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FELLOWSHIP IN RADIOLOGY

INTRODUCTION

PREAMBLE

The discovery of x-rays by Wilhelm Roentgen in 1895 heralded the arrival of a totally new method of medical diagnosis. The past century has experienced an explosion in the increasingly sophisticated utilisation of x-rays and other energy sources culminating into Diagnostic radiology. Diagnostic Radiology is a branch of medical practice that deals with the use of imaging techniques in the study, diagnosis and treatment of disease.

The specialty of Radiology has expanded enormously and now encompasses not only the traditional radiographic procedures but also Mammography, Ultrasound, Nuclear Medicine, Computed Tomography, Magnetic Resonance Imaging and Interventional procedures. Many departments are now known as Departments of Imaging rather than Departments of Radiology to reflect this change. Radiologists now play a key role in patient management and are now referred to as Clinical Radiologists to reflect their changing role.

RATIONALE

Radiology is still in its infancy in Ghana. Local training (Ghana) in radiology started officially in October 1999 to address the huge human challenge of few radiologists (total of 4 in the country, 1999).

Currently there are only a handful of Radiologists (26 in number as at August 2011) for a population of about 24 million. Of these the majority are in Accra. As a result many of the radiological examinations carried out in outlying hospitals/clinics are of unacceptable standard and without the professional input of the radiologist. This affects the standard of patient care in the country. There is therefore an urgent need to train more radiologists to promote this course.

The training program will be in two parts, a Membership and Fellowship programs. The Fellowship will be attained at least one year after the Membership.

GOALS

On completion of the Membership/Fellowship the Radiologist will be competent to function as a Specialist in Diagnostic Radiology. This requires the radiologist to have the ability to supervise, advise on and perform imaging procedures to such a level of competence, and across broad range of medical practice, as to function as a Specialist/Consultant to the referring clinicians.

SPECIFIC OBJECTIVES

A. MEMBERSHIP

At the completion of the Membership training, the resident will have acquired the following competencies and will function effectively as a Radiologist.

Radiologist

General Requirements:

- Demonstrate diagnostic and therapeutic skills for ethical and effective patient care.
- Assess and apply relevant information to clinical practice so as to have competence in clinical radiological skills.
- Demonstrate effective consultation services with respect to patient care, education and legal opinions

Specific Requirements:

- Understand the nature of formation of all types of radiological images, including physical and technical aspects, patient positioning, and contrast media usage.
- Knowledge of the theoretical, practical and legal aspects of radiation protection, including other imaging techniques and their possible harmful effects.
- Knowledge of human anatomy at all ages, both conventional and multiplanar, with emphasis on radiological applications.
- Knowledge of all aspects of clinical radiology, including pathophysiology of disease, appropriate application of imaging of patients, importance of informed consent, complications such as contrast media reactions, and factors affecting interpretation and differential diagnosis.
- Understand the fundamentals of quality assurance in radiology.
- Understand the fundamentals of epidemiology, biostatistics and decision analysis.
- Show competence in manual and procedural skills and in diagnostic and interpretive skills.
- Demonstrate the ability to manage the patient independently during a procedure, in close association with a specialist or other physician who has referred the patient. The radiologist should know when the patient's best interests are served by discontinuing a procedure, or referring the patient to another physician.
- Understand the acceptable and expected results of investigations and/or interventional therapy as well as unacceptable and unexpected results. This must include knowledge of and ability to manage radiological complications effectively.
- Understand the appropriate follow-up care of patients who have received investigations and/or interventional therapy.
- Show understanding of a sound and systematic style of reporting.
- Competence in effective consultation, conduct of clinico-radiological conferences and appreciation of radio-pathological correlation, and the ability to present scholarly material and lead case discussions.

Professionalism and ethics

General Requirements:

- Deliver highest quality care with integrity, honesty and compassion.
- Exhibit appropriate personal and interpersonal professional behaviours.
- Practice medicine ethically consistent with the obligations of a physician

Specific Requirements:

- Be able to accurately assess one's own performance, strengths and weaknesses.
- Understand the ethical and medico-legal requirements of radiologists.

Leadership and Managerial skills

General Requirements:

- Utilize resources effectively to balance patient care, learning needs, and other activities.
- Allocate finite health care resources wisely.
- Work effectively and efficiently in a health care organization.
- Utilize information technology to optimize patient care, life-long learning and other activities.

Specific Requirements:

- Be competent in conducting or supervising quality assurance including an understanding of safety issues and economic considerations.
- Be competent in information technology as applicable to the practice of radiology.

B. FELLOWSHIP

At the completion of the Fellowship training, the resident will have acquired the following competencies and will function effectively as Specialist Radiologist

Specialist Radiologist

The Specialist Radiologist is a Fellow of the Faculty of Radiology (FGCP) with knowledge, attitude, professionalism, managerial acumen, ethical behaviour and skill set of a radiologist as described above.

And in addition the Specialist Radiologist is expected to be a scholar

Scholar

General Requirements:

- Develop, implement and monitor a personal continuing education strategy.
- Critically appraise sources of medical information.
- Facilitate learning of residents, house staff/students and other health professionals.
- Contribute to development of new knowledge.

Specific Requirements:

- Competence in evaluation of the medical literature.
- The ability to be an effective teacher of radiology to medical students, residents, technologists and clinical colleagues.
- The ability to conduct a radiology research project, which may include quality assurance.
- Appreciation of the important role that basic and clinical research plays in the critical analysis of current scientific developments related to radiology.

COURSE DURATION

Minimum of 4 years training for Membership and 5 years for Fellowship

MEMBERSHIP TRAINING

A 4year course leading to the award of a Membership in Radiology. Trainees will become competent in all aspects of Conventional Radiology, Contrast Examinations (Fluoroscopy), Mammography, Computed Tomography and Magnetic Resonance Imaging.

The resident will also be competent in a wide range of Ultrasound Techniques including Endocavitary applications and ultrasound guided interventional procedures.

After qualification, the Member will be expected to take part in training programmes and is expected to be abreast with newer Radiological Techniques. Some administrative duties will also be necessary.

The Member will also be competent in basic interventional procedures such as abscess drainage and Biopsy Techniques using different Modalities. He/she should also be competent in Doppler Techniques and have other Interventional Skills.

The Member is expected to support the Radiographers and Technicians in the Radiology Department in order to maintain a minimum standard.

FELLOWSHIP TRAINING

The trainee should have acquired Membership qualification with the Ghana College of Physicians and Surgeons.

Trainee can gain admission into the Fellowship programme at least 1 year after qualifying as a Member or unless granted special dispensation to continue immediately after Membership qualification.

The fellowship training is geared towards subspecialisation in radiology but for the purposes of radiology practice in Ghana (presently), the trainee is encouraged to engage in all the activities mentioned for the Membership training but with special emphasis in the subspecialty of interest. In addition the trainee will have to write a dissertation which should be in the subspecialty of interest.

The choice of dissertation topic and approval will follow the general guidelines of the Ghana College of Physicians and Surgeons.

After the acceptance of the dissertation, the candidate vying for fellowship will be examined by a panel of at least 3 fellows including an External Assessor towards the defence of the dissertation.

They will also be required to sit an oral examination and/ or OSCE

ENTRY REQUIREMENTS- Membership

A Clinical Radiologist requires a good clinical background in order to work in close collaboration with colleagues in other Medical Specialties. The entry requirements must therefore reflect this.

The Entry Requirements include:

- Basic Medical Qualification i.e. MB. ChB or Equivalent
- 1 Year Post Registration Experience(at least 2 years after Medical School)
- Passing an entrance exam by the Ghana College of Physicians and Surgery
- Passing an interview- for those who have passed West Africa College of Surgeons Primary examination
- Should be in good standing with the Medical and Dental Council

NUMBER OF TRAINEES

The number of Trainees will be limited by the constraints of;

- Number of approved trainers available
- Accreditation of the centre

PROGRAMME STRUCTURE- MEMBERSHIP

PART 1

1A- At the end of the first year

1B- One year after passing the Part 1A

PART 2 - Two years after Part 1B

SYLLABUS FOR PART IA

MEDICAL PHYSICS

A recommended 40 hours (in total) to be given by Medical Physicists and Radiologists to include basic Practical Aspects of Radiological Physics and Radiation Protection.

RADIOLOGICAL ANATOMY

A recommended 3 hours a week of formal teaching by radiologists as well as daily supervised reporting of films.

RADIOLOGICAL TECHNIQUES

Taught by Radiographers & Radiologists to include specialized Procedures together with Basic Radiography and supervised reporting of films.

INTERPRETATIVE/COMMUNICATION AND REPORT WRITING

In the first year of training the trainee must begin to acquire some of the interpretative, reporting and communication skills that will eventually be required of a specialist in radiology.

A minimum of 2 sessions/week (7 hours) should be devoted to reporting. The trainee should have interpreted /reported the following under supervision:

- All core procedures and techniques performed by the trainee
- Radiographs taken for Trauma
- A selection of urgent inpatient and outpatient radiographs
- Reporting of a range of non-urgent radiographs
- Adequate knowledge in radiological anatomy (all systems)

Should also have working knowledge in the following:

- Conventional Radiology
- Gastro intestinal Imaging
- Uroradiology
- Obstetric & Gynaecological imaging
- Chest Imaging
- Ultrasonography
- Body Imaging
- Paediatric Imaging
- Breast Imaging
- Neuro-radiology

THE SECOND, THIRD AND FOURTH YEARS – MEMBERSHIP

The framework for the 2nd, 3rd, and 4th years will consist of rotations which should give appropriate and adequate experience in the following areas:

- System Based Sub-specialties
 - Cardiovascular Imaging
 - Chest Imaging
 - ENT/Dental Imaging
 - Musculo-skeletal Imaging
 - Gastrointestinal Imaging
 - Genitourinary Imaging
 - Neuro-radiology
 - Body Imaging
 - Breast and Obstetrics Imaging

- Technique Based Sub-specialties
 - Conventional Radiology
 - Ultrasound
 - Computed Tomography
 - Magnetic Resonance Imaging
 - Interventional Radiology

- Disease Based Sub-specialties
 - Oncological Imaging
 - Non-Oncological Imaging

- Age Based Sub-specialty
 - Paediatric Imaging
 - Geriatric Imaging

In addition, some knowledge of the indications and basic principles of nuclear medicine is desirable.

Should have acquired skills in basic research methodology by the end of the second year

SPECIALTY TRAINING REQUIREMENTS IN DIAGNOSTIC RADIOLOGY (CLINICAL RADIOLOGY)

Training in medical imaging integrates training in the imaging modalities and in the imaging of organ systems. This training **must** include adequate experience in imaging of adult and pediatric patients in inpatient, emergency and ambulatory settings. Resident training **must** include minimum training time as specified in the following organ systems and **must** include experience in general radiography, fluoroscopy, interventional procedures, ultrasound, CT, MRI and nuclear medicine as relevant to the following organ systems.

1. Minimum of 24 weeks of thoracic imaging, including general radiography, fluoroscopy, basic interventional procedures, CT, MRI and nuclear imaging of the respiratory and cardiac organs
2. Minimum of 52 weeks of imaging of the abdomen and pelvis, which must include a minimum of eight (8) weeks training in obstetric ultrasound and fetal imaging. This training must include experience in general radiography, fluoroscopy, basic interventional procedures, ultrasound, CT, MRI and nuclear imaging
3. Minimum of 12 weeks of vascular and interventional imaging to include basic vascular and non-vascular procedures, ultrasound, CT and MRI
4. Minimum of 24 weeks of musculoskeletal imaging to include general radiography, basic diagnostic and interventional procedures, ultrasound, CT, MRI and nuclear imaging
5. Minimum of 24 weeks of neuroimaging including head, face, neck, and spine to include general radiography, basic interventional procedures, CT, MRI, ultrasound and nuclear imaging
6. Minimum of 16 weeks of breast imaging including mammography, ultrasound, MRI, and interventional procedures under ultrasound and MRI guidance, and nuclear imaging
7. Minimum of 16 weeks of pediatric imaging to include general radiography, fluoroscopy, basic interventional procedures, ultrasound, CT, MRI and nuclear imaging

40 weeks of approved residency consisting of any combination of the following as long as these are appropriately integrated and approved by the Residency Training Committee:

- Thoracic imaging
- Body imaging, which may include abdominal, pelvic, obstetric or fetal imaging
- Vascular imaging which may include imaging for interventional procedures
- Musculoskeletal imaging
- Neuroimaging
- Breast imaging
- Pediatric imaging
- Nuclear medicine

Research project relevant to medical imaging

NOTES:

In view of the amount and variety of medical imaging to be covered, and the skills required to be prepared as a general imaging consultant, it will seldom be appropriate to spend the entire 40 weeks in any one of these areas.

SYLLABUS FOR PART 1 B (2ND YEAR)

Pathology

Eight weeks of lectures/rotation in basic Clinical Pathology

Clinical Skills

A recommended 3 hours a week of formal teaching by radiologists as well as daily supervised reporting of films.

CLINICAL CURRICULUM (4 YEARS)

	CORE
1. CONVENTIONAL RADIOLOGY	Film reporting Routine procedures
2. VASCULAR	Plain Films Arteriography Venography Interventional procedures Doppler Ultrasound CT Angiography MRI Angiography
3. CARDIAC	Conventional radiography (CXR) Echocardiography Angiography Cardiac CT/MDCT Radionuclide Imaging Cardiac MRI
4. CHEST	Plain Films CT of the Chest including HRCT Image Guided Biopsy Empyema drainage Ultrasound application of the chest
5. ENT	Plain Films Ultrasound BA Studies CT Sialography Magnetic Resonance
6. BREAST	Indications for Imaging Techniques Mammographic Techniques and Reporting U/S Biopsy Breast Localisation procedures MRI
7. MUSCULO – SKELETAL	Plain Films Arthrography(MR, CT and Conventional)

	CT ULTRA-SOUND MRI Nuclear MED
8. GASTRO INTESTINAL	Plain Films Barium studies Cholangiography (PTC, ERCP, MRCP) Sinography Ultrasound Image-guided GI interventions CT MRI
9. URORADIOLOGY	PLAIN FILMS Urography (Conventional, CT, MR) Retrograde Pyelogram Antegrade Pyelogram Nephrostogram Urethrogram M.C.U.G. Nephrostomy Abdominal Ct Angiography Endorectal U/S Nuclear Medicine Urodynamics MRI/US
10. OBSTETIRICS AND GYNAECOLOGY	Ultrasonography CT HSG MRI Interventional procedures
11. NEURORADIOLOGY	Plain Films MRI CT Angiography Ultrasonography Interventional procedures

RESEARCH & SECONDMENT

The trainee will be expected to undertake Research in the 2nd & 3rd years.

A period of secondment to a more advanced institution is recommended to make the training comprehensive.

Standardised log books will be used for documenting the degree of experience and skill attained.

GENERAL TOPICS

The academic program must provide opportunities for the resident to gain an understanding of the basic principles of biomedical ethics as it relates to the specialty of Diagnostic Radiology including, but not limited to:

- Informed consent
- Radiation exposure
- Relationship between and the nature of the contact between the referring physician and radiologist
- Relationship between radiologist and other departmental staff including gender issues
- The nature of the relationship between radiologist and patients
- Billing practices
- Appropriateness of studies
- Relationship between groups of radiologists

In addition

- Communication
- Information technology & Computer Literacy

Format of the Comprehensive Objective Examination in Diagnostic Radiology

Comprehensive objective examinations make it possible to obtain a more complete evaluation of the candidate's strengths and weaknesses. Success or failure is based on consideration of all components of the examination. The comprehensive objective examinations are considered a "whole" and cannot be fragmented. Candidates who are unsuccessful at this examination must, if within their period of eligibility, repeat all components of the examination, except in the Fellowship examination.

There are three main examinations in the training programme, namely:

- 1. Part I**
- 2. Part II (Membership)**
- 3. Fellowship (Post-membership)**

PART I RADIOLOGY EXAMINATION

The part I radiology examination consists of two parts- IA and IB

Part IA

- ❖ Candidates are allowed to sit this examination at the end of the first year.
Multiple choice questions on;
 - **Radiological anatomy**
 - **Radiological physics**
 - **Radiological techniques**

Part IB

- ❖ Candidates are allowed to sit this examination one year after passing the Part 1A
 - It consists of multiple choice questions, essay, OSCE and oral examination (film viewing)
- **150 Multiple choice questions for 3 hours (including relevant questions in pathology)**
- **Essay- 3 hour paper**
- **OSCE- 1 to 2 hour paper**
- **Oral examination- Two- 20 minute sessions discussing imaging studies.**

PART II RADIOLOGY EXAMINATION

A candidate is allowed to sit this examination two years after Part 1B and has been certified by the supervising consultant after reviewing the candidate's log book among others.

The Part II examination consists of multiple choice questions, essay, OSCE and oral examination (film viewing covering all systems). Candidates will be expected to demonstrate their knowledge and skills in detection, interpretation, management and consultation during the Oral examinations.

- **150 Multiple choice questions for 3 hours**
- **Essay- 3 hour paper**
- **OSCE- 1 to 2 hour paper**

- Oral examination- Two- 30 minute sessions discussing imaging studies.

If the candidate satisfies the examiners he is awarded Member of Ghana College of Physicians (Faculty of Radiology)

FELLOWSHIP EXAMINATION

A candidate is allowed to sit this examination at least 1 year after qualifying as a Member or unless granted special dispensation to continue immediately after Membership qualification. The examination consists of;

- Defence of the dissertation (book)
- Oral examination (film viewing)/ OSCE covering all systems with special emphasis on the subspecialty of interest.

If the candidate satisfies the examiners he is awarded Fellow of Ghana College of Physicians (Faculty of Radiology)

NB: It is mandatory for each candidate to report approximately 30 minutes before the time mentioned in his or her appointment letter in order to receive all the necessary information concerning the oral and OSCE.

SUGGESTED LOG BOOK CONTENT

SUGGESTED LOG BOOK CONTENT	NUMBER RECOMMENDED
BARIUM (CONTRAST) MEALS	50
CONTRAST ENEMAS	50
SMALL BOWEL MEALS	5
IVU	100
MCUG	1
URETHROGRAM	10
RETROGRADE PYELOGRAM	2
ANTEGRADE PYELOGRAM	1
NEPHROSTOMY	1
CONTRAST EXAM IN BABIES	
- MEAL	2
- ENEMA	2
VENOGRAMS/OR DOPPLER U/S	5
ARTERIOGRAM	2
CT CHEST	20
MAMMOGRAMS	50

ULTRASOUND BREAST	10
ULTRASOUND ABDOMEN	100
U/S GUIDED BIOPSY	5
U/S GUIDED DRAINAGE	2
CT BRAIN	20
CT ABDOMEN	20
SINOGRAM	1
OBSTETRIC U/S	30
TRANSVAGINAL U/S	10
PELVIC U/S	50
HSG	50
CT SPINE	10
MYELOGRAM	5
SCROTAL U/S	10
THYROID U/S	10

ULTRASOUND SYLLABUS FOR MEMEBERSHIP

ULTRASOUND PHYSICS

INTRODUCTION
SOUND WAVE PRODUCTION
SOUND WAVE PROPAGATION AND REFLECTION
RESOLUTION AND ATTENUATION
INTENSITY MEASUREMENTS AND BIOEFFECTS
REFERENCE DATA
PRACTICE QUESTIONS

ULTRASOUND IMAGING INSTRUMENTATION

INTRODUCTION
PULSE-ECHO IMAGING
DISPLAY MODES
ULTRASOUND TRANSDUCERS
IMAGE STORAGE, DISPLAY AND RECORDING
ULTRASOUND ARTIFACTS
ULTRASOUND QUALITY ASSURANCE
REFERENCE DATA
PRACTICE QUESTION

DOPPLER PRINCIPLES

INTRODUCTION
DOPPLER EQUATIONS
SPECTRAL DOPPLER
COLOR-FLOW DOPPLER
DOPPLER TISSUE IMAGING
POWER DOPPLER

REFERENCE DATA
PRACTICE QUESTIONS

VASCULAR PHYSICAL PRINCIPLES

INTRODUCTION
ELECTRICAL PRINCIPLES
HEMODYNAMICS OF ARTERIAL AND VENOUS CIRCULATION
VASCULAR SONOGRAPHY
PLETHYSMOGRAPHY
OTHER VASCULAR EVALUATION METHODS
REFERENCE DATA
PRACTICE QUESTIONS

CARDIOVASCULAR PHYSICAL PRINCIPLES

INTRODUCTION
CARDIAC ANATOMY, PHYSIOLOGY AND HEMODYNAMICS
BASIC EMBRYOLOGY
ECHOCARDIOGRAPHY
OTHER CARDIAC EVALUATION METHODS
REFERENCE DATA
PRACTICE QUESTIONS

EMBRYOLOGY, HISTOLOGY, GROSS ANATOMY AND NORMAL IMAGING ANATOMY OF THE LIVER

EMBRYOLOGY

- i. EARLY HEPATIC DEVELOPMENT
- ii. VENOUS DEVELOPMENT RELATED TO THE LIVER
- iii. FURTHER PRENATAL GROWTH OF THE LIVER
- iv. PRENATAL FUNCTION OF THE LIVER
- v. LIVER CHANGES AFTER BIRTH
- vi. CONGENITAL ANOMALIES

HISTOLOGY

- i. CAPSULE AND CONNECTIVE TISSUE STROMA
- ii. HEPATIC LOBULE
- iii. HEPATIC VASCULAR PATHWAYS
- iv. INTRAHEPATIC BILIARY SYSTEM
- v. PORTAL LOBULE AND HEPATIC ACINUS
- vi. HEPATOCYTES AND LIVER FUNCTIONS

GROSS ANATOMY AND NORMAL IMAGING OF THE LIVER

- a. EXTERNAL AND INTERNAL SUBDIVISION OF THE LIVER EXTERNAL LOBATION
- b. INTERNAL LOBATION AND SEGMENTATION
- c. PORTAL VENOUS SYSTEM
- d. COUINAUDS SEGMENTS

- e. HEPATIC VENOUS SYSTEM
- f. PERITONEAL RELATIONSHIPS OF THE LIVER
- g. VISCERAL
- h. EXTERNAL COURSE OF BLOOD SUPPLY TO THE LIVER
- i. LYMPHATIC DRAINAGE AND INTERVATION OF THE LIVER

I) VASCULAR ANATOMY OF THE UPPER ABDOMEN

- i. THE DIAPHRAGM
- ii. ABDOMINAL AORTA (AO) AND ITS BRANCHES
- iii. INFERIOR VENA CAVA (IVC)
- iv. PORTAL VENOUS SYSTEM
- v. SPLENIC VEIN
- vi. HEPATIC VEINS

II) SONOGRAPHY OF THE LIVER

- i. PARENCHYMAL ORGAN ECHOGENICITIES
- ii. HEPATIC FISSURES
- iii. FETAL REMNANTS
- iv. CAUDATE LOBE
- v. SONOGRAPHY OF THE DIFFUSELY ABNORMAL LIVER
 - a. SONOGRAPHIC LIVER PATTERNS NORMAL, CENTRILOBULAR, FATTY FIBROTIC
 - b. ACUTE FULMINANT HEPATITIS
 - c. CIRRHOSIS
 - d. PORTAL HYPERTENTION

SONOGRAPHY OF ABNORMAL LIVER MASSES

BENIGN CYSTIC LIVER LESIONS

- CYST
- HEMATOMA
- ABSCESS
- BILOMA/SEROMA
- BILIARY CYSTADENOMA
- VASCULAR

MALIGNANT CYSTIC LIVER LESIONS

- CYSTIC METASTASES
- BILIARY CYSTADENOCARCINOMA

BENIGN SOLID LIVER LESIONS

- HAEMANGIOMA
- ADENOMA
- FOCAL NODULAR HYPERPLASIA (FNH)
- MICROABSCESSSES
- REGENERATING NODULE
- FOCAL FATTY INFILTRATION

- FOCAL FATTY SPARING

MALIGNANT SOLID LIVER LESIONS

- METASTASES
- HEPATOCELLULAR CARCINOMA
- LEUKEMIA/LYMPHOMA

III) SONOGRAPHY OF THE GALL BLADDER

1. GALL BLADDER TECHNIQUE
2. GALL STONES
3. NON-VISUALIZATION OF GALL BLADDER
4. NON-SHADOWING ECHOGENIC FOCI IN GALL BLADDER
5. SLUDGE
6. ACUTE CHOLECYSTITIS
7. GANGRENOUS CHOLECYSTITIS
8. EMPHYSEMATOUS CHOLECYSTITIS
9. A CALCULOUS CHOLECYSTITIS
10. ADENOMYOMATOSIS
11. GALL BLADDER CARCINOMA
12. GALL BLADDER METASTASES

SONOGRAPHY OF THE BILE DUCTS

A) ANATOMY OF THE BILE DUCTS

EXTRAHEPATIC BILE DUCT

- a) THE CYSTIC DUCT
 - b) COMMON HEPATIC DUCT
 - c) COMMON BILE DUCT
 - ANATOMIC PITFALLS
- 1) ARTERIES MISTAKEN FOR BILE DUCTS
 - PROPER HEPATIC ARTERY FOR COMMON HEPATIC DUCT
 - GASTRODUODENAL ARTERY FOR COMMON BILE DUCT

B) COMMON DUCT MEASUREMENTS

- COMMON HEPATIC DUCT
 - NORMAL DIAMETER < 6mm
- COMMON BILE DUCT
 - NORMAL DIAMETER < 8mm
 - ADD 1mm/DECREASE AFTER 50Y
 - BILIARY OBSTRUCTION

SONOGRAPHIC DETERMINATION

- INTRAHEPATIC DUCT DILATATION
- ETIOLOGY OF BILIARY OBSTRUCTION
- CHOLEDOCHOLITHIASES
- PNEUMOBILIA
- PORTAL VEIN GAS

- BILIARY ASCARIASIS
 - NEOPLASM CAUSING BILIARY OBSTRUCTION
 - PANCREATIC CA
 - BILE DUCT CA
 - GALL BLADDER CA
 - HEPATIC TUMOUR
 - DUODENAL TUMOUR
 - PORTAL MASSES
- X CHOLANGIOCARCINOMA
- 1) RISK FACTORS
- ULCERATIVE COLITIS
 - SCLEROSING CHOLANGITIS
-
- HEPATICOLITHIASIS
 - CHOLEDOCHAL CYSTS
 - CAROLI'S DISEASE
 - CHOLEDOCHOENTERIC ANASTONOSIS
 - OCCUPATIONAL
 - CLONORCHIS SINESIS (BILIARY FLUKE)
 - KLATSKIN TUMOUR
- X PERIportal LYMPHADENOPATHY
- BILE DUCT WALL THICKENING
 - SCLEROSING CHOLANGITIS
 - CHOLANGIOCARCINOMA
 - AIDS CHOLANGIOPATHY
 - ASCENDING CHOLANGITIS
 - CHOLEDUCHOLITHIASIS
 - PANCREATIC
 - ORIENTAL CHOLANGIOHEPATITIS

SEGMENTAL BILIARY OBSTRUCTION
 CHOLEDOCHAL CYST

ULTRASOUND OF THE PANCREAS

- PANCREAS ANATOMY
- PHYSIOLOGY
- IMAGING TECHNIQUES
- ACUTE PANCREATITIS
- PANCREATIC PSEUDOCYST
- PANCREATIC CANCER
- MUCINOUS CYSTIC NEOPLASM OF PANCREAS
- DIFFUSE PANCREATIC ENLARGEMENT DUE TO LYMPHOMA
- ENLARGEMENT OF HEAD OF PANCREAS DUE TO METASTASES
- INSULINOMA

ULTRASOUND OF THE SPLEEN

- A ANATOMY
- B.TECHNIQE
- C.PHYSIOLOGY
- D.IMAGING TECHNIQUE
- E.SPLENOMEGALY
- F.ABSCESS
- G.CALCIFICATION
- H.CYSTS AND TUMOURS
- I.ECTOPIC SPLEEN
- J.RUPTURE
- K.SPLENIC ARTERY ANEURYSM/PSEUDOANEURYSM

SONOGRAPHY OF TIPS (TRANSJUGULAR INTRAHEPATIC PORTO-SYSTEMIC SHUNTS)

- INDICATIONS
- CONTRAINDICATIONS
- SONOGRAPHIC TECHNIQUE
- SONOGRAPHIC PARAMETERS FOR THE DETECTION OF STENT STENOSIS
- STENT VELOCITY
- MAIN PORTA VEIN VELOCITY
- MAIN PORTAL VEIN BRANCH FLOW DIRECTION
- HEPATIC ARTERY VELOCITY
- HEPATIC ARTERY VEIN FLOW DIRECTION

RENAL SONOGRAPHY

- 1) NORMAL RENAL ANATOMY
- 2) PARENCHYMAL ORGAN ECHOGENICITIES
- 3) RENAL SIZES
- 4) DIFFUSE PARENCHYMAL DISEASE
- 5) NORMAL RENAL VARIANTS
- 6) RENAL PSEUDOTUMOURS
- 7) CONGENITAL RENAL ANOMALIES
- 8) RENAL AGENESIS
- 9) RENAL OBSTRUCTION
 - a) HYDRONEPHROSIS
 - b) PELVOCALIECTASIS
- 10) PAPILLARY NECROSIS
- 11) DOPPLER IN RENAL OBSTRUCTION
- 12) RENAL CALCIFICATIONS
 - NEPHROLITHIASIS - COLLECTING SYSTEM
 - NEPHROCALCINOSIS - PARENCHYMA
 - CORTICAL 5%
 - MEDULARY 95%
- 13) CYSTIC RENAL LESIONS
 - a) RENAL CYST
 - b) PERIPELVIC CYST

- c) MULTICYSTIC DYSPLASTIC KIDNEY
- d) AUTOSOMAL DOMINANT POLYCYSTIC KIDNEY
- e) AUTOSOMAL RECESSIVE POLYCYSTIC KIDNEY
- f) ACQUIRED CYSTIC DISEASE
- g) MULTILOCULAR CYSTIC NEPHROMA
- h) RENAL INFECTION
- i) ANGIOMYOLIPOMA
- j) TUBEROUS SCLEROSIS
- k) ONCOCYTOMA
- l) RENAL CELL CARCINOMA
- m) VON HIPPEL – LINDAU DISEASE
- n) RENAL LYMPHOMA
- o) TRANSITIONAL CELL CARCINOMA
- p) PSEUDOKIDNEY SIGN

ADRENAL ULTRASOUND:
 NORMAL ANATOMY.
 SCANNING TECHNIQUE.
 SONOGRAPHIC ANATOMY
 PATHOLOGIC CONDITIONS:

- a)cystic lesions
- b)Adrenal haemorrhage
- c)Adrenal hyperplasia
- d)Adrenal cortical tumours
- e)Adrenal medullary tumours

US OF THE LOWER GENITOURINARY TRACT:
 THE URETERS;
 URETERIC OBSTRUCTION.
 MEGAURETER
 URETEROCELE

THE URINARY BLADDER:
 INDICATIONS FOR SCANNING
 RESIDUAL BLADDER VOLUME
 HAEMATURIA
 BLADDER TUMOURS

THE URETHRA
 SONOURETHROGRAPHY
 THE PENIS
 INDICATIONS FOR US SCANNING
 ERECTILE DYSFUNCTION
 OTHER PENILE PATHOLOGY

ULTRASOUND OF SMALL PARTS

I) SCROTUM

- a) EMBRYOLOGY
- b) NORMAL ANATOMY
- c) SPERMATIC CORD
- d) TESTIS
- e) EPIDIDYMIS
- f) TESTICULAR BLOOD FLOW
- g) HAEMODYNAMICS
- h) PENIS
- i) SCROTAL EXAMINATION CHECK LIST
 - TESTICULAR SIZE
 - TESTICULAR ECHOGENICITY
 - TESTICULAR MASS
 - EPIDIDYMAL SIZE
 - EPIDIDYMAL MASS
 - HYDROCELE
 - SCROTAL WALL THICKNESS
 - SCROTAL PATHOLOGY
 - CRYPTORCHIDISM
 - VARICOCELE
 - TESTICULAR CYSTS
 - EPIDIDYMAL CYSTS
 - SCROTAL CALCIFICATIONS
 - SCROTAL TRAUMA
 - INFLAMMATORY DISORDERS
 - TESTICULAR TORSION
 - TESTICULAR TUMOUR

ULTRASOUND OF THE PROSTATE AND SEMINAL VESICLES.

EUS(endosonography) ANATOMY AND EXAMINATION

EUS OF PROSTATE CANCER.

PROSTATE BIOPSY TECHNIQUE

BENIGN PROSTATIC HYPERPLASIA

INFLAMMATION

PROSTATIC CYSTS

ABNORMALITIES OF THE SEMINAL VESICLES

ULTRASOUND OF THE THYROID,PARATHYROID AND THE SALIVARY GLAND

THYROID:

ANATOMY

TECHNIQUE

THYROID GLAND ANOMALIES

DIFFUSE THYROID DISEASE

SIMPLE GOITRE

**MULTINODULAR GOITRE
THYROIDITIS(HASHIMOTO'S THYROIDITIS)
FOCAL THYROID ABNORMALITIES
THYROID CYST
BENIGN,SOLITARY,SOLID THYROID MASSES.**

- a)Colloid nodule
- b)Thyroid adenomas
- c)Solitary follicular thyroid adenoma

MALIGNANT SOLITARY THYROID MASSES.

- a)Papillary carcinoma
- b)follicular carcinoma
- c)Hurthle cell neoplasm
- d)Medullary carcinoma
- e)Anaplastic thyroid carcinoma.

FINE NEEDLE ASPIRATION BIOPSY (FNAB)

TECHNIQUE

BLIND BIOPSY

US GUIDED BIOPSY

US OF THE PARATHYROID GLANDS:

ANATOMY

TECHNIQUE

PARATHYROID PATHOLOGY

- 1)HYPERPARATHYROIDISM
- 2)PARATHYROID ADENOMA
- 3)PARATHYROID CARCINOMA

US OF THE SALIVARY GLANDS:

ANATOMY

TECHNIQUE

1)THE PAROTID GLAND

i.PAROTITIS

ii.BENIGN AND MALIGNANT NEOPLASMS

- a)PLEOMORPHIC ADENOMA
- b)PAPILLARY CYSTADENOMA(WARTHIN'TUMOUR)
- c)PAROTID CARCINOMA
- d)METASTASES FROM OTHER NEOPLASM(RARE) E.G. SQUAMOUS CELL CARCINOMA,LYMPHOMA

US OF SUBMANDIBULAR GLANDS

ANATOMY

TECHNIQUE

SIALOLITHIASIS

SUBMANDIBULAR GLAND NEOPLASM

INFLAMMATORY AND AUTOIMMUNE DISEASES.

MUSCULOSKELETAL ULTRASOUND:

GENERAL CONCEPTS OF MUSCULOSKELETAL US TECHNIQUE

NORMAL APPEARANCES OF MUSCULOSKELETAL STRUCTURES:

A.TENDONS

B.MUSCLES.

C.JOINTS/BURSAE

D.PERIPHERAL NERVES

E.SKIN

F.SUBCUTANEOUS FAT

G.BONE

APPROACH TO THE ABNORMAL SCAN

A.TENDONS

1.FULL THICKNESS TEAR,2.PARTIAL THICKNESS TEAR

3.ACUTE TENDINITIS,4.TENOSYNOVITIS,5CHRONIC TENDINITIS

6,ROTATOR CUFF TEARS(FULL THICKNESS TEAR,PARTIAL THICKNESS TEAR

7SUBLUXATION OR DISLOCATION.

B.MUSCLES.

1.ACUTE MUSCLE RUPTURE,2.MUSCLE CONTUSIONS,3MYOSITIS OSSIFICANS

4,MUSCLE INFLAMMATION

C.BURSAE

1.ILIOPSOAS BURSA,2.POPLITEAL(BAKER'S)CYST,3,OTHER BURSAE SEEN BY

US:RETROCALCANEAL,RETROACHILLES.PREPATELLAR,INFRAPATELLAR,TROC

HANTERIC,OLECRANON,SUBACROMION-SUBDELTOID

D.JOINTS

1.EFFUSIONS:SHOULDER,ELBOW,HIP,KNEE AND ANKLE.

2.SEPTIC ARTHRITIS

3.INTRAARTICULAR(LOOSE)BODIES

E.PERIARTICULAR PROCESSES.

.MENISCAL CYSTS,GANGLION CYSTS

F.PERIPHERAL NERVES

1.MASSES,2.INFLAMMATION

G.SUBCUTANEOUS TISSUES:

1.EDEMA,2.CELLULITIS/ABSCESS.3.SOLID MASSES,a)Malignant masses.b.lipomas,c.sebaceous cysts.4.FOREIGN BODIES

H.BONE.1.erosionsfrom inflammatory process,i.e osteomyelitis,2.cortical irregularities from degenerative arthritis.3.metastases.

I.SKIN Some authors have reported the utility of 20MHz in detecting skin disease. This technique is not yet being widely applied.

ULTRASONOGRAPHY OF THE SHOULDER:

ULTRASOUND OF THE ELBOW:

ULTRASOUND OF THE PEDIATRIC HIP:

ULTRASONOGRAPHY OF THE KNEE:

ULTRASONOGRAPHY OF THE ANKLE AND FOOT:

**ULTRASOUND OF THE HAND AND WRIST PATHOLOGIES:
MUSCULOSKELETAL SOFT TISSUE MASSES.
ULTRASOUND IN SPORTS MEDICINE:SPORTS US.**

OBSTETRICS/GYNECOLOGY

TRANSVAGINAL SONOGRAM

PELVIC SONOGRAM

TRANSVAGINAL

(TVS)

DETAILED VIEW

LOCAL

“TREES”

MAGNIFIED

TRANSABDOMINAL

(TAS)

GENERAL OVERVIEW

GLOBAL

“FOREST”

STANDARD

TRANSVAGINAL SONOGRAPHY

ADVANTAGES

DISADVANTAGES

TRANSDUCERS

PROBE DISINFECTION

SONOGRAPHIC LAND MARKS

UTERUS: ENDOMETRIAL STRIPE

OVARY : FOLLICLES

ULTRASOUND EVALUATION OF THE UTERUS

- I. NORMAL ANATOMY AND TECHNIQUE
- II. ADENOMYOSIS
- III. LEIOMYOMA
- IV. ENDOMETRIAL POLYPS
- V. POSTMENOPAUSAL UTERUS
 - ENDOMETRIAL ATROPHY
 - ENDOMETRIAL HYPERPLASIA
 - ENDOMETRIAL CARCINOMA
 - TAMOXIFEN

VI) SONOHYSTEROGRAPHY

ULTRASOUND EVALUATION OF THE OVARY

- I. NORMAL ANATOMY AND TECHNIQUE
- II. POLYCYSTIC OVARIAN DISEASE
- III. OVARIAN HYPERSTINULATION SYNDROME
- IV. OVARIAN TORSION
- V. OVARIAN MASSES

OBSTETRICS

ULTRASOUND EVALUATION OF THE FIRST TRIMESTER

- a) INDICATIONS
- b) EMBRYOLOGY
- c) SONOGRAPHIC LANDMARKS
- d) INTRAUTERINE GESTATIONAL AGE

- e) INTRADECIDUAL SIGN
- f) DOUBLE DECIDUAL SIGN
- g) ENDOMETRIAL TROPHOBLASTIC FLOW
- h) DATING

- i) VAGINAL BLEEDING IN THE 1ST TRIMESTER
- j) FETAL DEMISE
- k) ANEMBRYONIC GESTATION
- l) PREDICTORS OF POOR FETAL OUTCOME
- m) EARLY OLIGOHYDRAMNIOS
- n) AMNION
- o) SUBCHORIONIC HAEMORRHAGE
- p) SPONTANEOUS ABORTION
- q) PELVIC PAIN IN THE 1ST TRIMESTER
- r) HAEMORRHAGIC CYST
- s) DEVELOPMENTAL PITFALLS
- t) NUCHAL TRANSLUCENCY.

ULTRASOUND EVALUATION OF THE ECTOPIC PREGNANCY

1. OUTLINE
2. TECHNIQUE
3. US FINDINGS
4. TREATMENT

ECTOPIC PREGNANCY

- RISK FACTORS
- US FEATURES
- POSITIVE B-HCG/EMPTY
- QUANTITATIVE B-HCG
- EXTRAUTERINE GESTATIONAL SAC
- TUBAL RING
- ADNEXAL MASS
- FREE FLUID
- FLUID IN CUL-DE-SAC
- TUBAL RUPTURE
- ROLES OF DOPPLER US
- US FINDINGS (6-8% NORMAL US FINDING IN ECTOPIC PREGNANCY)
- INTERSTITIAL PREGNANCY US FINDINGS
- CERVICAL PREGNANCY
- HETEROTOPIC PREGNANCY

NON – GYNECOLOGIC CAUSES OF PELVIC PAIN IN THE FIRST TRIMESTER

1. RENAL COLIC
2. APPENDICITIS
3. DIVERTICULITIS

FETAL ANATOMIC SURVEY: PROTOCOLS AND BEYOND

1. FETAL HEAD
 - CALVARIUM
 - CHOROID
 - VENTRICULAR SYSTEM
 - BRAIN PARENCHYMA
 - SUBARACHNOID AND BRAIN COVERINGS
2. FETAL SPINE
3. FETAL THORAX (NORMAL SIZE, SHAPE OF THE THORACIC CAGE)
4. FETAL HEART
5. FETAL ABDOMEN
 - i. FETAL STOMACH
 - ii FETAL LIVER
 - iii FETAL UMBELICAL VEIN
 - iv DUCTUS VENOSUS
6. FETAL SPLEEN
7. FETAL BOWEL
8. FETAL KIDNEYS
9. FETAL ANDRENALS
10. FETAL URINARY BLADDER
11. FETAL EXTRIMITIES
12. FETAL EXTERNAL GENITALIA

SONOGRAPHY OF THE FETAL ANOMALIES

- A. HEAD & SPINE ANOMALIES
 - 1) HYDROCEPHALUS
 - 2) AQUEDACTAL STENOSIS
 - 3) HYDRANENCEPHALY
 - 4) HOLOPROSENCEPHALY
 - 5) ANENCEPHALY
 - 6) ENCEPHALOCELE
 - 7) MYELOMENINGOCELE
 - 8) MENINGOCELE
 - 9) CNS AV – MALFORMATIOM
 - 10) DANDY WALKER MALFORMATION
 - 11) LARGE CISTERNA MAGNA
 - 12) MYELOMENINGOCELE VS SACROLOCCY GEAL TERATOMA
 - 13) SACROCOCCYGEAL TERATOMA
 - 14) CHOROID PLEXUS CYSTS
 - 15) CALVARIAL ABNORMALITIES
 - B. FACE AND NECK ANOMALIES
 - 1) CLEFT PALATE AND LIP
 - 2) POSTERIOR NECK MASS
 - 3) CYSTIC HYGROMA
 - 4) NUCHAL SKIN – MEASUREMENT – 1ST TRIMESTER
- NUCHAL SKIN – MEASUREMENT – 2ND TRIM

C. FETAL CHEST ANOMALIES

1. SEQUESTRATION
2. CYSTIC ADENOMATOID MALFORMATION
3. CONGENITAL DIAPHRAGMATIC HERNIA, LEFT SIDED BOCHDALEK
4. CONGENITAL DIAPHRAGMATIC HERNIA RIGHT SIDED BOCHDALEK

D. CARDIAC ANOMALIES

1. PAPILLARY MUSCLES CALCIFICATION
2. ECTOPIC CORDIS
3. VENTRICULAR DISCORDANCE
4. VENTRICULAR SEPTAL DEFECT (VSD)

E. GASTROINTESTINAL ANOMALIES

1. ESOPHAGEAL ATRESIA
2. DUODENAL ATRESIA
3. SMALL BOWEL OBSTRUCTION (JEJUNOILEAL)
4. LARGE BOWEL (ANORECTAL) ATRESIA
5. ECHOGENIC BOWEL
6. OMPHALOCELE
7. PSEUDOOMPHALOCELE
8. GASTROSCHISIS
9. CYSTIC ABNORMAL MASS

(OVARIAN, OMENTAL, ENTERIC DUPLICATION CYST, NECONIUM PSEUDOCYST, GENITO-URINARY CYST)

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9. CYSTIC ABNORMAL MASS

(OVARIAN, OMENTAL, ENTERIC DUPLICATION CYST, NECONIUM PSEUDOCYST, GENITO-URINARY CYST)

F. RENAL ANOMALIES

1. HYDROCEPHALUS
2. URETEROPELVIC JUNCTION (PUJ) OBSTRUCTION
3. MULTICYSTIC DYSPLASTIC KIDNEY (MDK)
4. POSTERIOR UTETHRAL VALVES
5. PRUNE BELLY SYNDROME
6. RENAL AGENESIS

G. MUSCULO – SKELETAL ANOMALIES

1. CLUB FOOT
2. OSTEO GENESIS IMPERFECTA (OI)
3. THANA TOPHORIC DYSPLASIA
(THANATOPHORIC DWARFSM)

H. SYNDROMES

1. TRISOMY 21 (DOWN SYNDROME) – BASIC
2. TRISOMY 2II (DOWN SYNDROME)
3. TRISOMY 13
4. TRISOMY 18
5. TURNER’S SYNDROME

AMNIOTIC FLUID DISORDERS

1. OLIGOHYDRAMNIOS
2. OLIGOGYDRAMNIOS (SECONDARY TO SROM-SPONTANEOUS RUPTURE OR MEMBRANES)
3. POLYHYDRAMNIOS

OBSTETRICAL ULTRASOUND MEASUREMENT AND GROWTH

- 1) SONOGRAPHIC AGE DETERMINATION
GESTATIONAL AGE = MENSTRUAL AGE
BASED ON THE 1ST DAY OF THE LAST MENSTRUAL PERIOD.
 - 2) MENSTRUAL AGE PREDICTORS
 - 3) SONOGRAPHIC AGE ESTIMATION
 - 4) GESTATIONAL SAC MEASUREMENT (MSD)
 - 5) CROWN-RUMP LENGTH
 - 6) ROUTINE 2ND & 3RD TRIMESTER MEASUREMENT. HEAD, BODY, FEMUR.
 - A. HEAD – BIPARIETAL DIAMETER (BPD), CEPHALIC INDEX, AREA – CORRECTS BPD
HEAD CIRCUMFERENCE
 - B. ABDOMINAL MEASUREMENTS
 - C. FEMORAL LENGTH
 - D. ESTIMAATED FETAL WEIGHT (ETW) EFW PERCENTILE CHARTS
 - E. INTERVAL GROWTH RAGE
 - F. INTRAUTERINE GROWTH RESTRICTION
- THREE DIMENSIONAL ULTRASOUND IMAGING IN OBSTETRICS
 - THE PLACENTA AND ITS UMBILICAL CORD ORIGIN
- I. TROPHOTRPISM, A UNIFYING PRINCIPLE
 - II. PLACENTAL PREVIA

- III. FALSE PLACENTA PREVIA
- IV. SUCCENTURIATE LOBE AND OTHER ODD SHAPED PLACENTAS
- V. MARGINAL AND VELAMENTOUS CORD
- VI. VASA PREVIA
- VII. OBLIGATE CORD PRESENTATION
- VIII. PLACENTA ACCRETA

CERVIX

- a) NORMAL CERVIX
- b) CERVICAL CHANGE

METHODS OF SONOGRAPHIC EVALUATION OF THE CERVIX

- a) TRANSLABIAL OR TRANSPERINEAL
- b) TRANSVAGINAL
- CERVICAL INCOMPETENCE, PRETERM LABOUR AND THE RISK OF PRETERM DELIVERY
- CERVICAL STRESS TESTS
- CERCLAGE

FETAL BIOPHYSICAL PROFILE

- THEORETIC BASIS OF THE FETAL BIOPHYSICAL PROFILE
- METHOD FOR FETAL BIOPHYSICAL SCORE
- WHEN TO START TESTING
- FREQUENCY OF TESTING
- CLINICAL MANAGEMENT BASED ON THE TEST SCORE
- MODIFIED METHODS OF FETAL BIOPHYSICAL PROFILE SCORING
- i) SELECTIVE USE OF THE NONSTRESS TEST: BIOPHYSICAL PROFILE SCORE OF 8/8
- ii) SUBSTITUTION OF AMNIOTIC FLUID INDEX FOR THE LARGEST VERTICAL POCKET METHOD
- iii) NONTRESSS TEST/AMNIOTIC FLUID INDEX
- iv) BIOPHYSICAL PROFILE PLUS PLACENTAL GRADE
- BIOPHYSICAL PROFILE SCORE AND FETAL CORD BLOOD ACID-BASE AND PH VALUES.
- CLINICAL APPLICATION, PREDICTIVE ACCURACY AND IMPACT ON OUTCOME OF FETAL BIOPHYSICAL PROFILE SCORING
- BIOPHYSICAL PROFILE AND CEREBRAL PALSY.
- ADULT SEQUELAE OF FETAL ADAPTATION TO ASPHYXIA: THE ALPHA-OMEGA CONCEPT.

VASCULAR IMAGING AND DOPPLER ULTRASOUND

1. PHYSICS AND PRINCIPLES OF COLOR FLOW IMAGING
2. PRINCIPLES OF COLOR DOPPLER AMPLITUDE DISPLAYS
3. SYSTEM OPTIMIZATION
4. ULTRASOUND SYSTEM INSTRUMENTATION AND IMAGE OPTIMIZATION TECHNIQUES (KNOBOLOGY)
5. SPECTRAL AND COLOR DOPPLER
6. CEREBROVASCULAR ISCHEMIA
7. CEREBROVASCULAR ANATOMY AND PROTOCOL

8. TRANSCRANIAL DOPPLER AND TRANSCRANIAL COLOR DOPPLER IMAGING
9. CEREBROVASCULAR DUPLEX EXAMINATION
10. CEREBROVASCULAR ULTRASOUND
11. VERTEBRAL AND AORTIC BRANCH VESSELS
12. PREOPERATIVE ASSESSMENT OF CAROTID BIFURCATION
13. ILIOFEMORAL REGION
14. ULTRASOUND EXAMINATION OF INVASIVE PROCEDURE SITE
COMPLICATIONS
15. TREATMENT OF IATROGENIC FEMORAL ARTERY INJURIES WITH
ULTRASOUND-GUIDED COMPRESSION
16. DOPPLER EVALUATION OF THE LIVER
17. RENAL ARTERY STENOSIS
18. PROSPECTIVE SURVEILLANCE FOR PERIOPERATIVE VENOUS THROMBOUS
19. DUPLEX AND COLOR FLOW EVALUATION OF THE MESENTERIC ISCHEMIA
20. PERIPHERAL VENOUS ULTRASOUND
21. UPPER EXTREMITY VENOUS ULTRASOUND
22. COMPARISON OF DUPLEX US AND CONTRAST VENOGRAPHY FOR
EVALUATION OF UPPER EXTREMITY VENOUS DISEASE
23. PERIPHERAL ARTERIAL TESTING: COLOR DUPLEX IMAGING
24. DUPLEX EVALUATION OF THE MESENTERIC CIRCULATION
25. PROSPECTIVE SURVEILLANCE FOR PERIOPERATIVE VENOUS THROMBOSIS
26. DUPLEX ULTRASONOGRAPHY VASCULAR TESTING
27. NON-IMAGING VASCULAR TESTING
28. SAMPLES

CURRENT INDICATIONS FOR BREAST SONOGRAM

NORMAL ANATOMY

- MORPHOLOGIC VARIATIONS WITH AGE AND
HORMONAL CHANGES
- SONOGRAPHIC CHARACTERS OF THE NORMAL BREAST
- SONOGRAPHIC ABNORMALITIES OF THE BREAST
- DUCTAL ABNORMALITIES
- SOLID MASSES
 - a) BENIGN SOLID MASSES
 - b) MALIGNANT MASSES
- EVALUATION OF THE BREAST USING DOPPLER ULTRASOUND
- ULTRASOUND GUIDED INVASIVE PROCEDURES
 - a) FINE NEEDLE ASPIRATION
 - b) CORE BIOPSY
- BREAST IMPLANTS

ADVANCES IN SONOMAMMOGRAPHY

NEW FRONTIERS IN US BREAST IMAGING