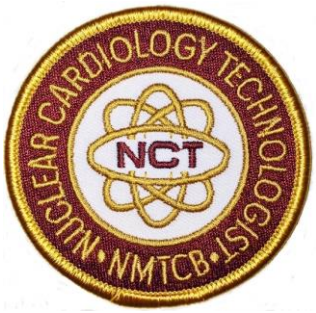
NMTCB

NUCLEAR CARDIOLOGY EXAMINATION



CONTENT SPECIFICATIONS

I. **Procedures: Indications, Instrumentation, Acquisition, and Processing (~50%)**

- A. Principles of Nuclear Cardiology and PET/CT Cardiac Imaging
  1. Patient Preparation
  2. Sequencing of procedures
  3. Injection techniques and imaging times
  4. Patient Positioning
  5. Gating parameters
     - a. Framing rate
     - b. Acceptance window
  6. Acquisition Parameters
  7. Sinograms
  8. Identification of normal and abnormal findings
     - a. Incidental findings
- B. Myocardial Perfusion Imaging
  1. Indications and Contraindications
  2. Treadmill exercise
  3. Pharmacologic stress
  4. Acquisition Protocols
     - a. SPECT and SPECT/CT MPI protocols
       - i. SPECT and SPECT/CT parameters
       - ii. Prone Imaging

b. PET and PET/CT MPI protocols

5. Processing
    a. Attenuation Correction
    b. Image manipulation techniques
    c. Image filtering and reconstruction
        i. Filtered back projection
        ii. Iterative reconstruction
    d. Ejection fraction determination
    e. Transient ischemic dilation (TID)
    f. Polar plot analysis
    g. Wall motion analysis

C. Equilibrium radionuclide angiogram (MUGA/RVG/ERNA)
1. Indications and Contraindications
2. Acquisition Protocols
    a. Resting
    b. Bicycle exercise
    c. Gating parameters
        i. Framing rate
        ii. Acceptance window
    d. Patient Positioning
3. Processing
    a. Ejection fraction calculations
    b. Wall motion analysis

D. First Pass and Shunt Studies
1. Indications and contraindications
2. Heart Shunt Study Protocols
    a. Left-to-right cardiac shunt study
    b. Right-to-left cardiac shunt study
3. First pass study for ejection fractions
4. Processing
    a. Cineangiogram
    b. Ejection fraction calculations

E. Cardiac Amyloidosis
1. Indications and Contraindications
2. Planar, SPECT and SPECT/CT acquisition protocols
3. Processing
    a. Grading on Planar and SPECT imaging

b. Heart to contralateral lung ratio
c. Heart to bone uptake

F. Heart Failure
1. Imaging
a. Indications and contraindications
b. Planar, SPECT and SPECT/CT acquisition protocols
c. Processing
i. Grading on Planar and SPECT imaging
ii. Heart / mediastinum uptake ratio
iii. Heart to bone uptake
2. Non-Imaging blood volume analysis

G. Cardiac Sarcoidosis
1. Indications and Contraindications
2. Acquisition Protocols
a. Planar, SPECT, and SPECT/CT
b. PET and PET/CT
3. Processing
a. SUV for Inflammation assessment

H. Cardiac PET and PET/CT Protocols
1. 2D vs 3D imaging
2. Viability Protocols
3. Coronary CTA
4. Processing and Quantitative Analysis
a. Calcium Scoring
b. Regional blood flow
c. Viability/heart to lung ratio
d. Functional images

I. Quality control/Quality Assurance
1. Camera/system performance for SPECT and SPECT/CT
2. System performance for PET/CT systems
3. Image assessment
4. Assessment of filtering techniques
5. Interpretation of results and appropriate action
a. Identification of false findings and their cause

J. Artifacts
1. Radiopharmaceutical distribution
2. Artifacts created by acquisition parameters

a. Uniformity
b. Energy window
c. Gating
d. Motion
e. COR
f. Attenuation

3. Artifacts created by processing techniques
4. Artifacts created by CT and image fusion

II. Anatomy/Physiology/Pathology (~10%)

A. Structure of the heart
1. Cross-sectional anatomy
2. Heart chambers
3. Heart wall
4. Heart valves and great vessels
5. Coronary artery distribution
a. Regional myocardial blood flow

B. Normal function of the heart
1. Cardiac electrophysiology
a. Conduction pathways
b. Normal electrocardiogram
2. Cardiac Output
3. Ejection Fraction
4. Stroke Volume
5. Myocardial cell metabolism
6. Normal and abnormal physiologic responses to stress

C. Abnormal Heart Function
1. Glucose metabolism
2. Hypokinesis, akinetic, dyskinesia, aneurysm

D. Cardiac pathologies
1. Amyloidosis
2. Angina
3. Arrhythmias
4. Cardiac Sarcoidosis
5. Cardiomyopathies
6. Congenital cardiac anomalies
7. Coronary artery disease

8. Heart Failure
9. Myocardial ischemia, infarction, hibernation, stunning
10. Valvular diseases and effects on the heart

III. Radiopharmaceuticals and Interventional Drugs: Properties, Indications, Contraindications, Dosages, Biodistribution, and Adverse Effects (~15%)

A. Radiopharmaceuticals
   1. I-123 MIBG
   2. Tc-99m- PYP
   3. Tc-99m sestamibi
   4. Tc-99m tetrofosmin
   5. Tl-201 thallous chloride
   6. Tc-99m labeled RBC's
   7. F-18 fluorodeoxyglucose (FDG)
   8. N-13 ammonia
   9. Rubidium-82 chloride
      a. Strontium-82
   10. Ga-67
   11. I-131 HSA

B. Interventional drugs
   1. ACE Inhibitors
   2. Acetylcholine Antagonist
      a. atropine
   3. Adenosine agonists
      a. adenosine
      b. regadenoson
   4. Adenosine deaminase inhibitor
      a. dipyridamole
   5. Antiarrhythmics
      a. lidocaine (C1)
      b. beta blockers (C2)
      c. amiodarone (C3)
      d. calcium channel blockers (C4)
      e. digoxin (other)
      f. adenosine (other)

6. Anticoagulants
    a. anticoagulant citrate dextrose (ACD-A)
    b. acetylsalicylic acid, clopidogrel, dipyridamole
        i. ibuprofen, naproxen
    c. heparin (unfractionated)
    d. low molecular weight heparin (Lovenox)
    e. warfarin
    f. alteplase (fibrinolytic)
    g. protamine, phytonadione (Vit.K) (antidotes)
7. Beta agonists
    a. dobutamine (B1)
    b. albuterol (B2)
8. Beta antagonists
    a. esmolol, propranolol, metoprolol (B2)
9. Diuretics (hydrochlorothiazide, furosemide)
10. Dyslipidemia medications
    a. statins (atorvastatin, lovastatin)
    b. OTC medications (red yeast rice, niacin)
11. IV Contrast
12. Methylxanthine derivatives
    a. caffeine, theophylline, aminophylline
13. Nitrates (including but not limited to nitroglycerin)

C. Preparation and quality control, and regulations of radiopharmaceuticals
1. Sr/Rb generator
2. Tc-99m labeled RBC's
    a. In-vivo labeling
    b. Modified in-vivo/in-vitro labeling
    c. In-vitro (Ultratag) labeling
3. Preparation and beyond use guidelines

IV. Non-Pharmacologic (Exercise) Stress Testing (~15%)

A. Contraindications to exercise stress testing
B. Physiologic measures of exercise capacity/performance
C. ECG acquisition
1. Patient preparation, electrode placement and leads

2. Rate calculation
3. ECG Artifacts

D. Treadmill tower operation
E. Bicycle and isometric exercise protocols
F. Patient assessment and monitoring
G. Endpoints

V. Patient Care (~10%)

A. Answering patient questions
   1. Risks of nuclear medicine procedures
   2. Comparison to correlative imaging techniques
B. Emergency care
   1. ACLS
   2. CPR
   3. Contrast Reactions
   4. Diabetic complications
   5. Emergency medications
   6. Appropriate response to ECG indicators of ischemia and infarction
C. Radiation Safety
   1. Effective dose
   2. Dose reduction techniques
   3. Recommendations for special populations