NUC 450: NUCLEAR MEDICINE PROCEDURES ll

University of Nevada, Las Vegas
College of Health Sciences
Department of Health Physics

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Credits: 3

Prerequisites: NUC 350

Course Description: Survey of in-vivo nuclear medicine procedures and pathology related to the endocrine, ureterogenital, central nervous systems, and to tumor/inflammatory and bone marrow imaging. Principles of sensitivity, specificity, accuracy and predictive values of diagnostic testing.

Course Goal: To acquire in-depth knowledge of the diagnostic imaging aspects of the above nuclear medicine procedures by integrating technical considerations with anatomy, physiology, pathology, and patient care considerations.

Course Objectives:

1. Examine the normal biodistribution, mechanism of localization, and route of excretion for each radiopharmaceutical currently utilized in these diagnostic procedures.
2. Understand the imaging parameters necessary to produce high quality diagnostic images in either count dependent, time dependent, or differential functional studies.
3. Recognize the normal adult doses administered to the patient and the route of administration for each radiopharmaceutical.
4. Evaluate each study for completeness of information by analyzing image appearance for normal structures and artifacts.
5. Describe the emission characteristics (type and energy) of each radionuclide used.
6. Examine computer applications, where appropriate, with emphasis on acquisition, analysis, processing, and enhancement.
7. State and label the required procedural views (ANT. POST, LAT, etc.) for each study.
8. Perform special views as required.
9. Illustrate the normal and abnormal patterns of radiopharmaceutical distribution for each study.
10. Understand the anatomy, physiology, and pathology related to each organ or

structure in these procedures.

11. Identify the most common indications for performing these procedures.
12. Discuss any procedures and/or substances that may interfere with the performance of these studies.
13. Discuss contraindications or adverse reactions associated with the studies.
14. Describe the appropriate patient preparations, including premedications, dietary requirements or restrictions, and/or physical limitations.
15. Describe the dose to image time for each study.

Teaching Methods: Lecture and discussion
Extensive use of whiteboard, anatomic models, slides, and images

Course Evaluation Methods:

Tests: Three major examinations will be given at specified times during the semester. The final exam will be comprehensive. Make-up up exams will not be allowed unless approved a minimum of 24 hours prior to the exam. Quizzes may be administered with or without notification on the subject matter discussed the previous week.

Grading: Examination 1=25%
Examination 2 = 25%
Final Examination 40%
Class participation and attendance = 10%

A final letter grade will be assigned as a percentage according to the following scale:

A = 93-100	C = 74-77
A - = 90-92	C - ,.. 71_73
B + = 87-89	D + =- 68-70
B = 84-86	D = 65-67
8 - = 81-83	D - = 62-64
C + =78-80	F = 0-61

PLEASE REMEMBER THAT YOUR CONTINUATION IN TIIE NUCLEAR MEDICINE PROGRAM DEPENDS ON YOUR ADHERENCE TO TIIE FOLLOWING: MAINTAIN A MINIMUM OF A 2.50GPA EACH SEMESTER; HAVE NO NEGATIVE GRADE POINTS; AND, RECEIVE A "C,. OR BEITER IN PROGRAM COURSES (NUC, CMI, HPS, AND RAD).

Leaming Enhancement Services (LES) houses Disability Services, Leaming Strategies and Supplemental Instruction. If you have a documented disability that may require assistance, you will need to contact LES for coordination in your academic accommodations. LES is located in the Reynolds Student Services Complex, suite 137. The phone is 702-895-0866, or TDD 702-895-0652. You may also visit their website at

www.unlv.edu/stundentl fe/les.

NUC 450: Topical Outline

I. Thyroid Imaging and Uptakes
   A. Location, size.shape and structure of thyroid
   B. Process of iodide trapping. organification. coupling, and secretion of thyroid hormones. T3 and T4
   C. Negative feedback system and thyroid regulation of the hypothalamic-pituitary-thyroid axis
   D. Carrier (transport) proteins (TBG, pre-albumin. albumin)
   E. Metabolic effects of thyroid hormones
   F. Pathology
      1. Hyperthyroidism
         a. Grave's disease
         b. Plummers' disease
         c. Toxic nodular goiter
      2. Hypothyroidism
         a. Primary, secondary, tertiary
         b. Myxedema
         c. Hasimoto's thyroiditis
      3. Goiter: endemic
      4. Carcinoma
         a. Papillary-follicular
         b. Medullary and undifferentiated
      5. Primary indications for thyroid uptakes and scans
         a. Evaluation of gland size and palpable nodules or masses in anterior neck
         b. Identification of Ectopic thyroid tissue
      6. Radiopharmaceuticals : I-123, I-131, Tc-99m
      7. Contraindications and/or interfering drugs and foods
      8. Principles and procedures and interpretations of in-vivo thyroid function tests
         a. Thyroid uptake of I-131, I-123, and Tc-99m pertechnetate
         b. Historical review of suppression. stimulation and perchlorate washout tests
      9. Principles, procedures, patient preparation and image analysis of thyroid imaging
         a. normal findings and presentations
         b. abnormal findings and presentations of pathologies listed in "F' above

II. Parathyroid Imaging

A. Anatomy and physiology of the parathyroid glands
B. Location and evaluation of parathyroid tumors
C. Radiopharmaceuticals :Tc-99m Sesttamibi Tl-201 and Tc-99m subtraction
D. Primary indication: evaluation of primary hyperparathyroidism
E. Principles, procedures, patient preparation, and special considerations

F. Image analysis of parathyroid images

III. Urinary Tract Imaging

A Anatomy and physiology

I. Gross

2. Functional

a. Role of nephronic function in relation to radiopharmaceutical Biodistribution (Tc-99m pertechnetate, Tc-99m MAG 3, Tc-99m DTPA, Tc-99m-glucoheptonate .Tc-99m DMSA, and historical I-131 Olli)

(I) glomerular filtration

(2) tubular secretion

(3) reabsorption

(4) fixation

b. Blood circulation through the cortex. medulla. glomerulus, and renal tubules

B. Indications for renal imaging

I. Relative blood flow and renal function

2. Obstructive uropathy

3. Renal transplant function

4. Renal function of potential kidney donors

5. Renovascular hypertension

6. Evaluation of renal trauma

7. Evaluation of congenital abnormalities, tumors and cysts

8. Patients allergic to radiographic contrast media

C. Principles, procedures, patient preparation, medical monitoring, and image analysis of renal function studies

I. . MAG-3 clearance, camera based single plasma sample

2. GFR, camera based study

3. Renograms and general interpretations

a. perfusion phase

b. accumulation or secretion phase

c. excretion phase

4. Diuretic renograms and obstruction (vasotec and furosemide)

5. Angiotensin-converting enzyme (ACE) inhibitor Renography and hypertension

IV. Radionuclide Cystography

A. Purpose and indications

B. Procedures, patient preparation, and image analysis in direct and indirect cystography

A Anatomy

1. Cerebral hemispheres.fissures and convolutions
2. Subcortical structures
3. Cerebellum
4. Meninges and cisterns
5. Cerebral spinal fluid dynamics
6. Arterial circulation: Circle of Willis and contributing vessels
7. Venous drainage
8. Blood-brain barrier

8. Cerebral function and neurotransmission as related to SPECT imaging

C. Pathophysiology

1. Primary and metastatic brain tumors
2. Cerebrovascular accidents (CVAs)
3. Neuropsychiatric disorders:dementias, depression, Alzheimer's, Huntington•s, multi-infarct dementia
4. Epileptogenic seizures
5. Brain death

D. Radiopharmaceuticals

1. Nonpenetrating :Tc-99m pertechnetate, Tc-99m DTPA and Tc-99m GHA
2. Penetrating: Tc-99m HMPAO (Ceretec) Tc-99m ECO (Neurolite)

E. Indications. procedures, patient preparation, and interpretation of planar brain imaging

I. Recognition of tumors and CVAs with planar, non-penetrating RPs,
2. Location of abnormalities on the basis of anterior, posterior, lateral, and vertex views

F. Indications, procedures, patient preparation, and interpretation of SPECT brain imaging

1. Identification of cortical and subcortical gray matter in the coronal, sagittal, and transverse images (nonnal and abnormal)
2. Identification of cortical and subcortical white matter in the three planes (nonnal and abnonnal)

G. Positron emission tomography (PET) and its implications in brain imaging

H. CSF imaging (cistemography)

I. Radiopharmaceuticals : In-1 11 DTPA and Tc-99m DTPA
2. Indications, procedures, and patient preparation
3. Image analysis in nonnal conditions, and in the abnonnal conditions of normal pressure hydrocephalus (NPH) and other forms of hydrocephalus
4. Shunt patency evaluation
5. CSF leaks

VI.I nflammation/Infection Imaging

A. Inflammatory response
B. White blood cells
C. Indications for WBC imaging

1. Detection and localization of infection and abscess
2. Evaluation of FUO and fever
3. Diagnosis of osteomyelitis in diabetic patients
4. Diagnosis of prosthetic rejection and loosening
5. Diagnosis of vascular graft infection
6. Acute appendicitis

D. In-111 and Tc-99m WBC labeling principles and mechanisms of localization
E. Normal and abnormal image findings (WBC labeled images)
F. Fanolesomab and acute appendicitis

VII. Tumor Imaging
A Conventional radiopharmaceuticals
1. Ga-67 citrate (lymphoma, melanoma, hepatoma)
2. Tl-201 chloride (brain, low-grade lymphoma, Kaposi's sarcoma, medullary thyroid)
3. Tc-99m teboroxime {MIBI) (breast and metastatic search)

8. Receptor imaging
1. In-111 pentetreotide (pheochromocytoma, neuroblastoma and paraganglioma. SCLC, pancreatic islet celi carcinoids, pituitary adenoma)
2. I-123 (131) Metaiodobenzylguanidine (MIBG) (pheochromocytoma, paraganglioma, neuroblastoma)

C. Antibody imaging
1. In-111 Capromab pendetide (Prostascint) prostatic metastases
In-111 Satumomab pendetide (Oncoscint): colorectal and ovarian cancer

D. Lymphatic Drainage Studies: sentinel node mapping for breast, prostate and melanoma

NUC 450: Nuclear Medicine Procedures
Weekly Schedule

Week 1	Anatomy, physiology and pathophysiology of the thyroid gland
Week 2	Labor Day Recess
Week 3	Thyroid imaging and uptake
Week 4	Thyroid therapy
Week s	Parathyroid and salivary gland imaging
Week 6	EXAM I
Week ?	Anatomy, physiology and pathophysiology of the brain
Week s	Brain imaging, planar, SPECT and PET
Week 9	Radionuclide cisternography
Week 10	Anatomy, physiology and pathophysiology of the ureterogenital system
Week 11	Renal imaging; radionuclide cystography
Week 12	EXAM 11
Week 13	Ga-67 Citrate and WBC (ln-111 and Tc-99m) imaging for inflammatory/infectious processes
Week 14	Ga-67 Citrate, Tl-201, Tc-99m Sestamibiffetrofosmin in tumor imaging; 1-123 (131); lymphoscintigraphy
Week 15	Neuropeptide receptor agents in neoplastic imaging; monoclonal antibody imaging
Week 16	Comprehensive Final Exam:

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Academic Misconduct – Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at: http://studentconduct.unlv.edu/misconduct/policy.html.

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Religious Holidays Policy – Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the end of the first two weeks of classes, September 22, 2015 of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: http://catalog.unlv.edu/content.php?catoid=6&navoid=531.

Incomplete Grades - The grade of I – Incomplete – can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade. Please note – Students cannot enroll in other nursing courses if they have an incomplete (I) in a course that is designated as a prerequisite to that course. (Per School of Nursing Policy C-12).

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