

Clinical SPECT/CT

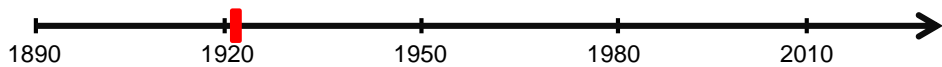
Lutz S. Freudenberg
ZRN Rheinland

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Basic Principle of Nuclear Medicine



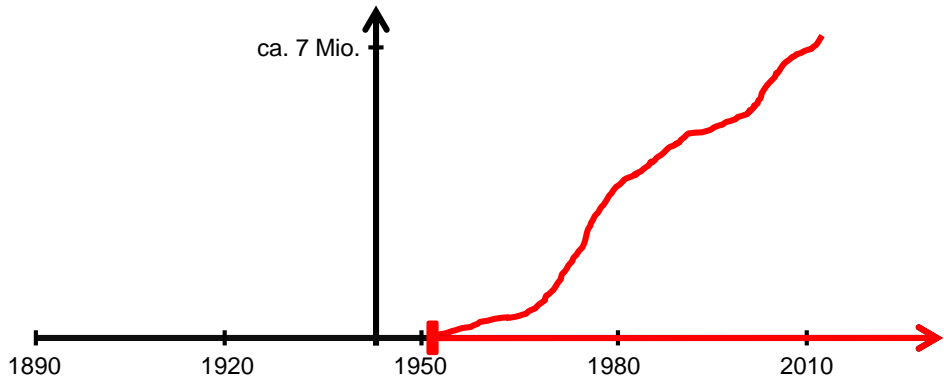
<http://www.foodsofengland.co.uk/steakandkidneypudding.htm>



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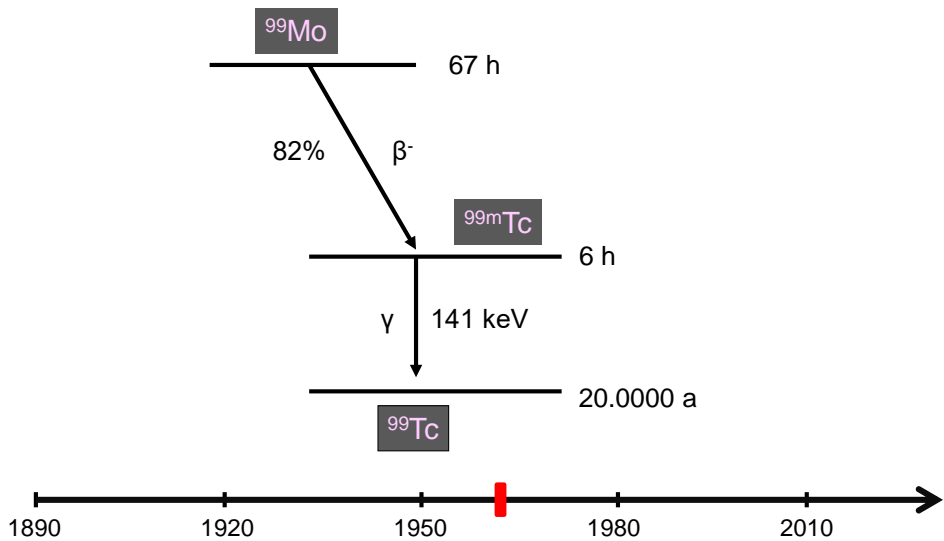
Increasing Number of NM Procedures

Nuclear Medicine Examinations in Europe



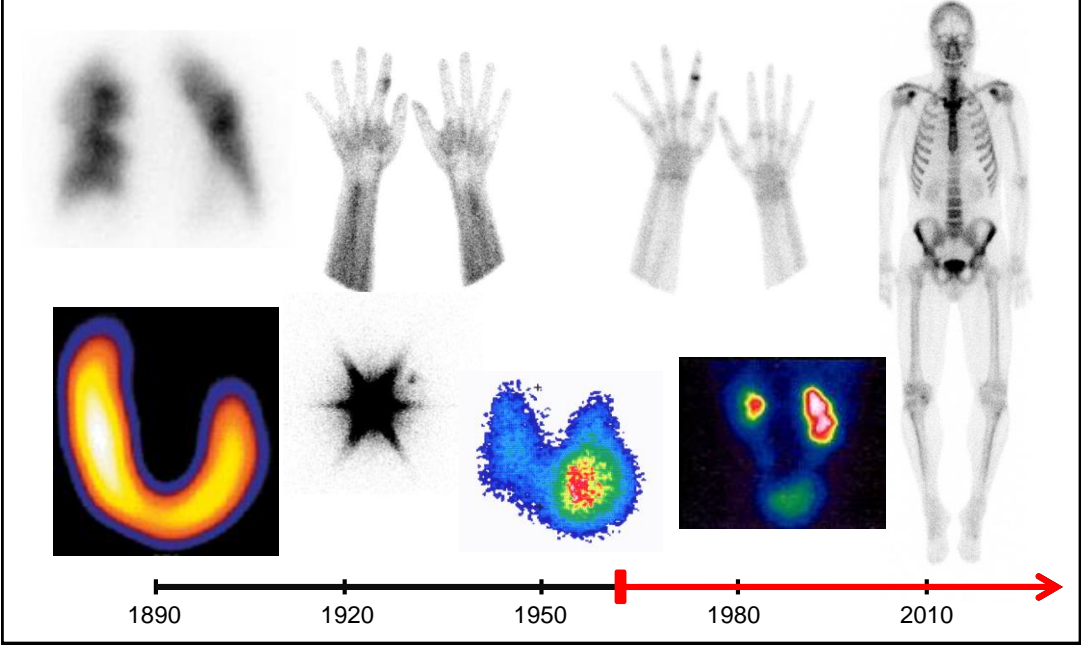
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Tracer



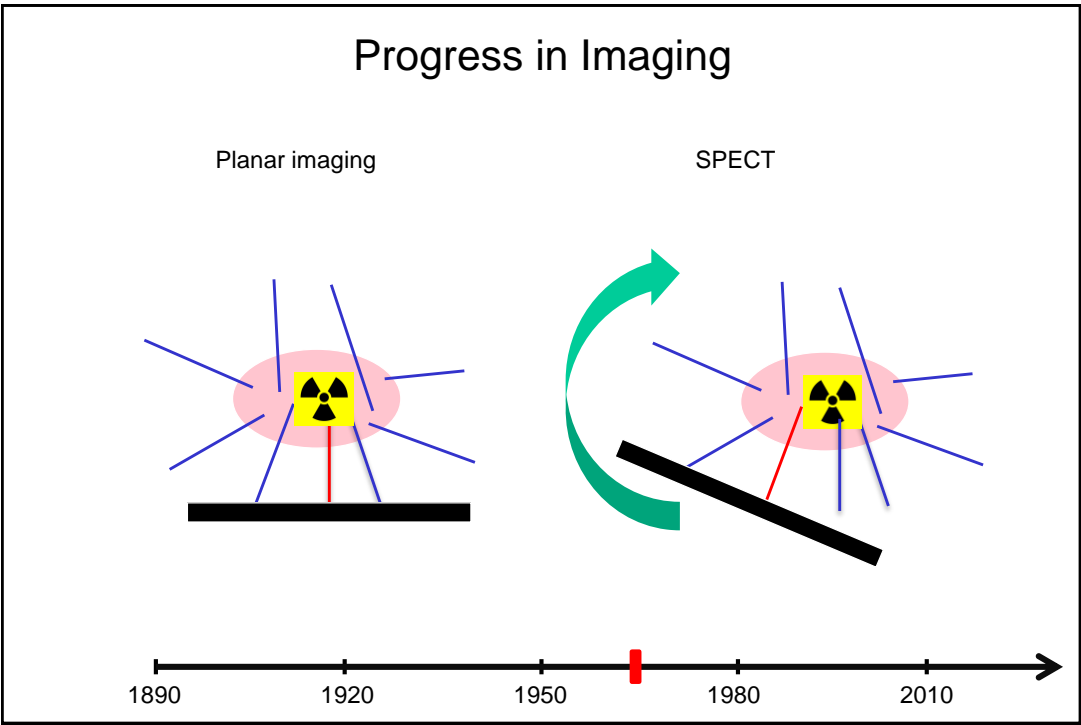
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Tracer Development for Functional Imaging



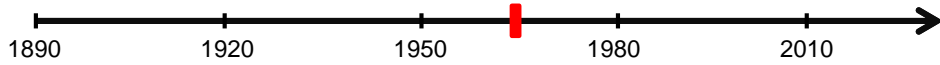
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Progress in Imaging



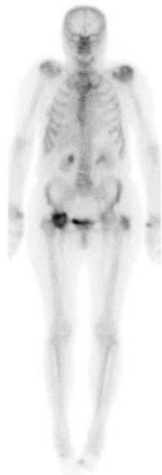
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Progress in Imaging



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Progress in Imaging: SPECT/CT



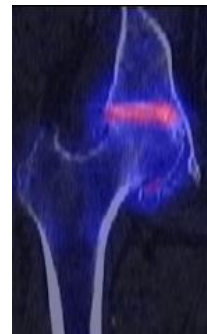
function

+

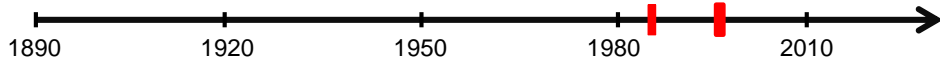


anatomy

=



anatomometabolic imaging



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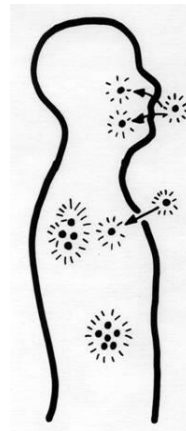
Radiation Protection due to Risk of

Contamination



- Contamination of body surface
- Risk to contaminated other areas/persons
- Risk to contaminate gamma camera
- Organ at risk: skin

Incorporation

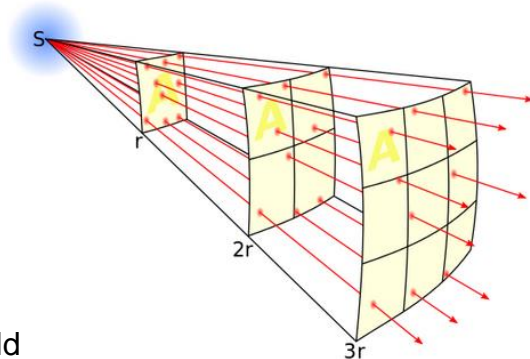


- Incorporation into the body via orifices of the body
- May remain for a long time (depending on half-life)

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Radiation Protection

- Inverse-square law
- Short patient contact
- Shielding
 - „hot lab“
 - syringes
 - transport-boxes
 - mobile radiation shield



https://en.wikipedia.org/wiki/Inverse-square_law

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Radiation Protection

- Protective clothing (gloves etc.)
- Prohibition to drink or eat
- Personal dosimetry
- Correct disposal of waste
- Knowledge of radiation protection rules

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NM Diagnostic Procedures Today

- PET/CT, PET/MR < 10 %
0.025 Mio PET/CT in 2009 (Germany)
- Szintigraphy, SPECT, SPECT/CT > 90 %
2.0 Mio in 2010 (Germany)

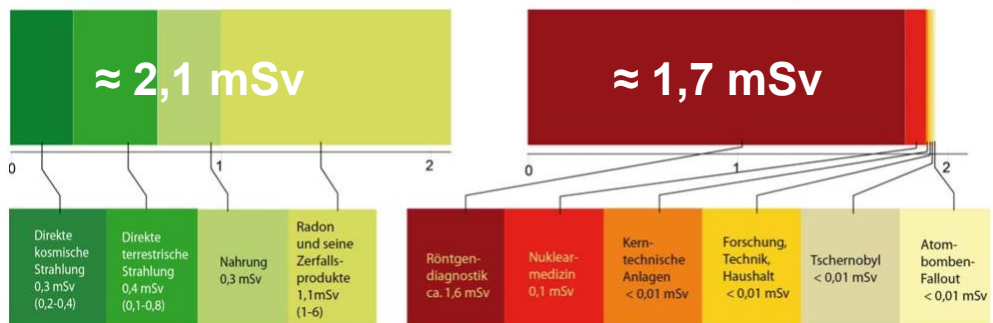
[Hellwig et al. 2011]

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Radiation Exposure

⇒ natural sources

⇒ from man-made sources



Effective annual dose to an individual due to ionising radiation in 2016 (in mSv), averaged over the German population (range in brackets)

https://doris.bfs.de/jspui/bitstream/urn:nbn:de:0221-2018112017017/1/JB2016_14112018.pdf

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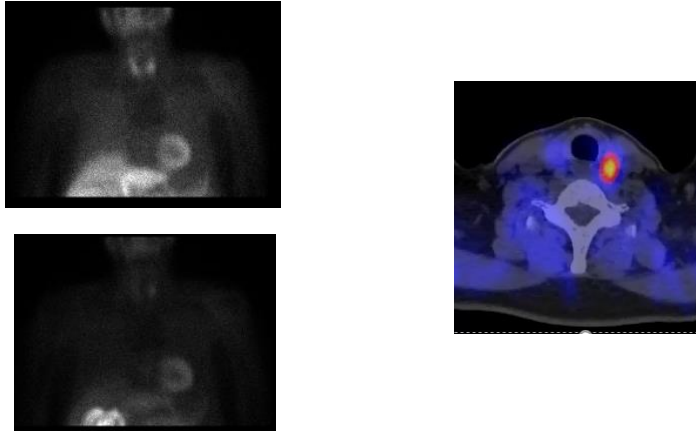
Objective Medical Advantages

- Sensitivity und specificity of SPECT/CT is higher than for SPECT alone
- Attenuation correction
- Quantification

[Mariani et al. 2010]

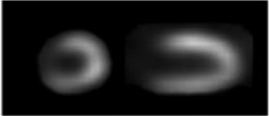
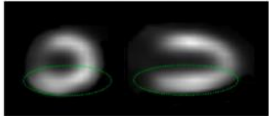

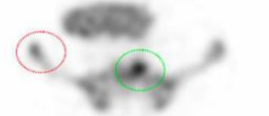
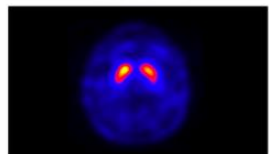
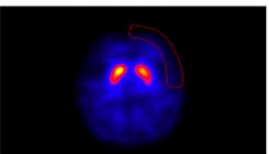
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Localization of Disease



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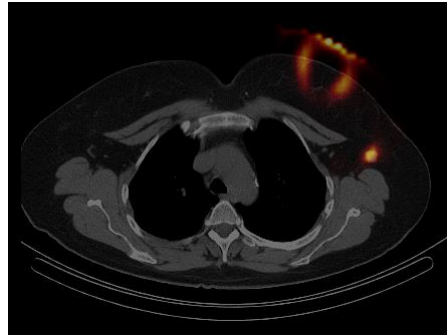
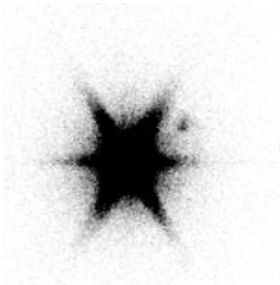
Attenuation Correction

	without CT attenuation correction	with CT attenuation correction
cardiac		
skeletal		
brain		

<http://jnm.snmjournals.org/content/49/8/1305.long>

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Treatment Planning



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Domain of SPECT/CT

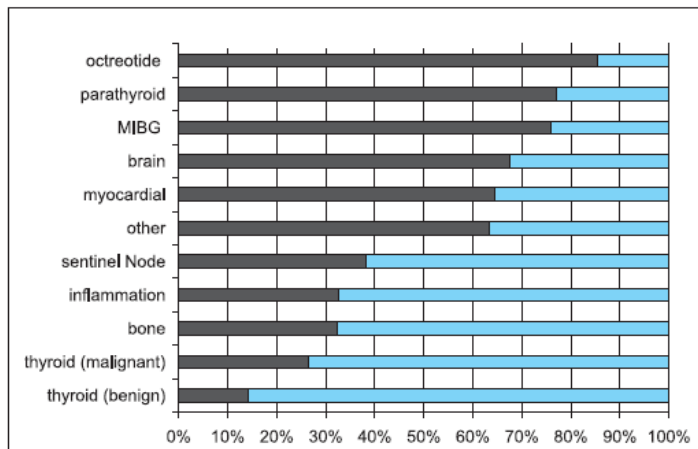


Fig. 3 Frequency (%) of "routine" (■) and "add-on" (■) dual-modality SPECT/CT for a range of clinical indications (see Tab. 2) across responding sites

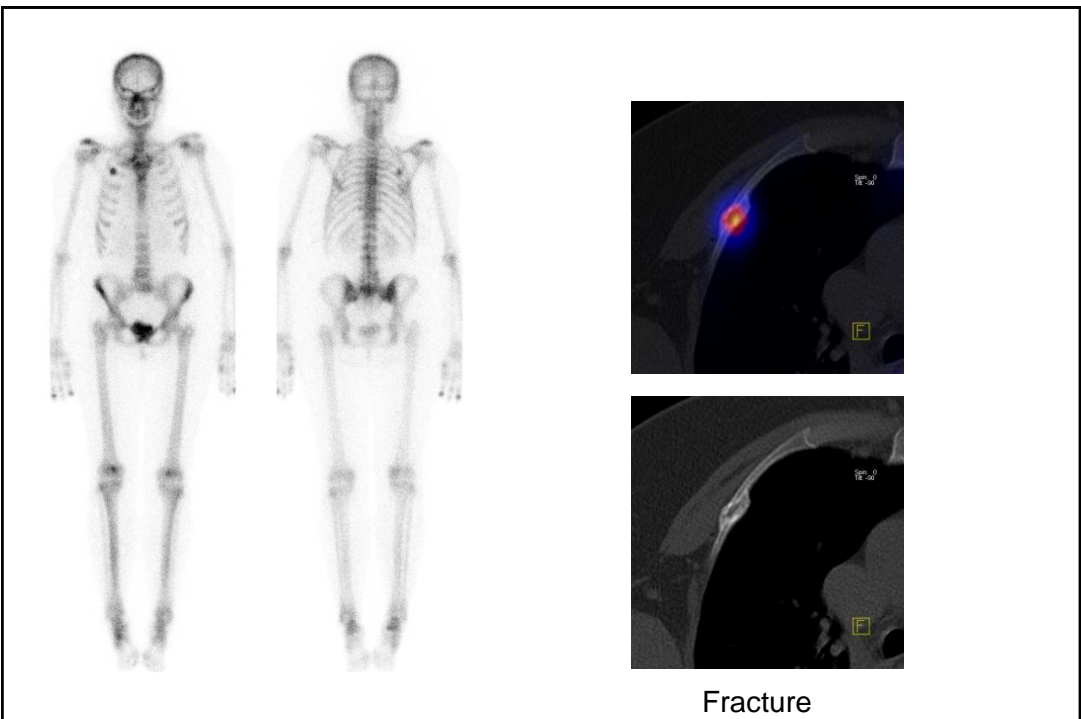
<https://www.thieme-connect.com/products/ejournals/abstract/10.3413/Nukmed-0467-12-01>

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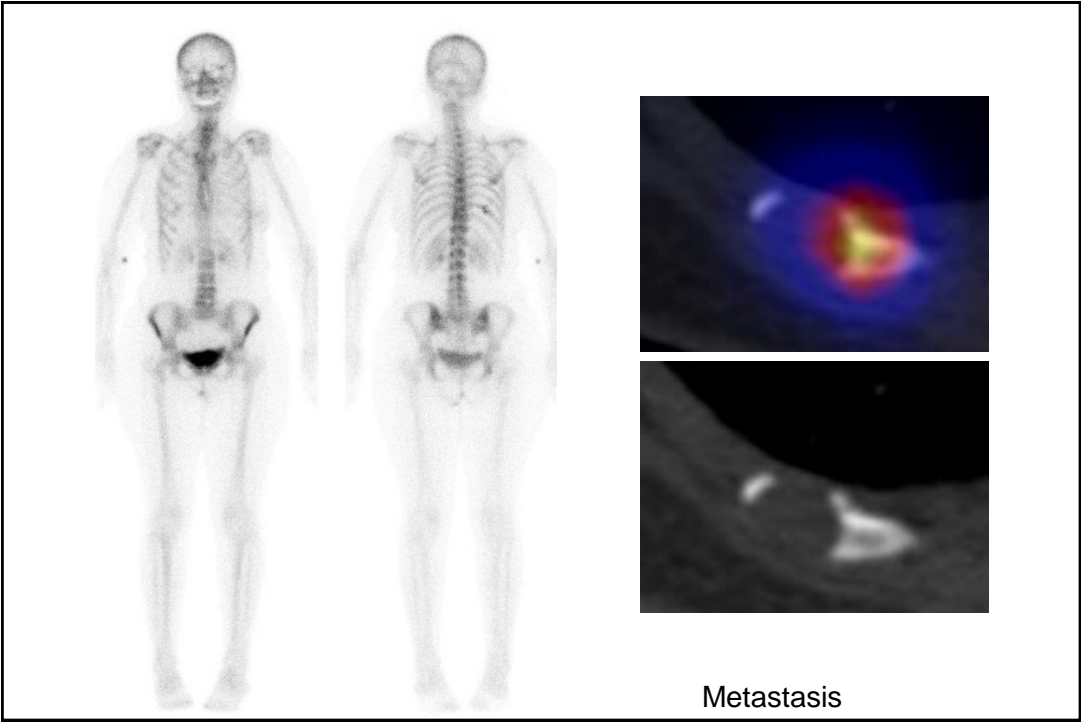
Subjective Medical Advantages

- CT is matrix for SPECT findings
 - Simplified and more accurate diagnosis
 - Integrated reporting
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- Higher confidence of imaging expert
 - Higher confirmability for referring physician

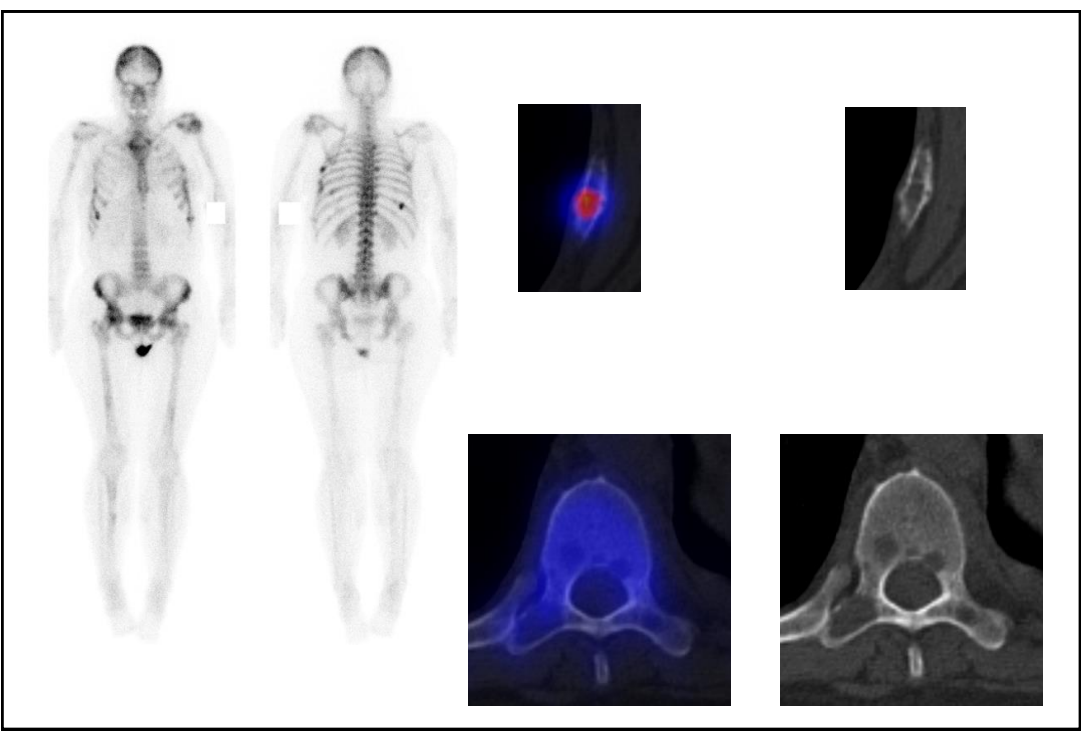
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Future of SPECT/CT

- Whole-body SPECT/CT
- New reconstruction
- New detectors
- Low-dose-concepts for CT
- SPECT list-mode data
- Quantification

“SPECT/CT remains the workhorse of nuclear medicine, even when compared to other strong contenders like PET/CT or PET/MRI.”

[Kuwert et al. 2013]

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