



Faculty point person:

Brendan Coleman, M.D.

Abdominal Imaging Fellowship: University of California, San Francisco

Radiology Residency: Saint Vincent's Medical Center, Bridgeport, CT

UMKC teaching faculty in Ultrasound:

Jeff Kunin, M.D. (SLH - Chest and Body)

Kelly Andresen, M.D. (SLH - Body)

Shaya Ansari, M.D. (SLH - Body)

Pablo Delgado, M.D. (SLH - Body)

Kay North, DO (CMH fetal and OB/GYN)

Socrates Jamoulis, MD (TMC)

Jean Dykstra, DO (KCVA)

Calvin Myers, PhD (physics)

Gordon Bell, technologist (physics - CMH)

Lisa H Lowe, MD (Brain and spine US)

Emily Kucera, MD (Pediatric Abdomen Sonography)

Delores Tizol-Blanco (KCVA)

Core lecture series in Ultrasound

Core lectures - Biweekly year round

7:30 or 12:00am at SLH

1. Practical Physics of Ultrasound
2. Right upper quadrant Ultrasound
3. Carotid sonography
4. Thyroid sonography
5. Renal transplant sonography
6. Venous US (DVT, insufficiency)
7. Hepatic Doppler Ultrasound
8. Mesenteric Doppler Ultrasound
9. Arterial Doppler (AV fistula, pseudoaneurysm)
10. Basic Obstetrical Imaging
11. Advanced Obstetrical and Fetal Imaging
12. Ultrasound of the Liver, Biliary, Pancreas and GI system
13. Scrotum sonography
14. Renal ultrasound/Renal artery stenosis
15. Female pelvis
16. Ovarian masses
17. Evaluation of the endometrium
18. Emergent female pelvis
19. Neonatal brain, spine, pylorus and hips

This curriculum is supplemented by the following interdisciplinary lectures:

- | | | |
|----|----------------------------|------------------|
| 1. | SLH - Biweekly Wed morning | Pulmonary |
| 2. | SLH - Biweekly Wed noon | Gastrointestinal |
| 3. | SLH - Biweekly Thurs noon | Journal club |
| 4. | SLH - Biweekly noon | Oncology |
| 5. | TMC - Monthly Mon noon | Endocrine |
| 6. | TMC - Weekly Wed noon | Tumor |
| 7. | TMC - Biweekly Fri 11am | Pulmonary |

Ultrasound – Rotation 1

General overview:

Radiology resident rotations in Ultrasound will include at least the equivalent of 3 months during the radiology residency. The learning of ultrasound will encompass multiple rotations with specific goals including objectives required for every level of training with graded supervision by the attending faculty. All aspects of ultrasound will be incorporated into the residency, including Obstetrical Ultrasound (in conjunction with the Department of Obstetrics and Gynecology at Saint Luke's Hospital), General Ultrasound (in conjunction with Saint Luke's Hospital and Truman Medical Center faculty), and Pediatric Ultrasound (in conjunction with Children's Mercy Hospital faculty). Breast Ultrasound at Saint Luke's Hospital will be incorporated into the Breast Imaging rotation while at that facility. Musculoskeletal Ultrasound at Saint Luke's Hospital will be incorporated into the Musculoskeletal rotation while at that facility.

Resident responsibilities:

1. The resident is involved in the daily conduct of ultrasound studies. At the start of every working day, the resident should be familiar with the patient schedule and anticipate needs for any procedures. The resident will check requisitions for next working day to evaluate for appropriateness of requested procedure or if additional exams/protocol needs to be performed. Absent clinical indication or seemingly in-appropriate requests will be clarified and discussed with referring physician.
2. The resident assigned to ultrasound is expected to be available for consultation by ultrasound technologists, clinicians and other health care professionals during regular office hours except during conference times, when attending faculty will cover.
3. Examinations should be checked by the resident before the patient leaves the department if requested to do so by the supervising faculty.
4. Any questions should be referred to the supervising faculty covering ultrasound.
5. Preliminary reports are written for emergency room referrals and patients who are going to clinic appointments on the same day of the examination when appropriate. This is communicated to attending radiologist and documented in the final report with name, date and time of such a communication.
6. Review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient work flow.
7. All examinations should be dictated by the end of every working day.
8. The resident will check his/her reports prior to final verification by supervising faculty.

Staff responsibilities:

1. Supervising faculty should be available at all times for any questions or consultations needed by the resident.
2. Supervising faculty should review all cases with the resident before the end of the day.

3. Supervising faculty should provide the resident with constructive feedback in any problem areas encountered during the rotation.
4. Supervising faculty should verify resident-generated reports in a timely manner and inform the resident of any major changes he/she made.

Resident evaluation: Residents are evaluated monthly via the electronic UMKC system as per description in UMKC Radiology Residency Manual

Ultrasound – Rotation 1 - goals and objectives

I. Patient care:

- (a) The resident should have knowledge of indications for the examinations requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- (b) The resident should be familiar with available medical records and how to access them for purposes of patient care.
- (c) All studies should be reviewed with supervising faculty attending.
- (d) Preliminary reports should be made available to all referring clinicians if needed prior to final review of cases. When there is a significant discrepancy between the preliminary reading and final reading, the resident should notify the referring clinician immediately.

II. Medical Knowledge:

- (a) Become familiar with ultrasound in all three areas of Hands on Scanning, Comprehensive Knowledge, and Clinical Applications.
 - I. Hands on Scanning – resident should be able to scan most of the clinical scenarios listed below:
 1. Gallbladder (acute cholecystitis/gallstones)
 2. Liver (masses)
 3. Kidney (hydronephrosis/stones)
 4. Transabdominal/transvaginal Pelvis (mass/cyst/free fluid)
 5. Lower Extremity (deep vein thrombosis)
 6. Abdominal Aorta (aneurysm)
 7. Pleural Effusion and Ascites
 8. Pregnancy (early intrauterine pregnancy and ectopic pregnancy)
 9. Thyroid Nodules
 - II. Comprehensive Knowledge – includes the basic principles of ultrasound physics listed below:
 1. Define ultrasound, including the relationship of sound waves used in imaging
 2. Straight narrow sound beams, simple reflection, constant sound speed
 3. Beam shape: linear, sector, curved array
 4. Probes: transabdominal, endocavitary
 5. Endocavitary imaging: transvaginal, transrectal, endoscopic, laparoscopic
 6. Display: Gray scale, M-mode, pulsed wave Doppler, color and power Doppler
 7. Image orientation: standard images in different planes
 8. Image optimization: power output, gain, time gain compensation
 9. Image recording options: electronic (digital), film, paper
 10. Acoustic properties of fluid, cyst, calcification, complex fluid and solid structures
 11. Tissue characteristics: acoustic shadowing and enhancement Focal zone
 - III. Clinical Applications – the resident should understand the importance of clinical ultrasound protocols. Published protocols/standards from the American College of

Radiology (ACR) or the American Institute of Ultrasound in Medicine (AIUM) with or without local modification are acceptable frames of reference. Residents should also be familiar with ACR appropriateness criteria as a guide for appropriate clinical use of ultrasound and other imaging modalities.

The resident should gain a general understanding of both the clinical uses and limitations of ultrasound as well as the appropriate integration of other complementary cross-sectional imaging studies, particularly CT and MRI.

The resident should understand the importance of documentation and reporting skills/requirements, including the electronic applications in their institution.

The resident should understand the importance of clinical quality assurance, including radiologic-pathologic correlation, as well as sonographer-physician discrepancies.

1. Abdominal

- a. Liver: Normal echotexture, size, and shape (including anatomic variants); Diffuse disease, (fatty infiltration, acute and chronic hepatitis, cirrhosis, edema); Focal masses, metastases, granuloma
- b. Gallbladder: Normal appearance, wall thickening, gallstones, including supine, decubitus and erect positions, sludge, acute cholecystitis (calculous/acalculous), sonographic Murphy's sign, other etiologies of wall thickening, polyp
- c. Bile ducts: normal intra- and extrahepatic bile duct diameters and dilatation
- d. Pancreas: normal anatomy, pancreatic duct, mass
- e. Spleen: normal echotexture, size and shape (including anatomic variants), focal masses (cystic versus solid), lymphoma, abscess, infarction, granuloma
- f. Peritoneal cavity: ascites, fluid localization/quantification (free/loculated)
- g. Pleural effusion

2. Kidneys/Urinary Bladder/Prostate

- a. Normal renal cortical echotexture, size and shape, glomerulointerstitial renal disease, simple renal cyst
- b. Ureters: hydronephrosis, pyonephrosis
- c. Urinary bladder: calculi, wall thickening, ureteral jets, bladder volume, including post-void residual

3. Gynecology

- a. Uterus: normal size, shape, position, echogenicity, fibroid identification
- b. Endometrium: normal appearance during phases of menstrual cycle and thickness measurement (pre-menopausal, post-menopausal, effects of hormone replacement), intrauterine device, fluid
- c. Ovary: normal size, shape, echogenicity, physiologic variation during phases of menstrual cycle (follicles, corpus luteum, hemorrhagic ovarian cyst)
- d. Free pelvic fluid

4. Obstetrics, First Trimester

- a. Normal findings: gestational sac appearance, size, gestational sac growth, yolk sac, embryo, cardiac activity including normal embryonic heart rate, amnion, chorion, normal early fetal anatomy/growth, crown-rump length measurement, correlation with BHCG levels and menstrual dates

5. Obstetrics, Second and Third Trimester

- a. Normal findings: normal fetal anatomy/situs/development, placenta, biometry, amniotic fluid volume, multiple gestations
 - b. Anencephaly
 - c. Oligohydramnios (spontaneous premature rupture of membranes, renal disease, fetal death, intrauterine growth retardation, infection)
 - d. Polyhydramnios, placenta previa
 - e. Cervical appearance and length
6. Thyroid/Neck
- a. Normal thyroid echotexture, size and shape
 - b. Thyroid disease: diffuse and focal disease
 - c. Multinodular thyroid
7. Vascular/Doppler
- a. Abdominal aorta: normal appearance and measurement, aneurysm
 - b. Inferior vena cava: normal appearance, thrombosis
 - c. Lower extremity deep vein thrombosis
 - d. Hematoma
 - e. Iatrogenic pseudoaneurysm
8. Scrotum
- a. Testes: normal echotexture, shape and size
 - b. Epididymes
 - c. Testicular mass
 - d. Hydrocele
9. Pediatrics
- a. Normal abdominal, pyloric and renal anatomy
 - b. Normal hip anatomy
 - c. Normal brain and spine anatomy
 - d. Normal small parts anatomy
10. Musculoskeletal
- a. Mass
 - b. Hematoma
 - c. Baker's cyst, including rupture
 - d. Cellulitis
 - e. Abscess
11. Breast
- a. Sonomammographic anatomy
 - b. Cystic versus solid mass
 - c. Mastitis/abscess
12. Interventional
- a. Informed consent
 - b. Sterile technique
 - c. Localization of fluid for paracentesis or thoracentesis to be performed by another service
 - d. Ultrasound-guided paracentesis

(b) The resident should be familiar with the anatomy of the organs examined in every case. An atlas of cross-sectional anatomy should be consulted when there is any doubt.

- (c) Depending upon the indication of the examination, the resident should be familiar with ultrasound findings in the disease entity suspected.
- (d) In cases where the resident is not familiar with the disease entity or expected findings on ultrasound scans, he/she should recognize their limitations and consult with supervising faculty or appropriate reading material.

III. **Practice Based Learning and Improvement:**

- (a) The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources.
- (b) Follow-up of abnormal or interesting studies should be accomplished through personal communication with the referring physician or patient medical records.
- (c) The resident should be competent in using the ultrasound PACS in the daily accomplishment of the work load and instruct others in its use.

IV. **Interpersonal Communication Skills:**

- (a) The resident should be able to communicate effectively results of studies to referring clinicians whenever needed. For emergent studies, reports to referring clinicians should be made in a timely manner.
- (b) The resident should be able to effectively convey the findings of examinations through accurate dictation of reports.

V. **Professionalism:**

- (a) Residents should be able to explain the nature of the examination or findings in an examination to patients and their families when needed.
- (b) Residents should observe ethical principles when recommending further work-up for cases.
- (c) Promptness and availability at work are expected of every resident.
- (d) Residents should dress appropriately at work, wearing a name badge at all times.
- (e) Ultrasound technologists and other health workers should be treated with respect and part of the health care team.
- (f) Patient confidentiality should be observed at all times.
- (g) Residents are required to complete an online professionalism module at least biannually.

VI. **System Based practice:**

- (a) Residents should be familiar with departmental procedures necessary in the performance of the examination.
- (b) Residents should learn appropriate language to be used in communicating to clinicians through reports or consultations so proper management decisions can be made.
- (c) Proper dictations should be made with indications, technique, findings and conclusions
- (d) Residents should dictate and correct their reports in a timely fashion to avoid delay in patient disposition.
- (e) Residents should assist in facilitating examinations whenever possible.
- (f) Resident should recognize the role that ultrasound plays in the management of patient's illness and make proper recommendations when needed
- (g) Suggestions to improve methods and systems utilized in radiology should be made whenever appropriate.

Reading list:

1. Sonoworld.com –Series of lectures
2. The Requisites – Ultrasound – Middleton WD, Kurtz AB, Hertzberg BS (eds). Mosby-Year Book. St Louis, 2004
3. Pediatric Radiology or US text book - chapters on head and hip sonography
4. Pediatric Radiology SPR modules on TCD, spine, head and pyloric sonography

Ultrasound - Rotation 2

General overview

Radiology resident rotations in ultrasound will include at least 3 months during the radiology residency. The specific goals include objectives required for every level of training with graded supervision by the attending faculty. All aspects of ultrasound will be incorporated into the residency, including Obstetrical Ultrasound (in conjunction with the Department of Ob/Gyn at Saint Luke's Hospital), General Ultrasound (at Saint Luke's Hospital and Truman Medical Center) and Pediatric Ultrasound (in conjunction with Children's Mercy Hospital faculty). Breast Ultrasound at Saint Luke's Hospital will be incorporated into the Breast Imaging rotation while at that facility. Musculoskeletal Ultrasound at Saint Luke's Hospital will be incorporated into the Musculoskeletal rotation while at that facility.

Resident responsibilities:

1. The resident is involved in the daily conduct of ultrasound services. At the start of every working day, the resident should be familiar with the patient schedule and anticipate needs for any procedures. The resident will check requisitions for next working day to evaluate for appropriateness of requested procedure or if additional exams/protocol needs to be performed. Absent clinical indication or seemingly in-appropriate requests will be clarified and discussed with attending MD.
2. The resident assigned to ultrasound is expected to be available for consultation by ultrasound technicians, clinicians and other health care professionals during regular office hours except during conference times.
3. Examinations should be checked by the resident before the patient leaves the department if requested to do so by the supervising faculty.
4. Any questions should be referred to the attending supervising faculty on ultrasound.
5. Preliminary reports are written for emergency room referrals and patients who are going to clinic appointments on the same day of the examination when appropriate. This is communicated to attending radiologist and documented in the final report with name, date and time of such a communication.
6. Review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient work flow.
7. All examinations should be dictated by the end of every working day.
8. The resident will check his/her reports daily prior to final verification by supervising faculty.

Staff responsibilities:

1. Supervising faculty should be available at all times for any questions or consultations needed by the resident.
2. Supervising faculty should review all cases with the resident before the end of the working day.
3. Supervising faculty should provide the resident with constructive feedback in any problem areas encountered during the rotation.
4. Supervising faculty should verify resident-generated reports in a timely manner and inform the resident of any major changes he/she made.

Resident evaluation: Residents are electronically evaluated monthly as per description in UMKC Radiology Residency Handbook

Ultrasound – Rotation 2 - Goals and objectives

I. Patient care:

- (a) The resident should have knowledge of indications for the examinations requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- (b) The resident should be familiar with available medical records and how to access them for purposes of patient care.
- (c) All studies should be reviewed with supervising faculty attending.
- (d) Preliminary reports should be made available to all referring clinicians if needed prior to final review of cases. When there is a significant discrepancy between the preliminary reading and final reading, the resident should notify the referring clinician immediately.

II. Medical Knowledge:

- (a) Become comfortable with basic ultrasound techniques and scans.
- (b) Become familiar with ultrasound in all three areas of Hands on Scanning, Comprehensive Knowledge, and Clinical Applications.
 1. Hands-On Scanning – resident should be able to scan most of the clinical scenarios listed below:
 - a. Pancreas (pancreatitis, mass)
 - b. Biliary (common bile duct, biliary ductal dilatation)
 - c. Abdominal mass/adenopathy Kidney (mass/cyst)
 - d. Basic Doppler (portal vein, pseudoaneurysm, arteriovenous fistula)
 - e. Pregnancy (first trimester, failed pregnancy, ectopic pregnancy)
 - f. Adnexal mass (ovarian and non-ovarian)
 - g. Testis (pain and masses)
 - h. Basics obstetrics (basic fetal biometry, basic second/third trimester fetal anatomy, placental localization, amniotic fluid volume)
 - i. Neonatal brain
 2. Comprehensive Knowledge – The resident should understand the basic principles of physics that form the foundation of clinical ultrasound.
 - a. Transducer choice: curvilinear, linear, sector, vector
 - b. Frequency, sound speed, wavelength, intensity, decibels, beam width, Fresnel zone, Fraunhofer zone
 - c. Interaction of sound waves with tissues: reflection, attenuation, scattering, refraction, absorption, acoustic impedance pulse-echo principles
 - d. Generation/detection of ultrasound waves
 - e. Doppler phenomenon, Doppler formula
 - f. Beam formation/focusing
 - g. Gray scale, M-mode, pulsed wave Doppler, color Doppler imaging, power Doppler imaging
 3. Clinical Applications
 - a. Abdominal
 - i. Liver: hematoma, biloma, abscess
 - ii. Post-liver transplantation collections: hematoma, biloma, abscess (see vascular section)
 - iii. Gallbladder: hyperplastic cholecystoses, carcinoma
 - iv. Bile ducts: bile duct stones, inflammatory disease, cholangitis, pneumobilia
 - v. Pancreas: neoplasm, cysts
 - vi. Pancreatitis complications: abscess, pseudocyst and pseudoaneurysm, chronic pancreatitis
 - vii. Peritoneal cavity: abscess, hemorrhage, omental mass, metastasis, carcinomatosis
 - viii. Spleen: varices

- b. Kidneys, Urinary Bladder and Prostate
 - i. Abscess/pyelonephritis, perinephric fluid
 - ii. Post-renal transplant collections: hematoma, urinoma, abscess, lymphocele (see vascular section)
 - iii. Complex renal cyst, adult polycystic disease and acquired renal cystic disease, renal cell carcinoma, angiomyolipoma
 - iv. Urinary bladder: mass, infection, hemorrhage, wall thickening, bladder outlet obstruction, diverticula, ureterocele
 - v. Transabdominal prostate
 - vi. Ureters: hydroureter
- c. Gynecology
 - i. Uterus: congenital anomalies, endometrial polyp, endometrial hyperplasia, endometrial carcinoma, endometritis, pyometrium, fibroid localization (submucous, intramural, subserosal), adenomyosis
 - ii. Ovarian cyst: hemorrhagic/ruptured cyst, endometrioma, polycystic ovarian disease, ovarian hyperstimulation syndrome
 - iii. Ovarian neoplasm: cystic/solid adnexal masses, cystadenoma/carcinoma, dermoid, fibroma, germ cell tumor, Doppler evaluation
 - iv. Ovarian torsion
 - v. Pelvic inflammatory disease, tubo-ovarian abscess
 - vi. Cervix: mass, stenosis, endometrial obstruction
 - vii. Fallopian tube: hydrosalpinx, pyosalpinx
 - viii. Post-hysterectomy
- d. Obstetrics
 - i. Multiple gestations (chorionicity and amnionicity), failed early pregnancy, spontaneous complete/incomplete abortion, ectopic pregnancy, blighted ovum, embryonic death, subchorionic hematoma, gestational trophoblastic disease, gross embryonic structural abnormalities, anencephaly
- e. Obstetrics, Second and Third Trimester
 - i. Recognition of fetal abnormalities that require high risk obstetrics referral, including intrauterine growth retardation, hydrops, holoprosencephaly, hydrocephalus, neural tube defects, multicystic dysplastic kidney, hydronephrosis
 - ii. Placental abruption, placental masses, two-vessel umbilical cord, cord masses, retained products of conception
- f. Thyroid/Neck
 - i. Thyroid nodule characterization: echotexture, calcifications including microcalcifications, margins, recommendations for fine needle aspiration biopsy
 - ii. Hashimoto's thyroiditis/Graves' disease
- g. Vascular/Doppler
 - i. Peripheral vascular aneurysm, including iliac and popliteal arteries
 - ii. Hepatic vasculature: pulsed Doppler and color Doppler imaging of the portal veins, splenic vein, hepatic arteries and hepatic veins, including normal direction of flow
 - iii. Hemodynamics of cirrhosis, portal hypertension and varices, portal vein thrombosis
 - iv. Upper extremity venous thrombosis: subclavian and internal jugular vein thrombosis, axillary and brachial vein thrombosis
 - v. Carotid artery: normal, atherosclerotic plaque, carotid artery stenosis and occlusion
 - vi. Renal vein thrombosis
 - vii. Iatrogenic arteriovenous fistula

- viii. Pre-graft vein mapping
- h. Scrotum
 - i. Epididymitis, orchitis
 - ii. Testicular torsion
 - iii. Testicular mass characterization: microlithiasis, germ cell tumor, lymphoma, metastasis
 - iv. Cystic ectasia of rete testis
 - v. Extratesticular masses/cysts, spermatocele, adenomatoid tumor, epididymal head cyst
 - vi. Varicocele
 - vii. Trauma
- i. Pediatrics
 - i. Brain: intracranial hemorrhage and complications, including periventricular leukomalacia and hydrocephalus, shunt evaluation
 - ii. Kidneys: hydronephrosis, stones, hydroureters, anomalies of position and fusion, renal scarring, masses, cystic disease
 - iii. Adrenal hemorrhage, masses (neuroblastoma)
 - iv. Liver: cirrhosis, choledochal cysts, liver masses, hepatitis/biliary atresia
 - v. Gallbladder: gallstones, biliary stones, hydrops
 - vi. Pancreatitis
 - vii. Normal hip
 - viii. Intussusception
 - ix. Acute appendicitis
 - x. Acute pancreatitis
 - xi. Hypertrophic pyloric stenosis
 - xii. Scrotal: torsion, epididymitis, orchitis, masses, undescended testis, mass
 - xiii. Ovarian torsion
 - xiv. Neck mass
 - xv. Deep vein thrombosis of upper and lower extremities
- j. Musculoskeletal
 - i. Normal tendon appearance
 - ii. Foreign body
 - iii. Soft tissue gas
 - iv. Joint fluid
 - v. Muscle tear
- k. Breast
 - i. Characterization of cysts
 - ii. Lymph node characterization: axillary, supraclavicular, intramammary
- l. Interventional
 - i. Pre-procedural evaluation: coagulation laboratory studies, anticoagulation medication
 - ii. Stratification of risk for percutaneous procedures
 - iii. Techniques for ultrasound-guided invasive procedures: understanding important landmarks and pitfalls of percutaneous procedures, including recognition of critical structures to be avoided
 - iv. Biopsy of soft tissue masses
 - v. Random core liver biopsy
 - vi. Aspiration of fluid collections, cysts and catheter placement for abscess and fluid drainage (pleural, peritoneal and other spaces)
 - vii. Ultrasound-guided thoracentesis
 - viii. Post-procedural evaluation: radiographic studies, patient monitoring, management of complications

4. Become familiar with and observe ultrasound basic procedures including thoracentesis and abdominal paracentesis.
 - (b) The resident should be familiar with the anatomy of the organs examined in every case. An atlas of cross-sectional anatomy should be consulted when there is any doubt.
 - (c) Depending upon the indication of the examination, the resident should be familiar with ultrasound findings in the disease entity suspected.
 - (d) In cases where the resident is not familiar with the disease entity or expected findings on ultrasound he/she should recognize that limitation and consult with supervising faculty or appropriate reading material.
- III. Practice Based Learning and Improvement:**
- (a) The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources.
 - (b) Follow-up of abnormal or interesting studies should be accomplished through personal communication with the referring physician or patient medical records.
 - (c) The resident should be competent in using the ultrasound PACS in the daily accomplishment of the work load and instruct others in its use.
- IV. Interpersonal Communication Skills:**
- (a) The resident should be able to communicate effectively results of studies to referring clinicians whenever needed. For emergent studies reports should be made and documented in a timely manner.
 - (b) The resident should be able to effectively convey the findings of examinations through accurate dictation of reports.
- V. Professionalism:**
- (a) Residents are required to complete an online professionalism module at least biannually.
 - (b) Residents should be able to explain the nature of the examination or findings in an examination to patients and their families when needed.
 - (c) Residents should observe ethical principles when recommending further work-up for cases.
 - (d) Promptness and availability at work are expected of every resident.
 - (e) Residents should dress appropriately when coming to work.
 - (f) Ultrasound technologists and other health workers should be treated with respect and part of the health care team.
 - (g) Patient confidentiality should be observed at all times.
- VI. System Based practice:**
- (a) Residents should be familiar with departmental procedures necessary in the performance of the examination.
 - (b) Residents should learn appropriate language to be used in communicating to clinicians through reports or consultations so proper management decisions can be made.
 - (c) Proper dictations should be made with indications, technique, findings and conclusions.
 - (d) Residents should dictate and correct their reports in a timely fashion to avoid delay in patient disposition.
 - (e) Residents should assist in facilitating examinations whenever possible.
 - (f) Resident should recognize the role that ultrasound plays in the management of patient's illness and make proper recommendations when needed
 - (g) Suggestions to improve methods and systems utilized in radiology should be made whenever appropriate.

Reading list:

1. The Requisites – Ultrasound – Middleton WD, Kurtz AB, Hertzberg BS (eds). Mosby-Year Book. St Louis, 2004
2. ACR Ultrasound Case files
3. Diagnostic Ultrasound: 2 volume set – Rumack C, Wilson S, Chaboneau W. Mosby, St. Louis 2004

Ultrasound – Rotation 3 (and above)

General overview

Radiology resident rotations in Ultrasound will include at least 3 months during the radiology residency. The learning of ultrasound will encompass multiple rotations including those at Saint Luke's Hospital Kansas City, Truman Medical Center and Children's Mercy Hospital. The specific goals include objectives required for every level of training with graded supervision by the attending faculty. All aspects of ultrasound will be incorporated into the residency, including Obstetrical Ultrasound (in conjunction with the Department of Ob/Gyn at Saint Luke's Hospital), General Ultrasound (at Saint Luke's Hospital and Truman Medical Center) and Pediatric Ultrasound (in conjunction with Children's Mercy Hospital faculty). Breast Ultrasound at Saint Luke's Hospital will be incorporated into the Breast Imaging rotation while at that facility. Musculoskeletal Ultrasound at Saint Luke's Hospital will be incorporated into the Musculoskeletal rotation while at that facility.

Resident responsibilities:

1. The resident is involved in the daily conduct of ultrasound services. At the start of every working day, the resident should be familiar with the patient schedule and anticipate needs for any procedures. The resident will check requisitions for next working day to evaluate for appropriateness of requested procedure or if additional exams/protocol needs to be performed. Absent clinical indication or seemingly in-appropriate requests will be clarified and discussed with attending MD.
2. The resident assigned to ultrasound is expected to be available for consultation by ultrasound technicians, clinicians and other health care professionals during regular office hours except during conference times.
3. Examinations should be checked by the resident before the patient leaves the department if requested to do so by the supervising faculty.
4. Any questions should be referred to the attending supervising faculty on ultrasound.
5. Preliminary reports are written for emergency room referrals and patients who are going to clinic appointments on the same day of the examination when appropriate. This is communicated to attending radiologist and documented in the final report with name, date and time of such a communication.
6. Review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient work flow.
7. All examinations should be dictated by the end of every working day.
8. The resident will check his/her reports daily prior to final verification by supervising faculty.

Staff responsibilities:

1. Supervising faculty should be available at all times for any questions or consultations needed by the resident.
2. Supervising faculty should review all cases with the resident before the end of the day.
3. Supervising faculty should provide the resident with constructive feedback in any problem areas encountered during the rotation.
4. Supervising faculty should verify resident-generated reports in a timely manner and inform the resident of any major changes he/she made.

Resident evaluation: Residents are electronically evaluated monthly as per description in UMKC Radiology Residency Manual

Ultrasound – Rotation 3 and additional rotations - Goals and objectives

I. Patient care:

- (a) The resident should have a high level of comfort with indications for the examinations requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- (b) The resident should be highly comfortable with available medical records and how to access them for purposes of patient care.
- (c) All studies should be reviewed with supervising faculty attending.
- (d) Preliminary reports should be made available to all referring clinicians if needed prior to final review of cases. When there is a significant discrepancy between the preliminary reading and final reading, the resident should notify the referring clinician immediately.

II. Medical Knowledge:

- (a) Be highly comfortable with basic ultrasound techniques and scans, and teach them to lower level residents and medical students.
- (b) Become familiar with ultrasound in all three areas of Hands on Scanning, Comprehensive Knowledge, and Clinical Applications.
 - 1. Hands-On Scanning – resident should be able to scan most of the clinical scenarios listed below:
 - a. Advanced obstetrics (comprehensive second/third trimester)
 - b. Pediatrics (abdomen, spine, hips)
 - c. Ultrasound-guided interventional procedures
 - d. Parathyroid
 - e. Carotid artery
 - f. Advanced abdominal Doppler (visceral organs, organ transplants)
 - g. Peripheral vessels (arterial bypass grafts, upper extremity veins)
 - 2. Comprehensive Knowledge (Physics/Instrumentation)
 - a. Beam width, side lobe, slice thickness artifacts
 - b. Multiple reflection artifacts - mirror image/reverberation
 - c. Refractive artifacts
 - d. Doppler artifacts- pulse wave, color imaging, including aliasing
 - e. Gray scale versus Doppler (trade-off of penetration and resolution)
 - f. 3-D volumetric imaging
 - g. Thermal/non-thermal effects on tissue: biological health risks
 - h. Image optimization
 - i. Harmonic imaging
 - j. Ultrasound contrast agents
 - k. Equipment quality assurance: phantoms, spatial/contrast resolution
 - 3. Clinical Applications
 - a. Abdomen
 - i. Liver: trauma
 - ii. Bile ducts: neoplasm (cholangiocarcinoma)
 - iii. Spleen: trauma
 - iv. Chest: pericardial effusion, mass, atelectasis/pneumonia
 - v. Organ transplants: see vascular section
 - vi. Gastrointestinal tract: normal gut ultrasound signature, acute appendicitis, diverticulitis, Crohn disease
 - vii. Peritoneal cavity: free air
 - viii. Abdominal wall hernia, inguinal hernia
 - b. Kidneys, Urinary Bladder and Prostate
 - i. Kidneys: xanthogranulomatous pyelonephritis, emphysematous pyelonephritis, congenital anomalies, pelvic kidney (see pediatrics section), medullary nephrocalcinosis
 - ii. Adrenal glands: mass

- iii. Retroperitoneum: adenopathy, mass
- iv. Ureters: ureteral stone
- v. Urinary bladder: ectopic ureterocele
- vi. Renal artery stenosis, renal vein thrombosis (see vascular section section)
- vii. Transrectal prostate
- c. Gynecology
 - i. Peritoneal inclusion cyst
 - ii. Ovarian cancer staging
 - iii. Saline hysterosonography
- d. Obstetrics, First Trimester
 - i. Unusual ectopic pregnancy: interstitial, cervical, ovarian, scar, abdominal, rudimentary horn Nuchal translucency
 - ii. Chorionic villous sampling
- e. Obstetrics, Second and Third Trimester
 - i. Recognition of fetal abnormalities that require high risk obstetrics referral, including congenital anomalies/chromosomal abnormalities and syndromes such as Down's syndrome and Turner's syndrome, hydrops, congenital infections, chest masses, cardiac malformations and arrhythmias, diaphragmatic hernia, abdominal wall defects, abdominal masses, gastrointestinal tract obstruction/abnormalities, ascites, skeletal dysplasias, cleft lip/palate, complications of twin pregnancy, hydranencephaly
 - ii. Borderline findings: nuchal thickening, choroid plexus cyst, echogenic cardiac focus, echogenic bowel, borderline hydrocephalus
 - iii. Placental cord insertion site/vasa previa, velamentous cord insertion, cord prolapse, succenturiate placenta, cervical incompetence
 - iv. Umbilical cord Doppler, fetal cranial Doppler, biophysical profile
 - v. Guidance for amniocentesis
 - vi. Placenta accreta, percreta, increta
- f. Thyroid/Neck
 - i. Parathyroid mass: adenoma
 - ii. Congenital cysts: branchial cleft
 - iii. Lymph nodes: benign and malignant characterization
 - iv. Post-thyroidectomy recurrence
 - v. Submandibular and parotid glands: normal and abnormal
- g. Vascular/Doppler
 - i. Renal transplant: arterial resistive index (rejection, acute tubular necrosis), transplant vein thrombosis, renal infarction, post-biopsy complications, renal arterial stenosis
 - ii. Liver transplants, including hepatic artery stenosis or thrombosis (resistive index), portal vein thrombosis, post-biopsy complications, inferior vena cava stenosis
 - iii. Pancreas transplant: arterial and venous anastomosis, patency and stenosis
 - iv. TIPS evaluation and complications
 - v. Lower extremities: chronic venous insufficiency
 - vi. Arterial bypass graft
 - vii. Hemodialysis graft/fistula
 - viii. Carotid artery: waveform analysis, stenosis, dissection, pseudoaneurysm, stent
 - ix. Vertebral artery: subclavian steal syndrome
 - x. Mesenteric ischemia
 - xi. Renal artery stenosis
- h. Scrotum
 - i. Hernia
 - ii. Non-descended testis

- iii. Fournier's gangrene
 - i. Pediatrics
 - i. Organ transplant
 - ii. Polysplenia, asplenia
 - iii. Hip dislocation
 - iv. Congenital brain malformations, agenesis of corpus callosum, vein of Galen aneurysm, Dandy Walker Malformation, aqueductal stenosis
 - v. Neonatal spine: tethered cord, intraspinal mass
 - vi. Liver Doppler
 - vii. Imperforate hymen, uterine anomalies
 - j. Musculoskeletal
 - i. Tendon tear, inflammation
 - ii. Rotator cuff tear
 - k. Breast
 - i. Characterization of solid masses: benign versus malignant
 - ii. Architectural distortion
 - iii. Intraductal masses/abnormalities
 - iv. Galactocele
 - v. Screening
 - vi. Multifocal malignancy
 - vii. Elastography
 - l. Interventional
 - i. Fine needle biopsy versus core biopsy in specific application, such as focal liver mass, renal mass, thyroid/parathyroid mass, retroperitoneal lymphadenopathy
 - ii. Pseudoaneurysm management: contraindications and technique of non-surgical treatment with ultrasound-guided compression repair versus thrombin injection
 - iii. Intraoperative ultrasound guidance
- (c) Become comfortable with common and uncommon diseases detected by ultrasound.
- (d) Depending upon the indication of the examination, the resident should be familiar with ultrasound findings in the disease entity suspected.
- (e) In cases where the resident is not familiar with the disease entity or expected findings on ultrasound he/she should recognize that limitation and consult with supervising faculty or appropriate reading material.

III. Practice Based Learning and Improvement:

- (a) The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources.
- (b) Follow-up of abnormal or interesting studies should be accomplished through personal communication with the referring physician or patient medical records.
- (c) The resident should be competent in using the ultrasound PACS in the daily accomplishment of the work load and instruct others in its use.

IV. Interpersonal Communication Skills:

- (a) The resident should be able to communicate effectively results of studies to referring clinicians whenever needed. For emergent studies including but not limited to V/Q and GI bleeding scans, this should be done in a timely manner.
- (b) The resident should be able to effectively convey the findings of examinations through accurate dictation of reports.
- (c) The resident should be able to instruct lower level residents and medical students regarding the performance and interpretation of ultrasound studies.

V. Professionalism:

- (a) Residents are required to complete an on line professionalism module at least biannually.
- (b) Residents should be able to explain the nature of the examination or findings in an examination to patients and their families when needed.
- (c) Residents should observe ethical principles when recommending further work-up.
- (d) Promptness and availability at work are expected of every resident.
- (e) Residents should dress appropriately when coming to work.
- (f) Ultrasound technologists and other health workers should be treated with respect and part of the health care team.
- (g) Patient confidentiality should be observed at all times.

VI. System Based practice:

- (a) Residents should be familiar with departmental procedures necessary in the performance of the examination.
- (b) Residents should learn appropriate language to be used in communicating to clinicians through reports or consultations so proper management decisions can be made.
- (c) Proper dictations should be made with indications, technique, findings and conclusions
- (d) Residents should assist in facilitating examinations whenever possible.
- (e) Resident should recognize the role that ultrasound plays in the management of patient's illness and make proper recommendations when needed
- (f) Suggestions to improve methods and systems utilized in radiology should be made whenever appropriate.

Reading list:

1. ACR Ultrasound teaching files.
2. The Requisites – Ultrasound – Middleton WD, Kurtz AB, Hertzberg BS (eds). Mosby-Year Book. St Louis, 2004
3. Diagnostic Ultrasound: 2 Volume Set – Rumack C, Wilson S, Charboneau W. Mosby, St Louis, 2004
4. Fill in gaps in any pediatric ultrasound sections, including Transcranial doppler