

CERTIFICATE OF FELLOWSHIP OF THE EUROPEAN BOARD OF NUCLEAR MEDICINE

Examples of Multiple Choice Questions (MCQ)

The MCQ paper in 2008 consisted of 140 Multiple Choice Questions. These were taken from the following Field Codes

FIELD CODES	N
Skeletal system	8
Cardiology	14
Endocrinology	12
Gastroenterology	4
Haematology	4
Infection	6
Pulmonology	7
Nephro - Urology	9
Neurology	11
Oncology	20
Therapy	10
Paediatrics	6
Physics, Radioprotection, Quality Control	11
Radiobiology	4
Radiopharmacy/radiochemistry	10
Biostatistics/Bioethics	4
<i>Total</i>	<i>140</i>

Examples of questions from previous exams are given below. In all cases there is only one correct answer.

- 1:1 Which one of the following benign lesions **does not** normally show increased tracer uptake on bone scans? C
- a) Paget's disease
 - b) Fibrous dysplasia
 - c) Bone cyst
 - d) Englemann's disease
 - e) Osteoid osteoma
- 2 Which one of the following statements **is not** a common finding on a conventional bone scan in a patient with renal osteodystrophy? A
- a) Decreased uptake in the calvaria
 - b) High-bone to soft tissue uptake ratio
 - c) Minimal or no evidence of urinary activity
 - d) Increased uptake in the axial skeleton
 - e) Increased uptake in costochondral junction
- 3 Bilaterally increased renal visualisation on skeletal scintigraphy can be found in the following conditions **except** in A
- a) Renal metastases
 - b) Hypercalcaemia
 - c) Recent chemotherapy
 - d) Renal vein thrombosis
 - e) Radiation nephritis
- 4 Indicate which examination is **the most accurate** in a suspected scaphoid fracture C
- a) Static bone scan
 - b) Dynamic and static bone scan
 - c) MRI
 - d) CT
- 5 Which one of the following statements regarding ^{99m}Tc labelled cardiac perfusion agents is **true**? B
- a) Tetrofosmin has been demonstrated to be more effective than sestamibi to assess myocardial viability
 - b) Hepatic clearance is faster for tetrofosmin than for sestamibi
 - c) Heart to liver ratio is higher with ^{99m}Tc labelled perfusion agents than with ^{201}Tl
 - d) Post-stress acquisition should be started within 10 minutes after injection of tetrofosmin and sestamibi
 - e) Tetrofosmin and sestamibi act as potassium analogues

- 6 Indicate the **correct** statement about the application of nitrates in myocardial perfusion study D
- a) Can be used as a pharmacologic stress agent
 - b) Nitrates reduce collateral flow into ischemic zone
 - c) Decrease myocardial blood flow in areas of resting ischaemia
 - d) Enhances the detection of myocardial viability by ^{99m}Tc radiopharmaceuticals
- 7 Indicate the statement about equilibrium radionuclide cardiography that is **not true** D
- a) A lower than 50% left ventricular ejection fraction is abnormal
 - b) Equilibrium radionuclide angiocardigraphy is commonly used in monitoring Doxorubicin cardiotoxicity
 - c) ^{99m}Tc labelled red blood cells are used in equilibrium radionuclide cardiography
 - d) In the case of cardiac aneurysm, echocardiography is more accurate than equilibrium radionuclide cardiography to determine left ventricular ejection fraction
 - e) Left ventricular ejection fraction below 30% after myocardial infarction indicates poor prognosis
- 8 All of the following statements regarding gated SPECT myocardial perfusion are **true except one** D
- a) Gating errors may result in overestimation of wall thickening
 - b) Gated SPECT provides data on both myocardial perfusion and function
 - c) Dobutamine stress may be used with gated SPECT to assess myocardial viability
 - d) Gated SPECT cannot be performed with ^{201}Tl
- 9 Indicate which one of the following techniques is **not used** in assessment of myocardial viability C
- a) ^{18}F -FDG PET
 - b) ^{201}Tl rest-redistribution imaging
 - c) ^{123}I -MIBG SPECT
 - d) Use of nitrates with ^{99m}Tc sestamibi
 - e) Dobutamine echocardiography
- 10 Metastatic medullary thyroid carcinoma can be localized with **all except one** of the following radiopharmaceuticals B
- a) ^{123}I -MIBG
 - b) ^{131}I -anti AFP antibodies
 - c) ^{18}F -FDG
 - d) ^{111}In -octreotide

- 11 Indicate which statement about radioiodine treatment of Grave's disease is **true** A
- a) Ophthalmopathy may worsen after ^{131}I therapy
 - b) Standard dosage capsules have a dosimetric advantage for the patient
 - c) Pregnancy and fathering should be avoided for at least 12 months after treatment
 - d) Treatment with beta-blockers should be discontinued for at least 5 days prior to radioiodine therapy
- 12 Indicate which one of the following drugs **may interfere** with the uptake of ^{123}I in the thyroid gland D
- a) Beta-blockers
 - b) Alpha-blockers
 - c) Calcium channel blockers
 - d) Amiodarone
 - e) Calcitriol
- 13 Indicate which statement is **true** about ^{111}In -octreotide (pentetreotide) B
- a) Is a peptide consisting of 5 amino acids
 - b) Has the highest affinity for the somatostatin receptor subtype 2 (SSTR2)
 - c) Can be used in treatment of neuroendocrine tumours based on emitted bremsstrahlung
 - d) Has a higher sensitivity than ^{123}I -MIBG in localizing pheochromocytomas and neuroblastomas
 - e) Has a sensitivity of >90% for localization of insulinomas
- 14 Indicate which diagnostic criterion for gastrointestinal bleeding localization using $^{99\text{m}}\text{Tc}$ labelled red cells blood is **false** C
- a) Imaging must be acquired dynamic or as serial static images
 - b) Abnormal activity increases over time
 - c) A focal area of increased red cell accumulation that does not move within the bowel is the most specific criterion
 - d) Abnormal activity can progress through the bowel retrograde
 - e) Small bowel bleeding can be differentiated from large bowel bleeding by the appearances of blood filling multiple small bowel loops

- 15 Indicate which statement about vitamin B₁₂ absorption (Schilling) test is **correct** A
- a) The Schilling test with intrinsic factor can be used to discriminate between intestinal malabsorption and lack of intrinsic factor
 - b) Low vitamin B₁₂ absorption when administered with intrinsic factor rules out pernicious anemia
 - c) The test cannot distinguish folic acid deficiency from pernicious anaemia
 - d) For patients on vitamin B₁₂ injection treatment, it is necessary to wait at least 4 weeks from last injection before performing the test
 - e) The most common assays use ¹²³I or ¹²⁴I labelled vitamin B₁₂
- 16 Indicate which statement about joint replacement is **incorrect** C
- a) High uptake of ¹¹¹In-oxine labelled WBC around a hip prosthesis may be due to loosening with or without infection or reactive bone marrow islands
 - b) Bone marrow scan using ^{99m}Tc sulphur colloid can be used in conjunction with ¹¹¹In-oxine WBC-scans to help differentiate loosening with or without infection from nonuniform marrow distribution
 - c) Concordant intense uptake of ^{99m}Tc sulphur colloid and In-111-oxin WBC is highly suggestive for loosening with or without infection
 - d) For the diagnosis of loosening (with or without infection) of a knee or hip prosthesis ¹¹¹In-oxine WBC and Tc-99m-HMPAO labelled WBC have equal diagnostic accuracy
- 17 Indicate which of the following statements about ^{99m}Tc -HMPAO labelled WBC is **correct** D
- a) In vivo labelling is preferred to in vitro labelling
 - b) Abdominal imaging should be delayed for a minimum of 4 hours
 - c) The radiation dose is higher than for ⁶⁷Ga
 - d) Urinary tract activity is commonly seen
- 18 Indicate which of the following statements related to ventilation / perfusion imaging is **false** C
- a) Ventilation / perfusion imaging is mainly used for the exclusion of pulmonary embolism in patients with abnormal D-dimer, normal chest x-ray low pre-test probability
 - b) Multislice CT is preferred to ventilation / perfusion imaging in patients with abnormal chest x-ray
 - c) A large (>75% of a lung segment) mismatched ventilation / perfusion defect indicates a high probability of pulmonary embolism (according to PIOPED)
 - d) The pathology behind a perfusion abnormality can rarely be confirmed without a multislice CT

- 19 Which of the AIDS related condition listed is **not** associated with increased ^{67}Ga uptake? D
- a) Mycobacterium avium intracellulare infection
 - b) Mycobacterium tuberculosis infection
 - c) Pneumocystis carinii pneumonia
 - d) Kaposi's sarcoma
- 20 Indicate which statement about $^{99\text{m}}\text{Tc}$ MAG₃ is **correct** A
- a) Liver uptake and bile excretion may be seen
 - b) It is stable for 12 hours at room temperature
 - c) $^{99\text{m}}\text{Tc}$ DTPA is preferred to MAG3 in patients with reduced renal function
 - d) It is excreted via 80% glomerular filtered and 20% tubular secretion
- 21 Indicate which statement about diuresis renography is **false** D
- a) The diuretic may be administered before, at the same time, or after injection of the radiopharmaceutical
 - b) The renal function is a major determinant of the of the diuretic induced flow rate
 - c) An optimal response to the diuretic is dependent on adequate hydration
 - d) A full bladder will not influence the upper tract urodynamics
- 22 Indicate which statement is **false** regarding angiotensin-converting enzyme inhibition (ACEI) renography A
- a) The plasma renin activity is reduced
 - b) Captopril enhances the abnormalities seen in the renal activity time curve in the presence of significant renovascular disease
 - c) Salt depletion enhances hypotension due to ACEI
 - d) ACEI does not result in a reduction of the parenchymal transit time in normal kidneys
- 23 Indicate which statement about regional cerebral blood flow (CBF) SPECT is **false** B
- a) It is useful in the differential diagnosis of dementia
 - b) It provides very specific pattern for each type of dementia
 - c) It is useful for localization of the epileptogenic focus before surgical treatment of refractory epilepsy
 - d) Images reflect the regional cerebral blood flow at the time of injection

- 24 Indicate which one of the listed substances is **normally used** to explore the cerebral vasodilatory flow reserve by means of CBF SPECT C
- a) Adenosine
 - b) Captopril
 - c) Acetazolamide
 - d) Dobutamine
- 25 Indicate which one of the following listed ligands **does not** provide information about the presynaptic transporter system for dopamine B
- a) ^{123}I - β -CIT
 - b) ^{123}I - IBZM
 - c) $^{99\text{m}}\text{Tc}$ - TRODAT
 - d) ^{123}I - FP-CIT
- 26 Which one of the following statements about PET of the brain is **true** D
- a) Ictal ^{18}F -FDG PET is preferred to SPECT for localization of the epileptogenic focus before surgical treatment of refractory epilepsy
 - b) ^{18}F -FDG uptake in radiation necrosis is consistently more intense than normal cortical uptake
 - c) ^{18}F -FDG uptake in the cerebellar cortex is normally less intense than cerebral cortex
 - d) ^{18}F -FDG is the most common used radiopharmaceutical for regional cerebral blood flow in PET
- 27 Choose the **false** statement about the sentinel node procedure in breast cancer D
- a) The procedure is normally not performed in women older than 80 years
 - b) The procedure is normally performed in ductal carcinoma in situ (DCIS) histologic grade III
 - c) The procedure is normally not performed when tumor size >5 cm
 - d) The procedure is indicated for T1-3 N0-1 M0 tumors
- 28 Tumor uptake of ^{18}F -FDG is influenced by all of the following **except** C
- a) Blood glucose level
 - b) Glut-1 expression (glucose transporter Glut-1)
 - c) Pgp expression (multidrug resistance p-glycoprotein)
 - d) Tumour growth rate
- 29 Choose the **correct** mechanism responsible for the specific uptake of MIBG in adrenal medulla C
- a) Bound to noradrenalin reuptake-1 presynaptic membrane receptors
 - b) Passive diffusion into postsynaptic granules
 - c) Accumulation in presynaptic storage vesicles
 - d) Metabolized to 3-methoxy-4-hydroxymandelic acid (VMA)

- 30 Choose the cancer that normally shows the **highest** uptake of ^{67}Ga D
- a) Lung cancer
 - b) Head and neck tumours (squamous cell carcinoma)
 - c) Colorectal cancers
 - d) Lymphoma
 - e) Malignant melanoma
- 31 Indicate the **correct** statement about scintigraphy with $^{99\text{m}}\text{Tc}$ labelled anti-CEA D
- a) Is useful for initial staging of colorectal cancer
 - b) Is useful in follow-up of colorectal cancer when serum CEA is normal
 - c) May be used to differential between benign and malignant hepatic tumors
 - d) May be used to detect and localize recurrent colorectal carcinoma in abdomen and pelvis
- 32 Indicate which one of the following tests is **the most sensitive** to indicate residual or recurrent disease in medullary thyroid cancer D
- a) ^{111}In -octreotide
 - b) ^{123}I -MIBG
 - c) ^{18}F -FDG PET/CT
 - d) Pentagastrin stimulated calcitonin
- 33 Which of the following drugs **does not** interfere with the uptake and / or retention of MIBG? A
- a) beta-blockers
 - b) antipsychotics
 - c) tricyclic antidepressants
 - d) calcium channel blockers
- 34 Which one of the following factors has **no influence** on the biodistribution and tumor uptake of ^{18}F -FDG? D
- a) Insulin level
 - b) Muscular exercise the day before
 - c) Ambient temperature
 - d) Body mass index

- 35 Indicate for which disease a response to ^{131}I -MIBG therapy is **best documented** A
- a) Neuroblastoma
 - b) Pheochromocytoma
 - c) Carcinoid
 - d) Medullary thyroid cancer
- 36 Which radionuclide is recommended for radiosynovectomy of small finger joints? A
- a) ^{169}Er
 - b) ^{188}Re
 - c) ^{90}Y
 - d) ^{198}Au
- 37 Indicate which one of the following statements regarding radionuclide therapy for bone pain palliation is **false** D
- a) Is indicated in multiple bone metastases
 - b) It does not have any significant anti-tumoral effect
 - c) Mild, reversible bone marrow suppression is the primary side effect
 - d) It cannot be used in patients with prior history of extensive external irradiation
- 38 Indicate which one of the following statements regarding treatment of lymphoma with ^{90}Y -ibritumomab tiuxetan (Zevalin) is **false** D
- a) Imaging cannot be performed with Zevalin
 - b) Radiation exposure to hospital staff and relatives is negligible with Zevalin
 - c) A dose of unlabeled rituximab is administered before injection of ^{90}Y -ibritumomab tiuxetan
 - d) ^{90}Y -ibritumomab tiuxetan has a disadvantage compared to ^{131}I -tositumomab (Bexxar) in more heterogeneous antibody distribution
- 39 Indicate which one of the following statements about hepatobiliary scintigraphy is **correct** D
- a) Biliary atresia is associated with poor uptake and excretion by the liver
 - b) Normal gallbladder ejection fraction is $>50\%$
 - c) Non-visualisation of gallbladder after 1 hour is almost diagnostic for acute cholecystitis in a symptomatic patient
 - d) A clearing of most of the radiopharmaceutical from the circulation by 5 minutes is normal

- 40 Indicate which finding on a ^{99m}Tc DMSA scan is the most typical for acute pyelonephritis D
- a) Irregular, increased uptake in the renal pelvis
 - b) Triangular shaped kidney
 - c) Triangular midzone lesion in a irregular shaped, large kidney
 - d) Triangular upper or lower pole defect in a normal sized and normal shaped kidney
- 41 Bricks are used to attenuate a gamma ray beam. Two bricks reduce the intensity to half of the initial value (no brick shielding). C
- Choose the **correct** statement
- a) Four bricks would reduce the intensity to 12.5% of the initial intensity
 - b) Six bricks would reduce the intensity to 25% of the initial intensity
 - c) Eight bricks would reduce the intensity to 6.25% of the initial intensity
 - d) Three bricks would reduce the initial intensity to 25% of the initial intensity
- 42 Choose the **correct** effect of using too high background subtraction in the calculation of left ventricular ejection fraction in equilibrium radionuclide angiography A
- a) Increases the ejection fraction
 - b) Decreases the ejection fraction
 - c) No change
 - d) No change but degrades the statistic
- 43 Indicate the **best statement** about the partial volume effect C
- a) Overestimation of activity in small volume because of scatter from surrounding activity
 - b) Underestimation of activity in a volume larger than the field of view
 - c) As the size of a radioactive structure decrease, the apparent activity concentration also decreases
 - d) Underestimation of activity in a volume because of too high count rate
- 44 Uniformity of a gamma camera depends on all of the following factors **except** one C
- a) Variation of photomultiplier tube response
 - b) X,Y positioning of pulses along the field of view
 - c) Photon energy resolution
 - d) Edge packing

- 45 Choose the **correct** statement: the absorbed dose to tissue in a nuclear medicine procedure is B
- a) The concentration of radioactivity in MBq per kg
 - b) The energy absorbed per unit mass of tissue
 - c) Measured in Sieverts
 - d) Dependent on the Quality Factor for the type of radiation
- 46 Indicate which cell type is the **most** radiosensitive A
- a) Lymphocytes
 - b) Granulocytes
 - c) Erythrocytes
 - d) Mucosal cells lining the GI tract
- 47 Indicate which statement is **false** about Tin (II) in technetium kits C
- a) Is necessary to reduce pertechnetate added to the kit
 - b) Is sensitive to the presence of oxygen
 - c) Forms an essential part of the final radiopharmaceutical
 - d) Is generally present in quantities of less than 1 mg
- 48 Choose the **correct** statement: exposure of ^{99m}Tc MDP to air may result in C
- a) Increased uptake in liver and spleen
 - b) Increased renal excretion
 - c) Increased uptake in stomach, thyroid and salivary glands
 - d) Increased uptake in the bone marrow
- 49 Indicate which statement about radiolysis is **false** D
- a) The longer half-life of the radionuclide, the more extensive is the radiolysis
 - b) The higher the specific activity, the greater is the radiolysis
 - c) The more energetic the radiation, the greater is the radiolysis
 - d) Radiolysis is independent of temperature
- 50 Indicate which one of the following statements is **not** fulfilled by the Helsinki Declaration A
- a) Clinical research does not need the subjects consent if it is expected to be of benefit to the subject
 - b) Biomedical research cannot be carried out unless the importance of the objective is in proportion to the inherent risk to the subject
 - c) Each experimental procedure should be formulated in a protocol approved by an independent committee
 - d) For those who are unable to give consent this should be sought from a responsible relative

