**Louisiana State University Health Sciences Center – Shreveport Radiology Residency Program**

**Ultrasound Curriculum, Goals and Objectives**

ULTRASOUND RESIDENT ROTATION

**Hours:** 7:30 a.m. – 4:00 p.m.

**Duties and Expectations:**

Welcome to the Ultrasound service. During your rotation through Ultrasound, you will obtain both skill and confidence in performing and interpreting Ultrasound examinations. You should get as much hands on experience performing the examinations as reasonably allowable, considering time constraints, number of patients, etc. We encourage you to be in the room with the ultrasound technologist as frequently as possible to further enhance your learning of ultrasound and to better provide care for the patients.

Your day begins with the 7:30 am conference. Following this conference, you should report to the ultrasound reading room. At that point, the examinations performed the previous evening/overnight should be reviewed. These should have a preliminary report provided by the resident on call. You will pick up these preliminary reports from the US Box in the Dept. Office. These examinations should be reviewed with the attending faculty assigned that day and then dictated. The schedule of examinations for the day should be reviewed with the sonographers and any protocol questions discussed with faculty. At noon, you will attend the daily noon conference. You will be given time off before to get your lunch. Following the conference, you should return to the ultrasound reading room and check in with the ultrasound technologists to check on the afternoon schedule and for any emergency examinations performed over the lunch/conference hour or any upcoming studies.

If you are new to Ultrasound, you need to spend time observing the sonographers performing examinations initially and later gain more scanning experience yourself. The general flow through this section is as follows:

1. The sonographers (or residents) perform an examination.
2. The sonographers send images to the PACS.
3. The images are reviewed by the resident and/or staff member, when possible.
4. The physician then scans any areas in question, based on the sonographers’ images, to complete the examination. (as requested by sonographers)
5. The mornings are generally reserved for scanning and the afternoons are for reading.

We have ongoing readout case-by-case throughout the day. You will dictate examinations with which you are involved. Because you need experience scanning as well as interpreting, you will be involved in different cases at different levels.

If this is your initial experience in ultrasound, you should concentrate on developing technical and interpretive skills for the ultrasound examinations that are most commonly requested on an emergent basis. This includes pelvic ultrasound (especially with a question of early intrauterine pregnancy or ectopic pregnancy), gallbladder/biliary ultrasound, and renal ultrasound. You should also attempt to learn the technique for evaluation of the lower extremities for deep venous thrombosis. After mastering the above, broaden the scope of ultrasound examinations with which you are involved. On your second Ultrasound rotation, you should become involved in the full spectrum of exams performed in the Ultrasound section.

Scanning is primarily done by the sonographers. It is your responsibility to assist them as needed to complete the exam. On call exams are done by the sonographers as well. However, it is important that you develop technical skills in scanning. You are expected to go in on any exams requested by technologists. Charts are available at the US desk on all inpatients. ER exams are done in the ER. Pediatric exams are the responsibility of the Pediatric service. The US resident is expected to assist as needed. It is the responsibility of Pediatrics to inform US if coverage is needed.

Keep in mind that on a day-to-day basis, you can learn a great deal from the sonographers, as well as from faculty.

ULTRASOUND RESIDENT GOALS/OBJECTIVES:

**Patient Care**

**FIRST YEAR RESIDENTS (PGY-2):**

1. A basic understanding of the choice of appropriate equipment for a given examination should be obtained. This includes knowledge of advantages and disadvantages of sector versus linear transducers. The relationship of transducer frequency to depth penetration and resolution should be understood. The effect of simple manipulations of controls on the machine should be understood. This includes adjustment of gain, time gain compensation curves, power output adjustment, level of electronic focus of transducer beam, depth of field, and Doppler controls.

1. The resident should achieve basic competence in performing ultrasound evaluation of the gallbladder and bile ducts, kidneys, female pelvis, and veins of the lower extremities. This includes endovaginal examination of the pelvis for questioned gynecological pathology or questioned ectopic pregancy. The resident should be familiar with ACR guidelines for abdominal and pelvic examinations.

3. The resident should become comfortable with interpretation of images generated by sonographers in the area of the abdomen and pelvis. This especially includes evaluation of the gallbladder and bile ducts, kidneys, and the female pelvis.

4. Demonstrate knowledge of and ability to use electronic patient information systems, including the radiology information system and appropriate use of electronic systems to obtain patient laboratory data, etc., to integrate with imaging findings to assist in an accurate diagnosis.

5. Understand the indications for each imaging examination performed and the specific indications for any examination performed on an individual patient. Perform exams responsibly and safely, assuring that the correct exam is ordered and performed.

6. Demonstrate the ability to use the internet as a tool for teaching and learning, including access to information to improve knowledge in patient care situations.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.

1. Demonstrate ability to integrate laboratory findings and other clinical parameters in recommending appropriate patient specific imaging strategies for diagnostic purposes.
2. Increase experience with the performance and interpretation of less common ultrasound examinations, including small parts (thyroid, scrotum, etc.).
3. The principles of Doppler ultrasound and its application to vascular studies should be understood. The ability to perform venous ultrasounds should be extended from applications limited to the lower extremities to other veins of the body.
4. Basic understanding of the application of ultrasound guidance to invasive procedures should be obtained. This should include an understanding of the approach to fluid aspirations and soft tissue biopsies including the thyroid.
5. All 2nd and 3rd trimester OB exams should be reviewed by the resident, but we do relatively few of these exams. We will try to allow you some time to observe OB exams in your 2nd and 3rd year rotations. (Wed. am will be set aside for special exams)
6. The resident should become a resource to medical students and junior residents in achieving the above objectives.

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.
2. Teaching of the above objectives to medical students and junior residents should be increasingly emphasized.

**Medical Knowledge**

**FIRST YEAR RESIDENTS (PGY-2):**

1. Normal sonographic anatomy of the abdomen and pelvis should be mastered along with knowledge of the effects of common pathologies of this anatomy. This includes cholelithiasis and cholecystitis, biliary obstruction, hydronephrosis, cystic renal disease, and common pathologies in the female pelvis. Particular emphasis should be placed on evaluation of early normal and abnormal intrauterine pregnancy, ectopic pregnancy, and alterations in the adnexa accompanying pelvic inflammatory disease and pelvic neoplasms.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.

2. Knowledge of the application of Doppler ultrasound should be broadened. This should include Carotid Doppler exams and Doppler exams of abdominal organs, especially the liver. Alterations in hepatic gray scale and Doppler related to cirrhosis and portal hypertension should be mastered. The significance of wave form alteration in interpreting carotid ultrasound should be understood. Methods of quantifying Doppler signals should be learned.

1. Demonstration of the knowledge associated with first and second year objectives (in this document and rotation specific objectives) should be demonstrated with teaching to medical students and junior residents.
2. Increased attention to MSK and OB US may be allowed as practical on Wednesdays and Fridays.

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.
2. Increased proficiency in performance and interpretation of obstetrical ultrasound should be demonstrated, especially during your one month OB Ultrasound elective with the High-Risk OB section. Knowledge of common abnormalities, including neural tube defects, abdominal wall abnormalities, GI obstructions, and GU obstructions should be demonstrated. Knowledge and understanding of the pathologies causing and associated with oligohydramnios and polyhydramnios should be mastered. The ability to identify different types of twin pregnancies sonographically should be demonstrated.
3. Increased proficiency with vascular ultrasound examination should be demonstrated.
4. Teaching of the above objectives to medical students and junior residents should be increasingly emphasized. After your OB Ultrasound elective, you should give a one hour lecture on any specific OB US topic to our department when Dr. Gates or Dr. Heldmann is present.
5. Increased attention to MSK US with Dr. Simoncini.

**Interpersonal and Communication Skills**

**FIRST YEAR RESIDENTS (PGY-2):**

1. Work to structure your dictated reports of imaging studies to accurately and effectively transmit results and recommendations to referring clinicians.

2. Work with attending staff to develop techniques for effective oral communication with patients, referring clinicians, and support personnel in radiology. Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives, and possible complications

1. Demonstrate appropriate phone communication skills and documentation in the dictated report of the name of the physician/clinician notified of any significant unexpected or potentially serious findings.
2. Work with technologist as required, to answer questions proposed. Go in on studies requested.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.
2. Demonstrate increasing skill in clearly and concisely communicating via the radiology dictated report.
3. Demonstrate a leadership role in communications/interactions with technical personnel and patients, including explanation of delays related to emergencies.
4. Demonstration of the knowledge/behavior associated with these objectives should be evident in teaching to medical students and junior residents.
5. Direct real time exams, modify as needed. Cooperate with technologists, complete exams as needed.

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.
2. Demonstrate increased ability to communicate effectively with providers at all levels of the health care system as well as those in outside agencies, etc.
3. The senior resident should model by action as well as directly teach the above objectives to referring clinicians, technical personnel, medical students and junior residents.

**Professionalism**

**FIRST YEAR RESIDENTS (PGY-2):**

1. Demonstrate compassion, honesty and ability to provide care/interact with others without regard to religion, ethnic, sexual, or educational differences and without employing sexual or other types of harassment.

2. Demonstrate understanding of the principles of patient confidentiality by compliance with the HIPAA Privacy Rule.

3. Demonstrate completion of medical records, including review/signoff of radiology reports, according to departmental/hospital guidelines.

1. Demonstrate positive work habits, including punctuality and professional appearance.
2. Demonstrate honesty with patients and all members of the health care team.
3. Cooperate with technical personnel as needed.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.
2. Demonstrate altruism (putting the interests of patients and others above own self-interest).

3. The resident should teach the above objectives to medical students and junior residents directly as well as by modeling behavior consistent with these objectives.

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.

2. The senior resident should increasingly supervise and mentor medical students and junior residents in achieving these objectives.

**Practice-Based Learning and Improvement**

**FIRST YEAR RESIDENTS (PGY-2):**

1. Analyze practice experience and perform practice-based improvement in cognitive knowledge, observational skills, formulating a synthesis and impression, and procedural skills. Demonstrate this by active review and performance modification and active participation in morbidity and mortality/ misses conferences.

2. Participate in Journal club, clinical conferences, and independent learning

3. Active participation in ultrasound audit and QC

4. Demonstrate use of multiple sources, including information technology, to optimize life long learning and support patient care decisions.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.

2. Residents should demonstrate that they are reading the current

literature, particularly the **Radiology** and the **American Journal of Roentgenology**, by being familiar with material recently published in those journals. A life-long pattern of reading these journals should be begun.

3.Other Journals specific to US include **AIUM** and **JCU.**

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.
2. Demonstrate awareness of resources available to practicing radiologists for lifelong learning, including print, CD-ROM, and internet products of the ACR.

3. Demonstrate knowledge of the above objectives by supervision of medical students and junior residents as well as by directly teaching these objectives.

**Systems-Based Practice**

**FIRST YEAR RESIDENTS (PGY-2):**

1. Begin to acquire knowledge regarding the costs of imaging studies and impact of costs on appropriate choices for clinical use.

**SECOND AND THIRD YEAR RESIDENTS (PGY-3 or 4):**

1. All of the objectives listed for first year residents should be reviewed with increased mastery.

1. Demonstrate the ability to design cost-effective imaging strategies/care plans based on knowledge of best practices.
2. Demonstrate knowledge of hospital-based systems that effect physician practice, including physician code of ethics, medical staff bylaws, quality assurance committees, and credentialing processes. This includes knowledge of how these processes may affect the scope of practice of any one physician and competition among practitioners.

**FOURTH YEAR RESIDENTS (PGY-5):**

1. All of the objectives listed for first, second, and third year residents should be reviewed with increased mastery.
2. Demonstrate knowledge of how decisions about the timing/availability of imaging studies may affect hospital length of stay, referral patterns for specific examinations and use of diagnostic studies outside the Department of Radiology.

3. Demonstrate knowledge of the regulatory environment. Demonstrate knowledge of basic management principles such as budgeting, record keeping, medical records, and the recruitment, hiring, supervision and management of staff.

#### ULTRASOUND REFERENCES

1. Middleton WD, Kurtz AB, Hertzberg BS. Ultrasound: The Requisites (2nd Edition), Mosby, 2004.

On first rotation, read the following first: Chapter 1 (Practical Physics), Chapter 2 (Gallbladder), Chapter 3 (Liver), Chapter 4 (Bile Ducts), Chapter 5 (Kidney), Chapter 9 (General Abdomen), Chapter 22 (Pelvis and Uterus), Chapter 23 (Adnexa), and Chapter 14 (The First Trimester and Ectopic Pregancy). If possible, read Chapter 6(Lower GU), Chapter 7 (Pancreas), Chapter 8 (Spleen), Chapter 11 (Extremities)

On second rotation, review the chapters listed above, and read Chapter 10 (Neck and Chest) and Chapters 12-21 (Obstetrical Ultrasound).

1. Rumack CM, Wilson SR, Charboneau JW. Diagnostic Ultrasound, 3rd Edition, Mosby-Year Book 2005. Reference book. Not realistic to read in entirety on rotation.
2. Callen, Peter. Ultrasound in Obstetrics and Gynecology, 4th Edition, 2000. OB/GYN Ultrasound Reference.
3. Journal of Ultrasound in Medicine. AIUM (American Institute of Ultrasound in Medicine)
4. Journal of Clinical Ultrasound. Wiley Periodicals.

## ULTRASOUND

The following curriculum is intended as a guideline for the training of radiology residents in ultrasound. The resident should be familiar with this material as a result of hands-on clinical experience combined with formal teaching materials such as conferences, teaching files, books, internet, etc. Depending on the organization of the residency program, this material could be covered during a dedicated ultrasound rotation, in a series of organ-based rotations that include more than one imaging modality, or in some combination of the two approaches.

## CURRICULUM

I. BACKGROUND/TECHNICAL CONSIDERATIONS:

A. PHYSICS

1. Definition of ultrasound, relationship of sound waves used in imaging to those

of higher/lower frequency with other properties.

1. Working knowledge of frequency, sound speed, wavelength,

intensity/decibels

1. Interaction of sound waves with tissues: reflection, attenuation, scattering,

refraction, absorption, acoustic impedance.

1. Generation/detection of ultrasound waves.
2. Doppler phenomenon.
3. Pulse-echo principles.

7. Beam formation/focusing

B. BIOEFFECTS/SAFETY

1. Thermal/nonthermal effects on tissue

1. Relative effects of gray scale, M-Mode, pulsed wave Doppler, color flow

imaging, power imaging, harmonics

3. Contrast agents

C. IMAGING APPLICATIONS/EQUIPMENT OPERATION

1. Transducer choice

1. Frequency: gray scale/Doppler (understand tradeoff of

penetration/resolution), optimal gray scale probe may not be the optimal

Doppler probe

3. Shape: linear, sector, curved

4. Approach: external, endocavitary, translabial

1. Display: gray scale, M-Mode, pulsed wave Doppler, color/power imaging,

3-D

6. Image orientation: standard images in different planes

7. Image optimization: power output, gain, time gain compensation

8. Image recording options- electronic, film, paper, videocassette

9. Endocavitary imaging - vaginal, rectal, endoscopic techniques

10. Interventional techniques

D. ARTIFACTS:

1. Underlying principles (straight narrow sound beams, simple reflection,

constant sound speed)

2. Beamwidth artifacts, sidelobes, slice thickness

3. Multiple reflection artifacts - mirror image/reverberations

4. Tissue characteristics- shadowing/enhancement

5. Refractive artifacts

6. Doppler artifacts- pulse wave, color imaging (includes aliasing)

E. QUALITY ASSURANCE

1. Equipment QA Program

2. Phantoms- spatial/ contrast resolution

3. Sonographer/physician based QA

II. CLINICAL USES OF ULTRASOUND

A. GENERAL CONSIDERATIONS

1. Examination protocols- protocols for each routine examination should be

understood. Published protocols from the American Institute of Ultrasound in Medicine (AIUM) or the American College of Radiology (ACR) with or without local modification are acceptable frames of reference.

2. Basic cross sectional/ultrasound anatomy/range of normal sonographic

findings as related to age and sex for each of the anatomic areas included

below.

3. General diagnostic criteria used to evaluate tissue characteristics and

distinguish normal from abnormal, cystic from solid, etc.

4. General knowledge of clinical uses/limitations of ultrasound and use of other

imaging studies to complement ultrasound.

1. Techniques for ultrasound guided invasive procedures- aspiration(of tissue

masses, fluid collections), biopsy, catheter placement(into pleural, peritoneal, other fluid collections), amniocentesis

1. Reporting skills/ requirement

B. SPECIFIC APPLICATIONS

1. HEAD/SPINE

1. Neonatal head: hemorrhage, hydrocephalus, shunt evaluation,

periventricular leukomalacia, congenital malformations

b. Neonatal spine: lipoma, tethered cord, sacral skin dimple

c. Neurosurgical: guidance for intracranial fluid aspiration, mass

localization

2. NECK

1. Thyroid: size, shape, multinodular goiter, benign/malignant neoplasm,

associated adenopathy, localization of parathyroid mass, biopsy of

thyroid/parathyroid mass or adenopathy

1. Vascular exams: carotid duplex exam(with Doppler spectrum analysis)

including normal appearance, arterial occlusion, stenosis, plaque,

subclavian steal, jugular thrombosis

3. CHEST

1. Pleural fluid (simple vs. loculated/complex) or mass, aspiration/

catheter drainage of fluid.

b. Vascular; subclavian vein thrombosis

c. Breast: cystic vs solid mass, malignancy, abscess, ultrasound guided

needle localization/biopsy/cyst aspiration

d. Cardiac: pericardial effusion

4. ABDOMEN

1. Liver: normal size, shape, écho texture, Doppler and color imaging of

hepatic arteries, veins, and portal veins, diffuse disease, focal mass

(cyst, hemangioma, hepatocellular carcinoma, metastatic lesions),

cirrhosis/portal hypertension, varices, transplant evaluation,

intrahepatic porto-systemic shunt Doppler evaluation

1. Gallbladder/Bile Ducts: normal gallbladder, intra- and extra-hepatic

duct size, gallstones, acute cholecystitis calculus/acalculous),

hyperplastic cholecystosis, sludge, polyps, carcinoma, HIV related

biliary disease, biliary obstruction/dilatation, duct stones

1. Pancreas: normal anatomy/size, duct size, acute/chronic pancreatitis,

pseudocyst, calcifications, cysts, masses (benign/malignant)

1. Spleen: normal anatomy/size, focal lesions (cystic vs solid), trauma,

splenic varices

1. Kidneys/Ureters: normal anatomy/size, cysts (simple/ complex), cystic

diseases, renal cell carcinoma, angiomyolipoma, hydronephrosis/

/hydroureter, calculi, abscess/pyelonephritis, perinephric fluid, renal

arterial Doppler(including use of resistive index), renal transplant

evaluation (include Doppler)

f. Adrenal Glands: focal lesion (cyst/solid), neonatal hemorrhage

g. Peritoneal cavity: localization/quantification/aspiration of fluid

(free/loculated) – including abscess, blood, omental mass, free air

1. Gastrointestinal Tract: normal appearance, appendicitis, pyloric

stenosis, intussusception, mass

1. Retroperitoneum/Vessels: adenopathy, aorta (normal/aneurysm,

including proximal and distal extent), inferior vena cava

(normal/thrombosis)

5. PELVIS (excluding pregnancy)

1. Urinary Bladder: mass, calculi, obstruction, infection, diverticula,

ureterocele, color flow imaging of ureteral jets

1. Uterus: normal size, shape, echogenicity. Endometrium- normal

thickness(premenopausal, postmenopausal, effect of hormone

replacement), physiologic variation, carcinoma, hyperplasia, polyps,

endometritis, pyometra. Myometrium- leiomyomata, adenomyosis.

Cervix- mass, stenosis, obstruction. Saline hysterosonography.

1. Ovary: normal size, shape, echogenicity, physiologic variation

(follicles, corpus luteum). Torsion, infection, abscess, cystic/solid

mass- cystadenoma/carcinoma, hemorrhagic cyst, dermoid,

endometrioma

d. Fallopian Tube: hydrosalpinx, pyosalpinx

e. Prostate: normal size, shape, echogenicity, cystic/solid mass,

carcinoma, abscess, biopsy

1. Scrotum: normal size, shape, echogenicity of testis and epididymis,

cystic/solid testicular or extratesticular mass. Testicular carcinoma,

torsion, epididymitis/orchitis, varicocele, hydrocele, spermatocele,

trauma

6. EXTREMITIES

1. Vascular: venous thrombosis evaluation (upper and lower extremity)

with compression/Doppler/color imaging, venous insufficiency,

aneurysm, pseudoaneurysm/compression, arteriovenous fistula

1. Musculoskeletal: mass (cystic/solid), tendon (tear, inflammation),

neonatal hip, foreign body

7. OBSTETRICS

EARLY PREGNANCY:

1. Normal findings: gestational sac appearance, size, growth, yolk sac,

embryo, cardiac activity, amnion, chorion, embryology, normal

early fetal anatomy/growth, crown rump measurement, multiple

gestations, correlation with hCG levels

1. Abnormal findings: spontaneous abortion, embryonic death, blighted

ovum, bleeding/hematoma, ectopic pregnancy, gestational

trophoblastic disease, gross embryonic structural abnormalities

2ND/3RD TRIMESTER:

1. Normal findings: fetal anatomy/development, placenta, biometry,

amniotic fluid, multiple gestations, umbilical cord Doppler,

alpha-fetoprotein testing, perform complete exam according to the

AIUM/ACR guidelines. Amniocentesis, chorionic villous sampling

guidance.

1. Nonfetal abnormalities: oligohydramnios, polyhydramnios, placenta

previa, placental abruption, placental masses, 2 vessel umbilical cord,

cord masses, cervical shortening/dilatation (including translabial

imaging).

1. Fetal abnormalities: intrauterine growth retardation, chromosomal

abnormalities/associated syndromes, hydrops, congenital infections,

neural tube defects, hydrocephalus, hydranencephaly, chest masses,

cardiac malformations and arrhythmias, diaphragmatic hernia,

abdominal wall defects, abdominal masses, GI tract obstructions,

urinary tract obstruction/cystic abnormalities, renal agenesis, ascites,

limb shortening abnormalities, cleft lip/palate, twin/twin transfusion

syndrome.

1. Understand significance of borderline findings: choroid plexus cyst,

echogenic focus in heart, echogenic bowel, borderline hydrocephalus.

**Reference:**

Curriculum Committee of the Society of Radiologists in Ultrasound.

# Resident Assessment

1. Electronic evaluation by the attending faculty on a monthly basis following your rotation as well as every 6 Months a written evaluation reviewed with you by the Program Director.

2. OSCE given twice per year

3. ACR in-training examination

4. Written ABR exam

5. Oral ABR exam

6. Raphex physics exam

**References:**

Association of Program Directors in Radiology ([www.apdr.org](http://www.apdr.org))

Stony Brook University Radiology Residency

University of Co Denver

**Ultrasound Core Lectures: Linda Nall, M.D.**

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| 1 | Introduction: techniques, transducers, artefacts |
| 2 | Obstetrical US: early pregnancy |
| 3 | Obstetrical US: 2nd and 3rd trimester fetus; normal/abnormal anatomy |
| 4 | Obstetrical US: 2nd and 3rd trimester placenta, cervix, measurements |
| 5 | Liver and gallbladder |
| 6 | Spleen, pancreas, retroperitoneum |
| 7 | Kidney, bladder |
| 8 | Vascular ultrasound |
| 9 | Pediatric hip ultrasound |
| 10 | Neurosonography |
| 11 | Gynecologic ultrasound |
| 12 | Pediatric abdominal ultrasound |