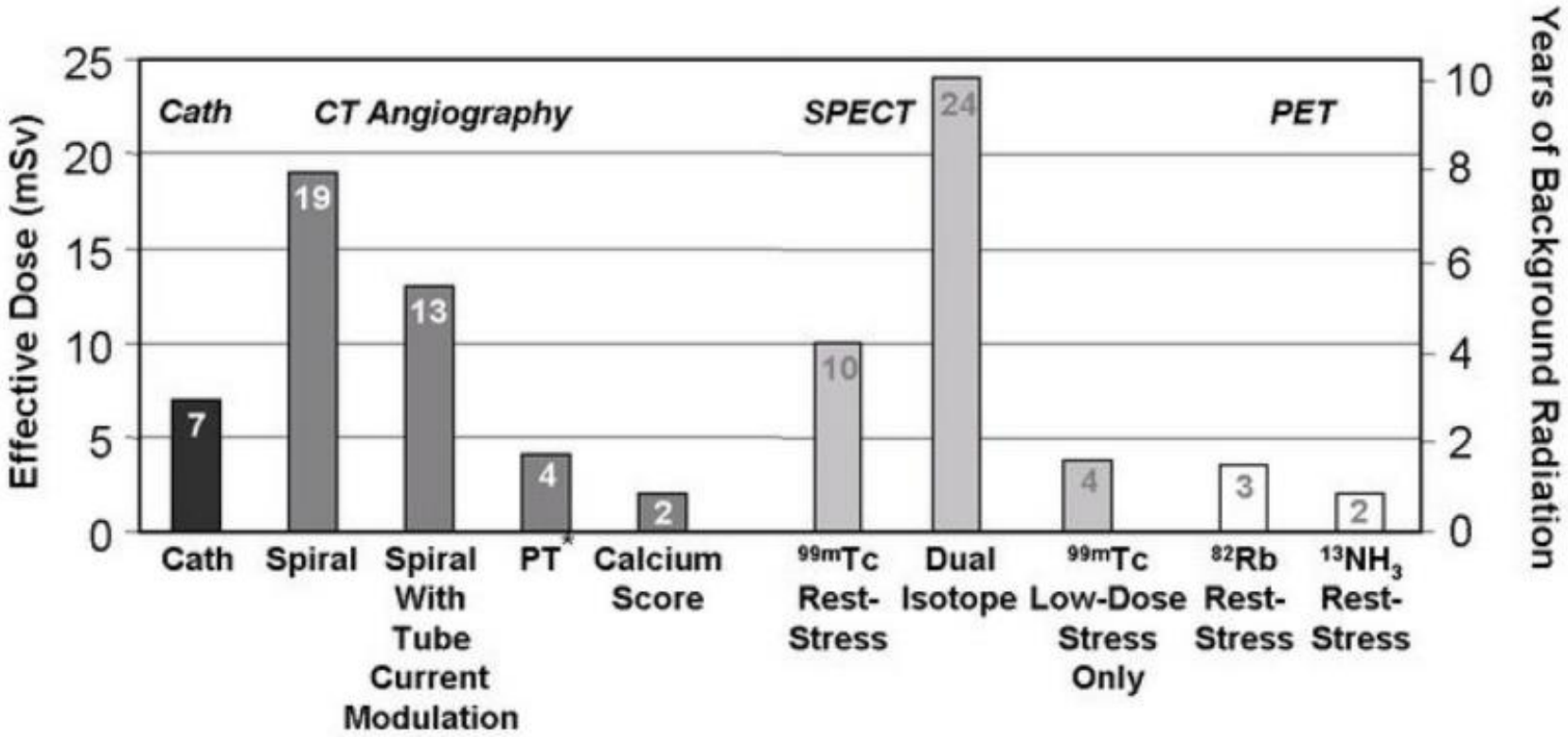

Figure 3. typical effective doses from cardiac imaging procedures. “PT” denotes Prospective Triggering. (Adapted from Einstein[25])

25. Einstein AJ. J Am Coll Cardiol 2012; 59(6):553–565

Proposed Algorithm for Maximal Reduction in Radiation Exposure

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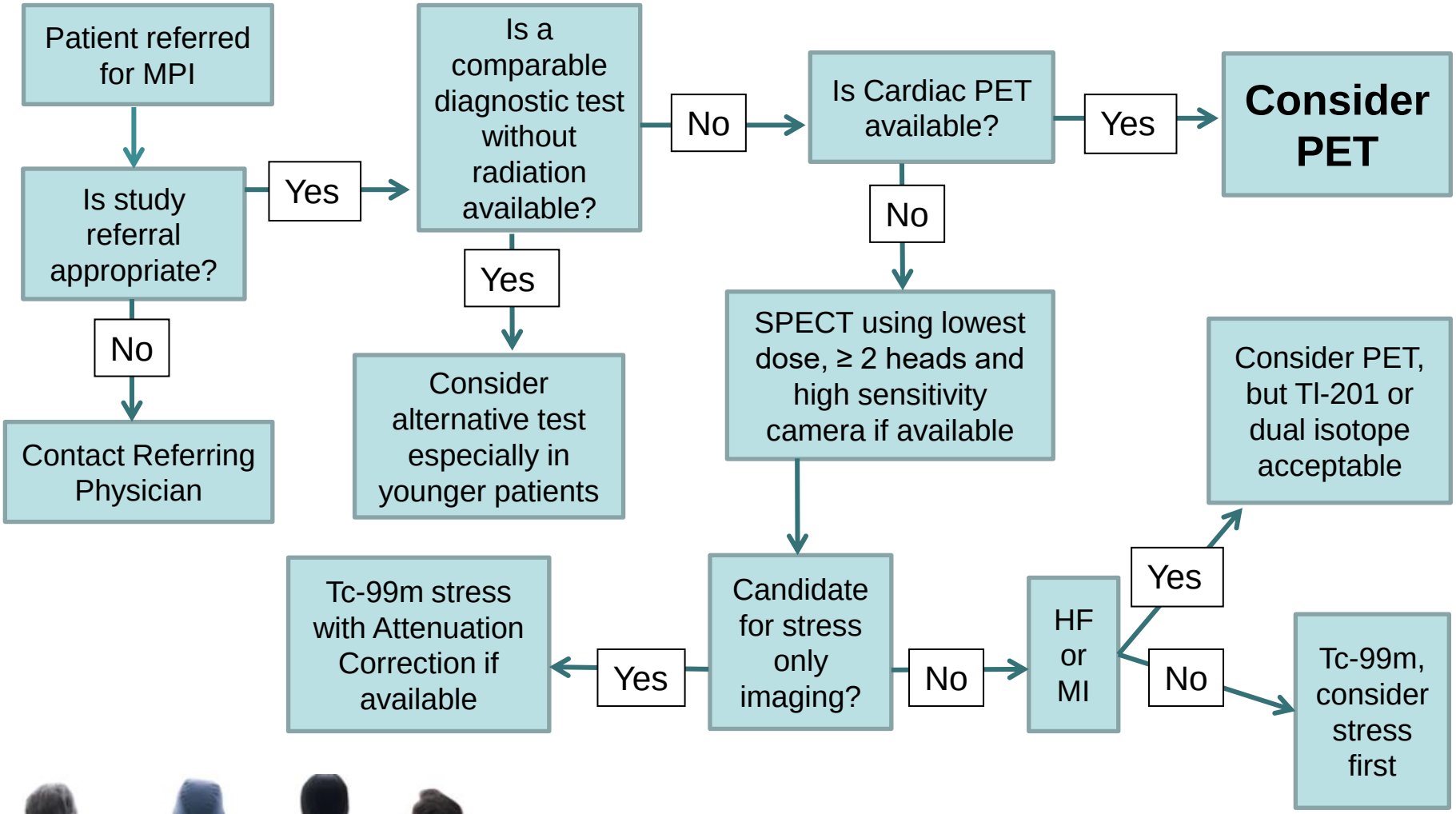

26. Cerqueira MD, et al. J Nucl Cardiol May 2010

Summary

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- The physics of PET and pharmacokinetics of the tracers are more optimal for myocardial perfusion imaging (MPI)[1-5, 9-10]
- PET can help improve the management of patients with known or suspected CAD, heart failure and cardiac sarcoidosis[1-3,6,7,18-24]
- PET can help implement a strategy to reduce radiation exposure from cardiac imaging procedures[25-26]

Summary

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- Cardiac PET addresses the need for improved interpretive certainty and greater efficiency[1-4]
- Cardiac PET performs well even with challenging patient types (e.g., pharm stress, obesity, female) [1,3-4,6,7,17]
- Cardiac PET more accurately identifies multi-vessel disease[1,3-4,6,7,17]
- Quantification of myocardial blood flow adds incremental prognostic value[18,22,23]

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Important Safety Information

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- Image interpretation errors can occur with PET imaging. A negative image does not rule out recurrent prostate cancer and a positive image does not confirm its presence. Clinical correlation, which may include histopathological evaluation, is recommended.
- Hypersensitivity reactions, including anaphylaxis, may occur in patients who receive PET radiopharmaceuticals. Emergency resuscitation equipment and personnel should be immediately available.
- PET/CT imaging contributes to a patient's overall long-term cumulative radiation exposure, which is associated with an increased risk of cancer. Safe handling practices should be used to minimize radiation exposure to the patient and healthcare providers.
- Adverse reactions, although uncommon, may occur when using PET radiopharmaceuticals. Always refer to the package insert prior to use.

F18 FDG USPI

Rb82 USPI

N13 Ammonia USPI