Hull University Teaching Hospitals NHS Trust

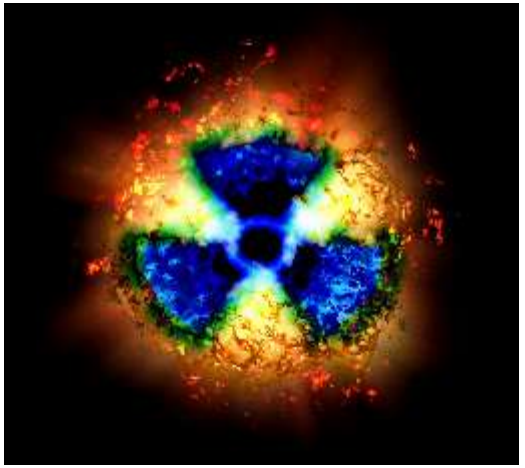
FRCR Lecture VI



Artefacts & Practice Questions

Nuclear Medicine

Dr Helen Gill
Clinical Scientist
Nuclear Medicine Department
Castle Hill Hospital
Hull University Teaching Hospitals NHS Trust
email: helen.gill@hey.nhs.uk

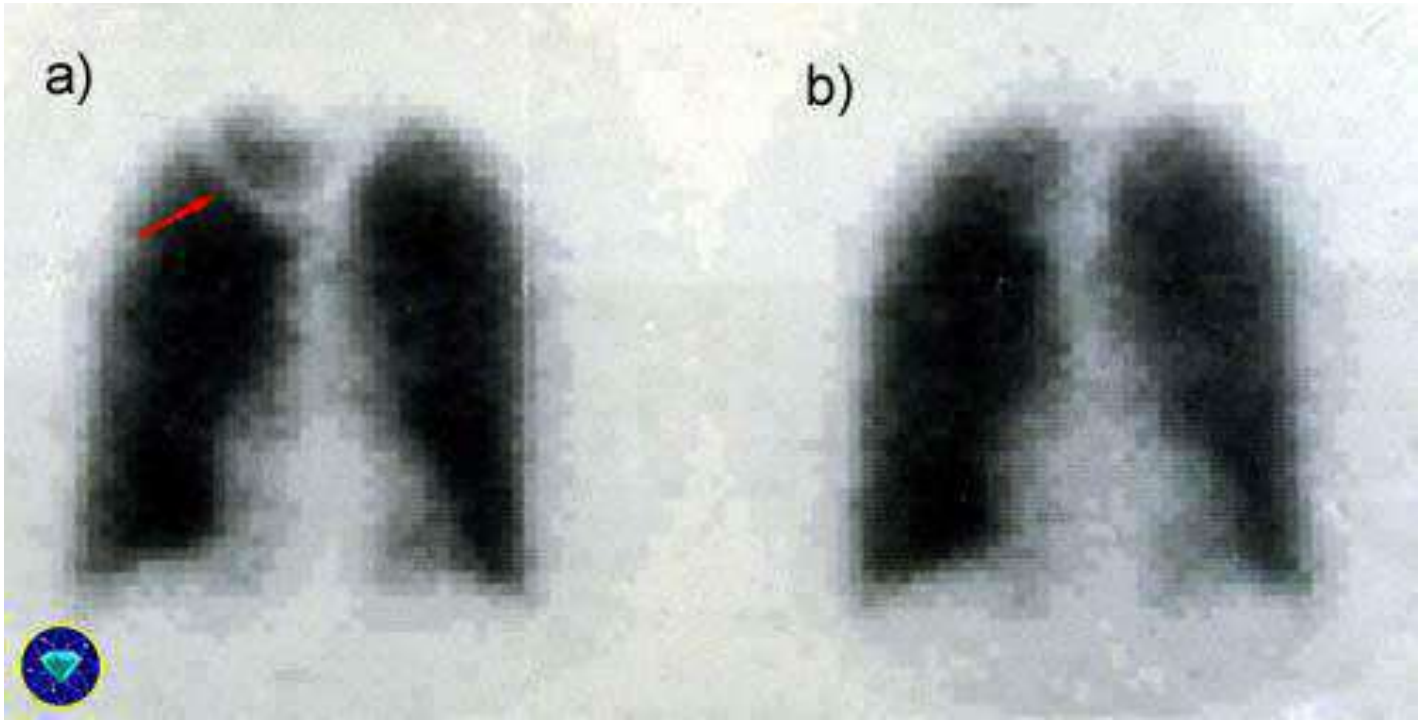


Artefact

- A structure that is not naturally present
  - introduced during preparation or investigation
- Need for constant vigilance
  - before and during scanning

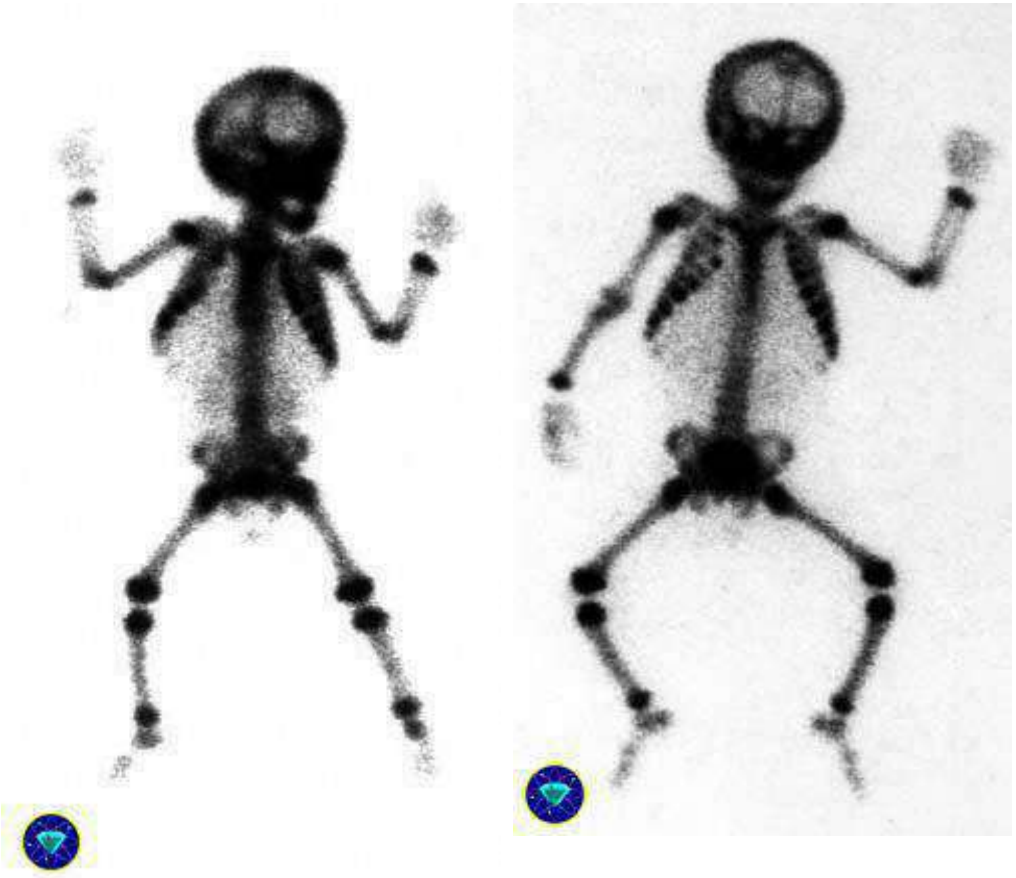


Artefact 1



a) metal jewellery round the neck
b) after removal

Artefact 2

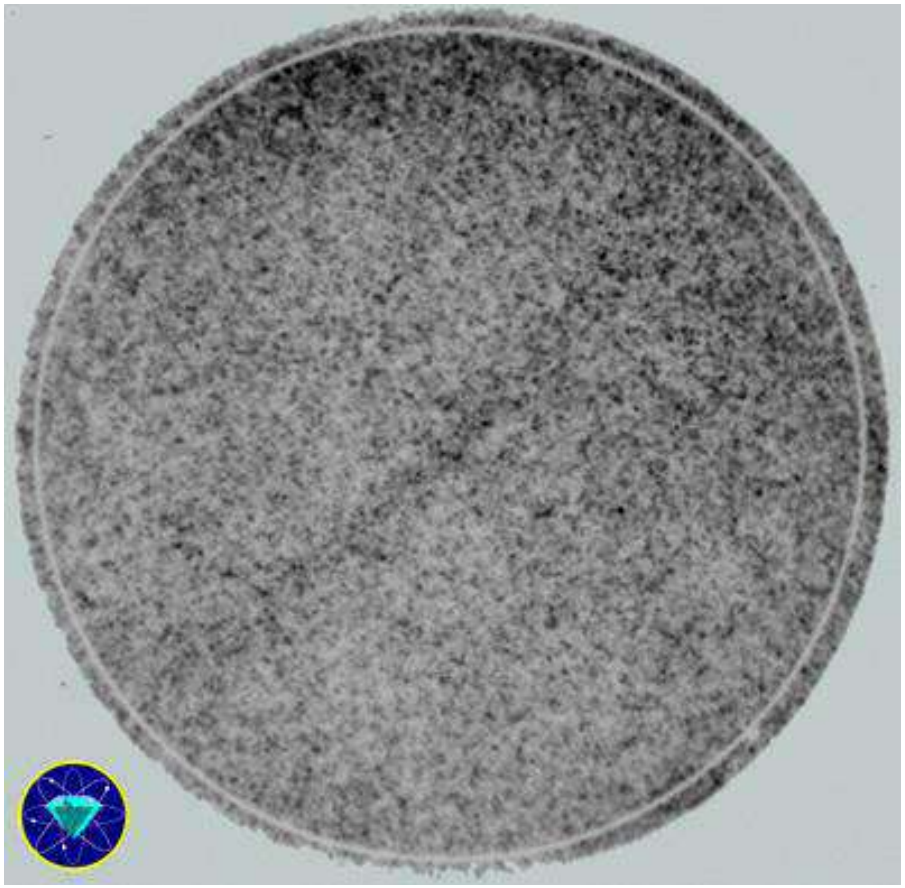


Incorrect collimator

LEGP

LEHR

Artefact 3



Crack in crystal

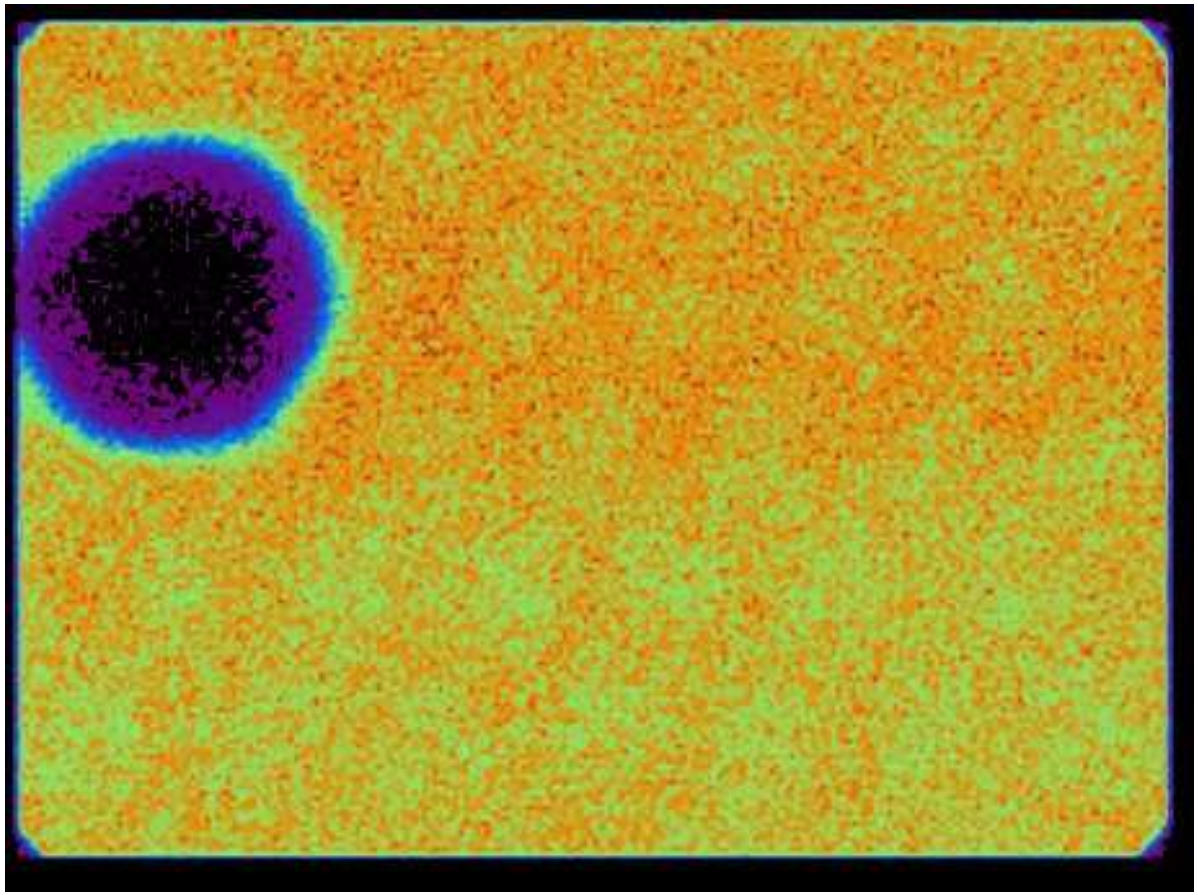
the window was left open overnight !

Artefact 4



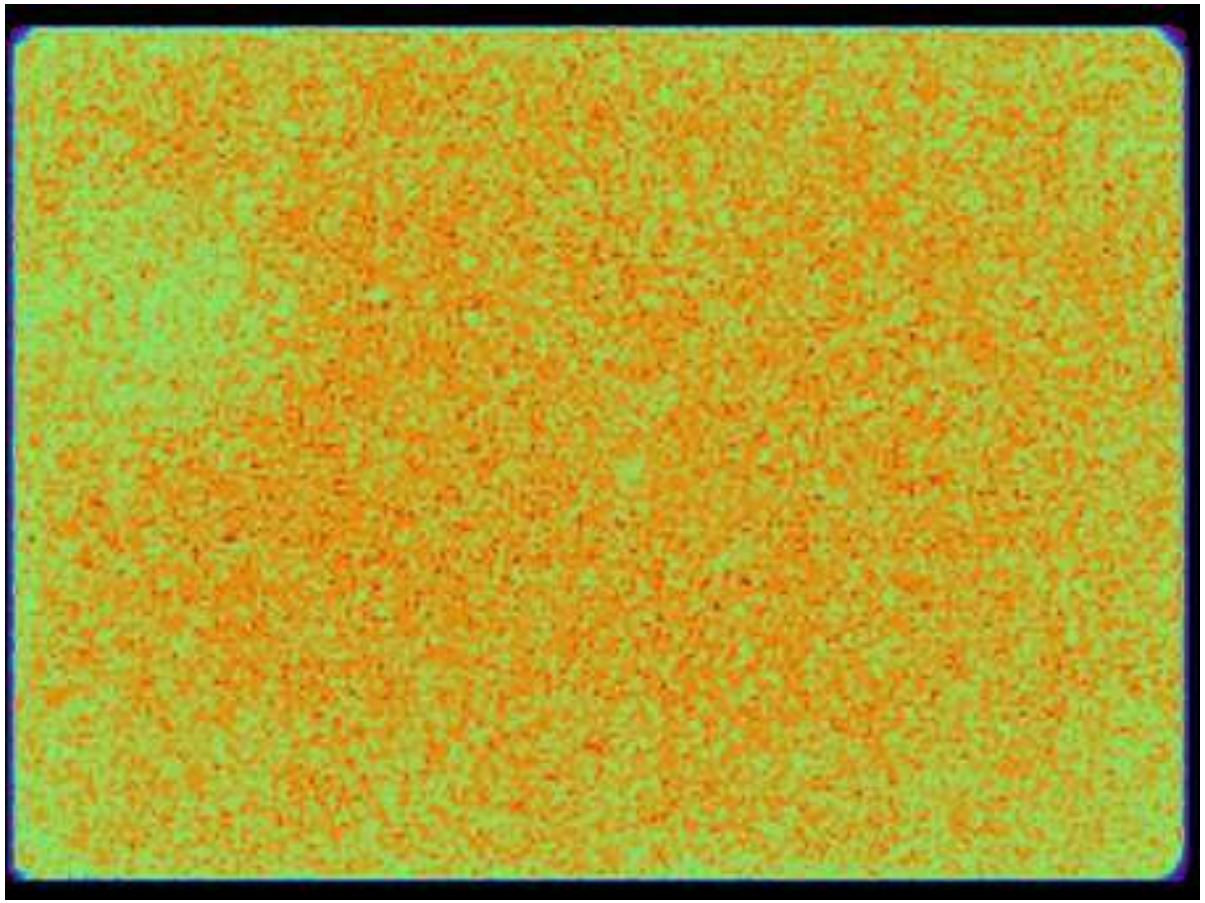
Patient wearing belt

Artefact 5



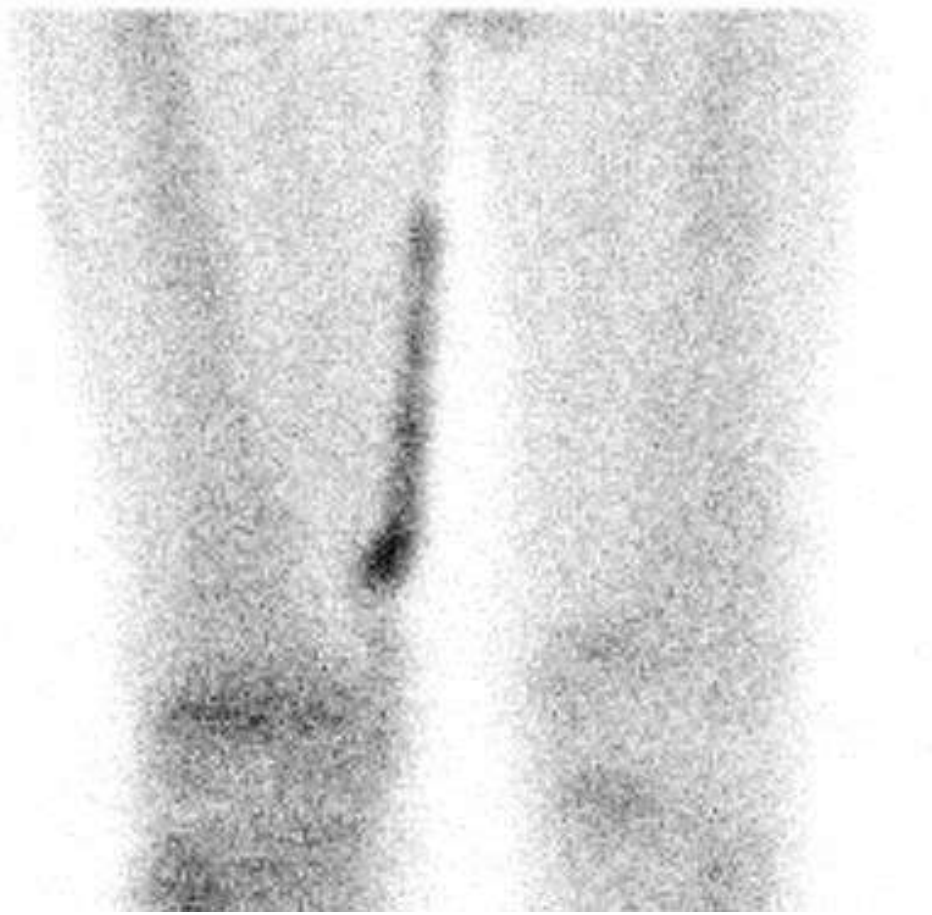
Photomultiplier tube not working

Artefact 6



Non-uniformity artefact

Artefact 7



Patient with urine in catheter

Artefact 8



Urinary contamination

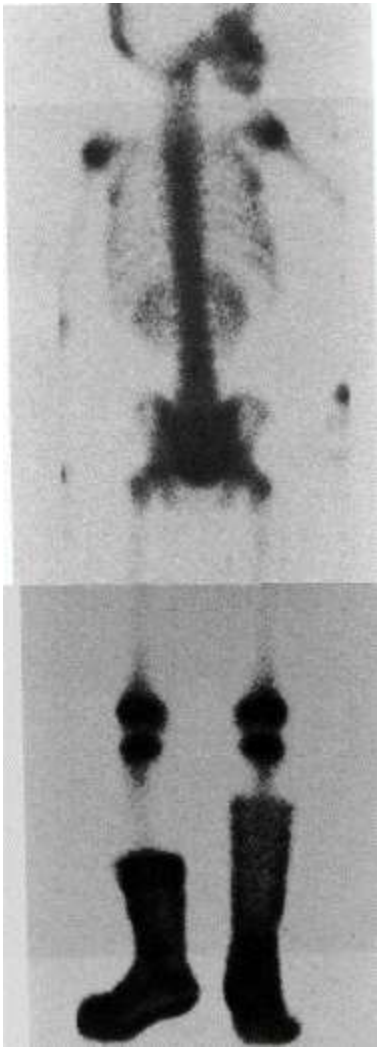
Artefact 9



Extravasation

- Can obscure joints
- Always administer on opposing side to suspect joints
- Always use a venflon or butterfly
- Radiation necrosis in therapy doses

Artefact 10



- Bone spot views
- Contamination
  - Patient spilt urine onto floor
  - Mopped it up with socks !
- Notice increased background counts in lower part of image


Q
&
A

QUESTION 1

Which of the following is a quality control concern for the end user of ^{99m}Tc ?

a. Radionuclide purity

b. Radiochemical purity

c. Chemical purity

d. All of the above

QUESTION 2

In a gamma camera, low energy electrons are ejected when light strikes the:

a. Anode of the PMT

b. Cathode of the PMT

c. The NaI(Tl) crystal

d. The dynode array of the PMT

QUESTION 3

Which of the following is not an example of a gas-filled detector?

a. Dose calibrator

b. Survey meter

c. Photomultiplier Tube

d. Geiger counter

QUESTION 4

Positron emission tomography systems do not use NaI(Tl) crystals because of their:

a. low light yield at 511 keV

b. high linear attenuation coefficient at 511 keV

c. expense

d. low stopping power at 511 keV

QUESTION 5

If a nucleus decays by electron capture which of the following will be emitted in the process:

a. A positron

b. An alpha particle

c. A neutron

d. Characteristic radiation

QUESTION 6

Which of the following would result in increased system spatial resolution for a gamma camera with a parallel-hole collimator:

a. Making the collimator holes longer

b. Making the collimator holes larger in diameter

c. Making the collimator septa thinner

d. Moving further away form the face of the collimator

QUESTION 7

An MPS study using ^{99m}Tc is acquired with the energy window centered around the ^{201}Tl photopeak. Which of the following statements is correct?

a. Tomographic images should be reconstructed using the filter settings for ^{201}Tl

b. The raw images should be evaluated with the final report indicating that the study was suboptimal

c. The acquisition needs to be repeated using the correct energy window

d. The raw data should be corrected using a ^{201}Tl uniformity correction map prior to reconstruction

QUESTION 8

If all other factors are kept constant, a positron emitting radiotracer with a shorter positron range compared to a radiotracer with a longer positron range will provide:

a. Superior image quality

b. Higher radiation dose

c. Faster imaging protocol

d. Reduced photon attenuation

QUESTION 9

The inverse square law is associated with which factor of radiation exposure:

a. Time

b. Distance

c. Shielding

d. All of the above

QUESTION 10

If your dose calibrator is not working, which method could you follow to determine the activity of the radiopharmaceutical to be injected:

a. There is no alternative; you must use another calibrator

b. You can use the activity and assay time provided by the radiopharmacy and apply a decay correction

c. You may use your survey instrument provided it was calibrated for the isotope to be used

d. You must contact the Radiation Protection Adviser

QUESTION 11

After eluting the $^{99}Mo/^{99m}Tc$ generator for the first time, the $Na^{99m}TcO_4$ solution must be assayed to determine:

a. the ^{99m}Tc activity

b. the ^{99}Mo activity

c. both ^{99m}Tc & ^{99}Mo activity

QUESTION 12

Spatial resolution will _____ with increasing distance from a parallel-hole collimator.:

a. degrade

b. improve

c. remain unchanged

d. improve initially, then degrade

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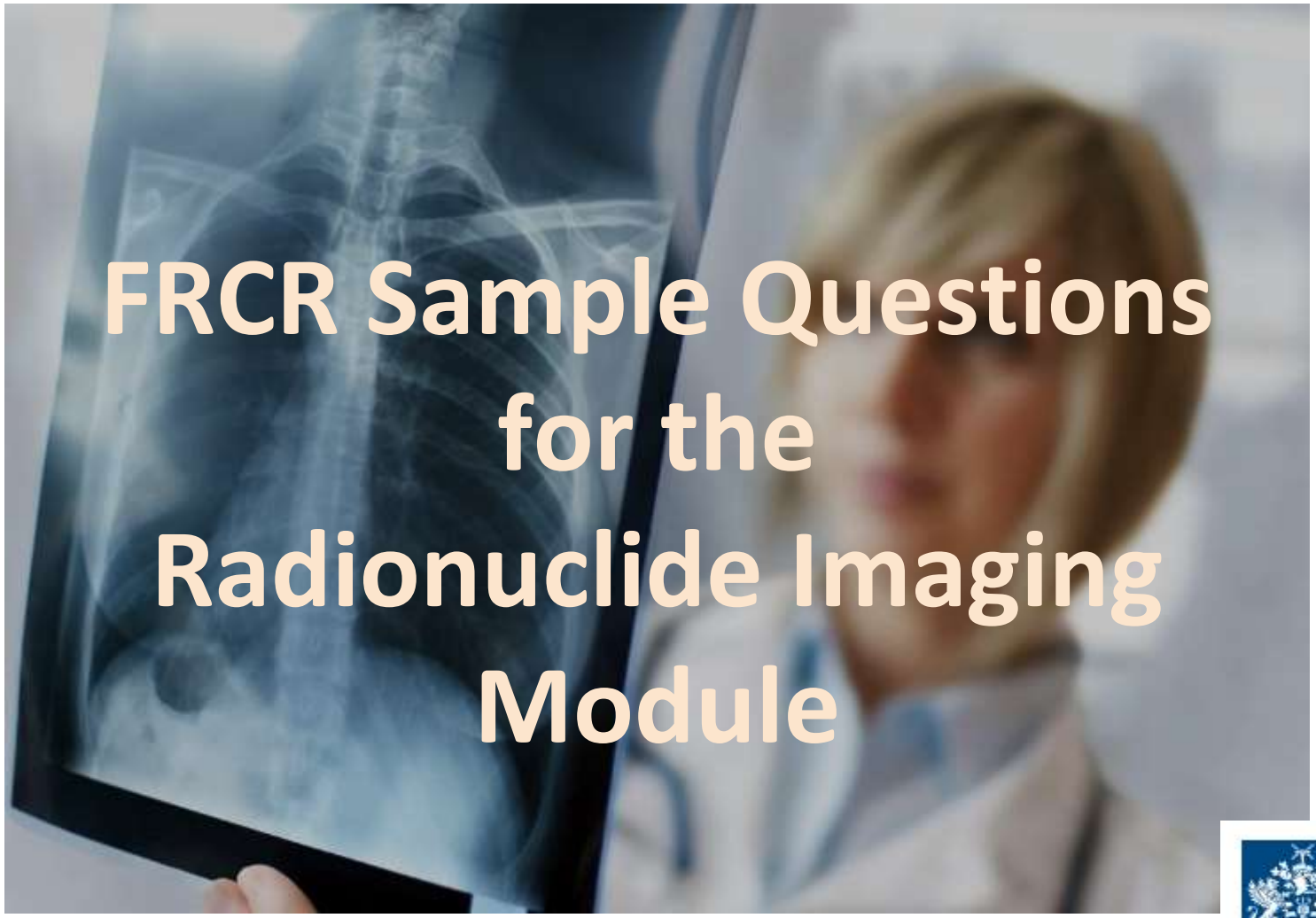

FRCR Sample Questions for the Radionuclide Imaging Module

Clinical Oncology
The Royal College of Radiologists

Radionuclides

a) ideally emit alpha particles when used in a diagnostic setting
b) can be created locally in a cyclotron for medical use
c) that are isotopes of their parent nuclide are easily separated for clinical use
d) are not radioactive until injected into the patient

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In planar imaging, the gamma camera

a) simultaneously creates images of radioactive distribution in many planes

b) can only detect gamma radiation

c) uses sodium iodide (NaI) crystal which is sensitive to the gamma radiation of ^{99m}Tc

d) determines the position of an incident gamma photon in the camera crystal by a few large PMTs

e) uses PMTs to transform light photons into electrons which can be read as an electrical signal that represents light intensity

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Remarkable people.
Extraordinary place.

Collimators, spatial resolution and sensitivity

a) A collimator with more and smaller holes will increase sensitivity
b) A collimator with more and smaller holes will improve spatial resolution
c) A convergent hole collimator may be used for small organs and children
d) The sensitivity of a typical collimator is only in the region of 20-30%
e) It is not possible to have maximum sensitivity and spatial resolution using the same collimator

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b) The current measured in the ionisation chamber of a radionuclide calibrator is dependant on the container in which the radionuclide is housed

c) Vials containing ^{99m}Tc radiopharmaceuticals should be housed in Perspex pots

d) All spillages should be reported to the HSE

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c) would produce gamma rays with a very high HVL

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Thank you for listening

