Resident Ultrasound Guide

Welcome to your Ultrasound rotation. Ultrasound is portable, safe, and a relatively low cost imaging modality that is ideal as a first line imaging tool in multiple clinical settings. US is the primary imaging modality for many clinical scenarios (such as RUQ pain/gallbladder pathology, pediatrics, and OB-GYN), and a complementary imaging modality for many other clinical scenarios (F/U CT portal vein thrombosis, F/U CT renal lesion to confirm cyst, etc). It is an ideal tool for image guided biopsies due to "real-time" imaging throughout the biopsy procedure. However, one disadvantage of ultrasound is that it is very user dependent, and the images obtained are subject to the skills of the sonographer and the equipment available. The goal of your US education is to provide the necessary training you will need to interpret and obtain images that are diagnostic, comply with guidelines and scanning protocols, and are able to answer the clinical question. This includes hands-on training to learn how to scan. An understanding of anatomy, ultrasound physics/artifacts, and instrumentation/image optimization is required to accurately scan and interpret US studies.

In Ultrasound, perhaps more than other service, you will be learning a key component of your training from our dedicated and talented US technologists. Their goal is to make you a successful sonographer able to take call by the end of your first year. Please be respectful at all times, and be attentive to the fact that they are balancing their teaching responsibilities and clinical responsibilities with a very busy schedule. They will be giving you constructive feedback on your scanning, and it is important that you learn how to accept this feedback in a professional manner. We ask that you do your best to cultivate a good relationship with the US technologists. If any issues arise, please do not hesitate to reach out to the education director, residency program director, or one of the US attendings for guidance.

<u>Patient care:</u>

Please be aware and respectful that US exams may make patients feel exposed and uncomfortable. This is particularly true of pelvic and scrotal exams but may also be of concern for abdominal imaging and other exams. Please be aware of patient needs for ultrasound of a sensitive nature. Introduce yourself at the beginning of the exam. If a patient is uncomfortable with you in the room, respect their decision and find an alternative exam. Please do not enter the room after the exam has begun.

<u>Daily schedule:</u>

When staffing permits, our goal is assign a dedicated teaching sonographer to a first year resident (rotation #1 and #2) at least two days per week to optimize teaching and provide extra time for the resident to scan. The remainder of the time, the resident will check the daily schedule before 8 am and communicate with the charge technologist to determine which cases they will scan that day (please see "First rotation" below). Please also communicate with the sonographer assigned to the room for cases you have selected. Some exams are not seen routinely (i.e. renal transplant, appendicitis, intussusception, and pyloric stenosis), and you will want to prioritize these exams to gain as much exposure as possible by observing, scanning, and reading out with the attending. It is the resident's responsibility to communicate with the technologists to coordinate hands-on scanning opportunities that are focused on the competencies the resident is trying to complete. Please maximize your scan time whenever there is time to do so. After the technologist has finished scanning, you will have several minutes to 'back scan' the patient. It is recommended that you focus on a specific skill for each patient (e.g. obtaining images of the common bile duct) as you will not, at least initially, have time to complete the exam. If you feel that you have the basics covered, start to change settings and patient position to modify the images and learn more about artifacts with and without Doppler.

You will be focusing on scanning skills for the competencies listed below in the first 2 rotations by shadowing the technologists. The goal of the first 2 rotations is to make sure that you are prepared to take US call by the end of your fist year, so please keep this in mind as you work your way through the competencies. In later

rotations you will rotate through the OB department to learn 2nd and 3rd trimester OB US, and then rotate through vascular US 2-4th to learn Vascular US.

During your third and fourth rotations in US, you will spend more time in the reading room interpreting and dictating cases. You are also expected to back-scan as appropriate, and to focus on intermediate and advanced cases (as listed in the core competencies). The goal is that you will able to "run" the section by the time you are a 4th year senior resident.

Reporting:

We use a combination of Powerscribe and AS template reporting in ultrasound. The technologist enters their findings into AS. It is important that you review these findings to make sure that you agree their report that becomes part of the final report in eDH – their findings should not contradict your impression. It also critical to ensure that the same patient is linked in all 4 systems: PACS, Epic, Powerscribe, and AS. When you close and open studies quickly, patients may not link properly.

General:

There are often several learners in Ultrasound. Nephrology fellows, and Medial students rotating through the general elective, women's imaging elective, and US elective all spend time in US. Please be professional and courteous, and help with teaching whenever time permits. Finally, it is important to keep in mind that many of your clinical colleagues are increasingly using point-of-care ultrasound (POCUS) in the ED or at the bedside to answer specific clinical questions. You may be called on to clarify their findings or repeat a study. Please be sure to communicate in a way that is respectful and that is most constructive for optimal patient care.

PREPARE for your first rotation:

Below is the list of US Scanning Core competencies that you will be required to complete during residency:

US Scanning CORE COMPETENCIES

Scrotal	Basic
RUQ	Basic
Pelvis TA and TV	Basic
Renal	Basic
1st trimester viability	Basic
Renal transplant	Intermediate
Appendicitis	Intermediate
Abdomen Vascular	Advanced
Obstetric, limited	Advanced

EXPECTATIONS FOR US ROTATIONS

For all rotations including your first one, please be proactive in filling your time efficiently. Learn to anticipate what is needed on service (please ask if you aren't sure), and when things are quiet, make use of teaching files,

reading material, and on line resources that are listed in this guide. Please see Goals and Objectives for more detailed information.

R1: First rotation:

***** Bring a laptop (best) or tablet to US. We are very short of workstations and you will need it for studying between cases*****

Sonosim is a web-based training simulation program with an US simulation component and educational modules that cover basic physics and sonographic anatomy. Please review the Sonosim modules before your first rotation to orient you to basic physics, anatomy, and image optimization. Prioritize the Core Clinical Modules (with the exception of the vascular access module) for your first rotation. Keep in mind that this program is also designed to educate POCUS users—on occasion you will see the transducer held in a way that is suboptimal for our purposes (i.e. subxyphoid cardiac ultrasound). Be sure to follow instructions from the technologist on optimal hand position. You will receive an email at the beginning of your residency with instructions on how to log in to Sonosim: www.sonosim.com. If you do not have this prior to your first US rotation, please check in as soon as possible with Matt Henry who will provide you with the necessary information.

Please see "Daily schedule" for details on how to check in with the sonographers to best coordinate your scan time.. Ultrasound is a bit of a dance requiring attention and flexibility -- your US education will depend in large part on your ability to communicate and adapt to the daily changes to the clinical schedule. We understand that during the first rotation, it may be difficult to balance learning a new skill while getting oriented to a busy service -- we are always hoping to improve the resident ultrasound learning experience, and if you have any feedback that would be helpful, please let us know. Use your time between studies fruitfully by reviewing teaching studies, WiREd modules or Sonosim on your laptop or tablet.

Focus on scanning skills and knowledge of scanning protocols for Renal and RUQ US and then advance to other studies when you feel confident. The student handbook prepared by for the NH Technical Institute technologist training is excellent and reviews scanning techniques and anatomy. American Institute of Ultrasound in Medicine (AIUM) scanning protocols and practice parameters that we use in our department can be found at: https://www.aium.org/resources/guidelines.aspx)

Follow up the cases you scan with the attending and consider dictating a few cases by the end of your first rotation.

Sign off on the following competencies:

1) RUQ US
2) Renal

R1: Second rotation

Focus on transvaginal and transabdominal pelvic US for first trimester OB studies and general GYN. Also learn how to perform scrotal US. Scan other acute presentations such as appendix as they become available.

Sign off on the following competencies:

1) Pelvic US TA and TV
2) OB First trimester US for viability
3) Scrotal US

R2 and R3

1. Review studies and provide preliminary interpretation.
2. Consider scanning ED studies that are added on during the day if you feel that additional hands on scanning would be helpful for call.
3.
4. Learn how to determine that studies are complete per AIUM guidelines, and request additional images or back scan if you feel more information is needed to complete the exam: https://www.aium.org/resources/guidelines.aspx)
5. Determine if additional images are needed to adequately answer the clinical question.
6. Focus on scanning cases of intermediate difficulty and sign off on the following competencies:
    a) Appendicitis
    b) Renal transplant
7. Go to vascular ultrasound Monday half am (R2), Monday all day (R3)
8. Go to OBGYN US (5M) Wed am

R4

1. Be prepared to run the service independently as a junior faculty. Try to preview as many cases as possible for completeness and render preliminary interpretation before the attending reviews the case.
2. Focus on scanning cases of advanced difficulty and sign off on the following competencies:
    c) Abdomen vascular exam
    d) OB 2nd and 3rd trimester
3. Go to vascular ultrasound Monday all day (R4)
4. Go to OBGYN US (5M) Wed am

2 YEAR CONFERENCE SCHEDULE

YEAR 1

July: Uterus (diFlorio)

August: Renal/GU (Silas)

September: US image optimization: Knobology (Colin Schafer)

October: Abdomen I: GB/biliary (Rooney)

November: 1st Trimester (Yen)

December: Abdomen II: pancreas, spleen, bowel (diFlorio)

January: Renal Transplants (Yen)

February: O-RADS lexicon and risk assessment (diFlorio)

March: Doppler (diFlorio)

April: VP vascular

May: fetal CNS (MFM)

June: pelvic pain (each Spring pre-call diFlorio)

YEAR 2

July: Ovaries and Adnexa (diFlorio)

August: Dating and growth (Pschirrer)

September: Knobology

October: Twins (MFM)

November: Physics/artifacts (diFlorio)

December: Emergency US (diFlorio)

January: Placenta Cervix (Yen)

February: Fetal GI and GU (MFM)

March: fetal heart (MFM)

April: VP/open

May: pelvic pain (each Spring pre-call diFlorio)

June: Scrotum (Rooney)

June: Abdomen III: Liver (Silas)

READING LIST:

Ultrasound Requisites is the required textbook for ultrasound. Note that 'core exam prep' type texts are not suitable for R1 and R2 and will not provide sufficient knowledge depth.

FIRST ROTATION (R1):

Radiology Handbook, Lewis and McNulty. Pgs 234-262, 276-280

US Requisites. Ch 1 practical physics

Ultrasound requisites: kidney (73-77)

Ultrasound requisites: normal anatomy and technique of:

liver (pgs 3-5)

gallbladder (35-38)

bile ducts (55-57)

Ultrasound of Focal Liver Masses. Tchelepi and Ralls. Ultrasound Quarterly 2004. Vol 20; 155-169

Detection and Characterization of Renal masses by Ultrasound. Heller et al. Ultrasound Quarterly, 2007: vol 23; 269—278

Imaging Evaluation for Acute Pain in the **Right Upper Quadrant. Hanbridge et al.** *Radiographics* 2004 24:4 1117-1135

SECOND ROTATION (R1):

US Requisites

pancreas (122-126)

spleen (142-143)

pelvis (359-368)

adnexa (388-391)

scrotum (152-182)

Rodgers et al "Normal and Abnormal US Findings in Early First Trimester Pregnancy: SRU consensus Recommendations" Radiographics 2015 35: 2135-2148

Maitray Patel "Rule out ectopic' Asking the Right questions, getting the right answers. . Ultrasound Quarterly June 2006

Atypical Ectopics. Dibble etal. AJR 2016; 207:1–13

Chang, Bhatt, and Dogra "Pearls and Pitfalls in Diagnosis of Ovarian Torision". Radiographics, 2008

Management of Asymptomatic Ovarian Cysts Imaged by US. Consensus Statement Society of Radiologists in US. US Quarterly 2010, vol 26; 121-131

Evaluation of the Scrotal Mass. Winter etal. US Quarterly 2009. Vol 25: 195-205

Clinical Doppler Ultrasound. Alan et al, first chapter: "Physics: principles, practice and artifacts"

US of the Adnexa: Laing et al. Radiographics 2012; 32: 1621-1639

Gynecologic, Obstetric, and Scrotal Emergencies. In The Radiology of Emergency Medicine. Pope and Harris. 5th Ed. Pgs 707-747

Avery et al. Imaging of Penile and Scrotal Emergencies.. RadioGraphics 2013; 33:721–740

Dogra et al. First trimester Bleeding Evaluation. US Quarterly 2005. Vol 21: 69-85

Revzin et al. Imaging Evaluation of Fallopian tubes and related disease. Radiographics 2020; 40: 1473-1501

THIRD ROTATION:

US requisites ch 12-21. OB

US Inguinal Canal. Revzin et al. RadioGraphics 2016; 36:0000–0000

US GI Tract. Muradali etal. RadioGraphics 2015**;** 35:50–70

Appendix visualization CT insights. Lin et al. *AJR* 2017; 209

US Requisites ch 9 and 10 (220-268). General Abdomen. Thyroid and Neck (including carotids)

US Artifacts. Baad et al, Radiographics 2017: 37(5):1408-1423

ACR appropriateness criteria:

https://acsearch.acr.org/list?_ga=2.226634718.2105403064.1606672446-1855451861.1606672446

FOURTH ROTATION:

Doppler Ultrasound of the Liver Made Simple. McNaughton et al. Radiographics 2011: vol 31: 161-188

Doppler Sonography of Portal Hypertension. Robinson et al. Ultrasound Quarterly 2009: vol 25: 3-13

Spectral Doppler Signature Waveforms in Ultrasonography. US Quarterly 2010; vol 26: 83-99

O-RADS. Andreotti et al. J Am Coll Radiol 2018;15:1415-1429.

SRU Ovarian Cysts F/U. Levine et al, Radiology 2019; 00:1–13

ACR TIRADS: Tappouni et al. TIRADS pitfalls, solutions. Radiographics 2019; 39: 2040-2052

OPTIONAL BUT GOOD:

Dynamic US of Hernias of the Groin and anterior Abdominal Wall. Stavros et al. US Quarterly 2010; 26: 135-169

RESOURCES:

WiREd

https://dhradiology.knack.com/elective-scheduling#home/wired/

Ultrasound modules, most very short. Vary between very basic and advanced for senior residents. Links available from resident database on all desktops.

Teaching files: there are 3 teaching files on PACS with US cases. Files 1 and 2 are suitable for junior residents and med students:

1) US elective TF in the **Public Teaching Files** folder
2) GU sub-folder of the **Elective Teaching Files** folder
3) US teaching file in **Public Folders** (with subsection heading Ovary, Liver, etc)

Radprimer.com

AIUM med ed portal:

http://meded.aium.org/

➔ Sound judgement series good articles evidence based

➔ Additional resources → SAEM narrated US lectures (TV pelvic US: https://vimeo.com/channels/aeus/52830902)

SUSME Society of US on Med Ed:

http://www.susme.org/learning-modules/

accept disclaimer and will lead to U South Carolina modules. Excellent modules on physics, image optimization, abdominal and pelvic US

UC Irvine iTunes videos:

https://itunes.apple.com/us/itunes-u/ucimc-ultrasound-education/id452550953

Ultrasound Cases: 6000 online US cases by region:

http://ultrasoundcases.info/

Need to register for FREE and will have access to many lectures

https://sonoworld.com/

US artifact youtube links:

https://www.youtube.com/watch?v=3k3L4ZNAZqk

https://www.youtube.com/watch?v=YVCugJe2IVw

https://www.youtube.com/watch?v=UuQtYuQ1ufE

https://www.youtube.com/watch?v=O74CeO6nRmo

STUDY GUIDES

NHTI student guide (permission granted- printed copy in RR and pdf sent upon request)

SRU consensus conference statements:

*Levine et al: **Asymptomatic** adnexal cysts 2010: https://pubs.rsna.org/doi/10.1148/radiol.10100213*

*Levine et al: **simple** adnexal cysts updated 2019: https://pubs.rsna.org/doi/full/10.1148/radiol.2019191354*

Rodgers et al: review of SRU 1st trimester 2015: https://pubs.rsna.org/doi/full/10.1148/rg.2015150092

Needleman et al: SRU statement US DVT 2018: https://pubmed.ncbi.nlm.nih.gov/29610129/

Reading list (enclosed)

Websites (enclosed)

Youtube videos (enclosed)