ULTRASOUND DIVISION: INFORMATION FOR PHYSICIANS
(RESIDENTS, FELLOWS, STAFF)

I. HOURS OF OPERATION: M F 8:00 a.m. – 5:30 p.m. (see below for working hours of residents, fellows, staff, and for after hours/weekend coverage).

II. DAILY SCHEDULE AND ROUTINE

1. First Year Resident
   (a) Hours: M F 8:00 a.m. - 12:00 p.m. and 2:00 p.m. - 5:30 p.m.
   (b) Goals and Expectations: see Appendix B

2. Fellows
   (a) Hours: M F 8:00 a.m. - 12:00 p.m. and 12:45 p.m. - 5:30 p.m.
   (b) First week: will be assigned to a sonographer to become familiar with equipment and examination protocols.
   Subsequently: gradual assumption of greater responsibilities, in two phases:
   Phase 1: Same role as higher-year residents
   Phase 2: Participate in specialized cases, including vascular lab, NICU, guidance of biopsies and aspirations.
   Transition from Phase 1 to Phase 2 occurs when the Fellow's performance level is appropriate, as judged by the division Director or Assistant Director, and schedule permits.
   Present morning teaching conference as assigned

3. General comments concerning scanning by residents and fellows.
   (i) Residents and Fellows are to attend 8:00 - 8:30 a.m. teaching conference in the Ultrasound reading room.
   (ii) It is important to be in ultrasound during the indicated hours and to return promptly after conferences. Absences during working hours are permitted only when absolutely necessary, should be timed if possible to avoid busy periods during the day, and should be approved by the Director or Assistant Director of Ultrasound. The assistant chief sonographer (or ultrasound coordinator) should be notified about these absences.
   (iii) Residents and Fellows must follow the departmental scanning protocols and must adhere to the following time limits per scan, prior to reviewing the case with staff radiologist. If they need a sonographer's help in completing the study, they should request the help from the ultrasound coordinator.

Abdomen:	20 minutes
OB:	20 minutes

   (iv) When doing an OB scan on a patient about to have a therapeutic abortion, do not discuss the findings with the patient or point out fetal body parts to her.

4. Staff Radiologists
   (i) "E" (early) physician: 8:00 a.m. - 12:00 p.m. and 1:00 p.m. - 4:30 p.m. (The 12:00 and 4:30 ending times are approximate in that the early physician should remain until the workload is down to the point that it can be handled by the W and L radiologists). In addition to checking ongoing cases, the early physician has two other responsibilities:
      8:00 a.m. - 8:30 a.m.: give the teaching conference for trainees, including residents, fellows, and student sonographers.
      Review and sign cases from prior night
   (ii) "W" physician: 8:00 a.m. - 12:00 p.m. and 1:00 p.m. - 5:00 p.m. (The 12:00 and 5:00 ending times are approximate; "W" physician may leave when the workload is such that it can be handled by the L radiologist alone).
      The "W" physician signs out baseline fertility scans and follicular monitoring studies

performed on weekdays, as well as baseline and follicular studies from 850 Boylston, Foxborough and South Shore sites. The "W" physician also reads other cases from the South Shore site, with ultrasound codes that begin TU.

The "W" physician is responsible for the NICU cases.

The "W" physician covers intraoperative cases before 9 a.m. and from 1 p.m – 1:30 p.m.

The "W" physician covers outpatient renal biopsies Wednesday mornings.

(iii) "L" (late) physician: 9:00 a.m. – 1:00 p.m. and 1:30 - 5:30 p.m. The "L" physician is responsible for lunch time and late day coverage. If no cases are going on during lunch, the "L"physician may leave ultrasound, but must be easily and quickly available. The "L" physician is responsible for all cases completed by 5:30 p.m. Pending cases after 5:30 pm should be assigned to the next morning's "E" physician or on call physician, depending on the day of the week. The "L" physician should sign all outstanding ultrasound reports before departing at lunch time and at the end of the day.

The "L" physician covers intraoperative cases after 9 a.m. except from 1 p.m – 1:30 p.m.

(iv) "R" (Remote cases): Responsible for all "remote" (outside) cases from the day before. Cases should be completed and signed by 1p if assigned in the morning and by 5p if assigned in the afternoon.

Note: If the assignment is "R" or "RV", this person has no other role with respect to L-1 cases (he/she will NOT function as a backup for L-1).

Note: If the assignment is "R" with "E", "W", or "L", ongoing cases in the department take precedence over the outside cases. Thus, if the "R" person is asked to check a case on L-1, he/she should stop reading the outside cases immediately to check the cases in the department.

(v) "H" (High-Risk Unit) physician: 8:00 a.m. - 12:00 p.m. and 1:00 p.m. - 4:30 p.m. or when last case completed.

(vi) "H1" (High-Risk Unit) physician: 8:00 a.m.(unless required for a 7:30 a.m. case) - 12:00 p.m. and 1:00 p.m.– 4:30 p.m.

(vii) "H2" (High-Risk Unit) physician: 8:30 a.m. - 12:00 p.m. or when last case completed; 1:00 p.m.– 4:30 p.m or when last case is completed. To assist in covering L1 cases morning and afternoon if High Risk is quiet enough to be covered by the H1.

(viii) "B" (Back up for High Risk Unit) physician: 9:00 a.m. – 12:00 p.m. and 1:15 p.m. – 4:00 p.m.

(ix) "8" (850 Boylston) physician: Monday, Tuesday, Wednesday, Friday 12:30 p.m. – 5:30 p.m. to cover contrast, Friday 1:30 p.m. – 5:30 p.m., unless otherwise specified. Responsible for reading the non-obstetrical ultrasound cases done at Faulkner Hospital.

(x) "C" (calls for Vascular Lab): 8:00 a.m. - 1:00 p.m. and 1:00 p.m. - 5:00 p.m. Responsible for taking calls from the vascular lab for ongoing cases.

(xi) "V" (Vascular Lab): Responsible for signing the vascular lab cases from the day before

(xii) "Q" (Quality Assurance (QA)): Responsible for performing 20 QA cases from the most recent regular work day

911: E, W, and L physicians should immediately come to L1 ultrasound upon receiving a 911 page. H2 should immediately come to ultrasound upon receipt of this page unless High Risk is too busy to leave the H1 alone

411: H, H1, H2, and B physicians should immediately come to High Risk Unit upon receiving a 411 page.

III. NIGHT AND WEEKEND ULTRASOUND

1. Cases other than Peripheral Vascular

Inpatient emergency ultrasounds at night and on weekends should be performed as limited studies, restricted to the region of clinical concern and related organs. (See attached protocols for Emergency obstetrical ultrasounds.) The sonographer should prepare a preliminary UltraSTAR report for each case. All patients should leave the department with a copy of the preliminary report. These cases are reviewed the next morning by the "E" physician, and on Saturday and Sunday by the on call attending.

If the sonographer has a question about the type of study ordered or the indication for the examination, the sonographer will page the on call attending. Likewise, if the sonographer has a question about the findings or interpretation for the preliminary report, the sonographer will page the on call attending.

The call period is Monday through Monday, except for Monday holidays. Such holidays are covered by the previous week's on call physician, and the next call period begins Tuesday.

2. Peripheral Vascular Cases
   a. Weekdays 5:00 p.m. to 7:00 a.m.: Peripheral venous sonograms requested after 5:00 pm are the responsibility of the ultrasound L person until 6 pm. After 6 pm, lower extremity venous ultrasounds on ED patients are performed by L1 ultrasound sonographers and interpreted by ED radiologist. Lower extremity venous ultrasounds on Labor and Delivery are performed by the L1 ultrasound sonographer and interpreted by the ultrasound radiologists. All other requests (including uncommonly requested studies such as upper extremity venous sonogram or carotid sonogram) are the responsibility of vascular lab attending on call and are handled on an individual basis.

   b. Weekends and Holidays
      i) 9:00 a.m. to 3:00 p.m.: Responsibility of vascular lab sonographer and the Radiology, Medicine, or Vascular Surgery attending on call for the Vascular Lab. Ultrasound physicians are sometimes assigned vascular weekend call and are responsible for signing any vascular studies performed during this time.

      ii) 3:00 p.m. to 9:00 a.m.: Peripheral venous sonograms (lower or upper extremity) requested from 3:00 p.m. to 9:00 a.m. are handled on an individual basis, but are ultimately the responsibility of vascular lab attending on call, if needed.

      iii) Uncommonly requested studies (e.g., carotid sonograms) are the responsibility of the vascular lab attending on call

III. ON CALL FOR ULTRASOUND

1. The call period is Monday through Monday, except for Monday holidays. Such holidays are covered by the previous week's on call physician, and the next call period begins Tuesday. Weekdays, call begins at 5:30 p.m.

2. The ultrasound attending on call is responsible for reading and signing all ultrasound cases performed before 3 p.m. on the weekend days and holidays.

3. On weekend days and holidays, the on call attending should arrive in ultrasound no later than 4 pm to sign cases, in order to speak to the sonographers who have been on during the day.

4. The on call attending is responsible for reading the outside cases from the Friday preceding the weekend, as well as any other outside cases left over from the week before.

5. The on call attending is responsible for reading the vascular cases performed on the Friday preceding the weekend.

6. If "Vascular" is written on the schedule for call, the on call attending is responsible for the vascular lab during those weeknights and weekends and holidays, including reading cases performed during the weekend and holiday.

Note: On weekends and holidays, OB/Gyn is responsible for reading all baseline and follicular scans.

IV. ULTRASOUND REPORTS

1. All reports should be generated and signed on UltraSTAR.
2. In almost all cases, the patient is provided with an UltraSTAR or OBUS report before leaving the

department if the case is an obstetrical scan or if the patient is going to see his/her doctor the same day or if the patient asks for a copy of the report. Patients in whom a significant new finding is encountered, and in whom the physician judges that the patient would be upset by reading the report should not leave with a report. In these cases, the referring physician should be called directly by the ultrasound staff.

V. NOTIFICATION AND TRACKING OF ABNORMAL RESULTS

When critical or discrepant results are called to a clinician, document in ANCR not only who was called, but also who made the call (talked to the clinician) and at what time and date. In the COMMENTS of the OBUS report or in the notification box of UltraSTAR, include the comment that "Results were communicated and documented in ANCR."

In some cases, the clinician may be notified directly via ANCR without a phone call, in which case, documentation of the ANCR notification should be included in the UltraSTAR or OBUS report.

VI. TEACHING FILE

Interesting cases should be added to our interesting case folder by placing a copy of the final ultrasound report into that folder. Images from interesting cases should be saved to the electronic teaching file through the PACS system.

VII. IMPORTANT PHONE NUMBERS AND BEEPERS

Ultrasound coordinator	617-732-7190	14462 (beeper)
L radiologist on L1	617-732-7195	
W radiologist on L1	617-732-7191	
E radiologist on L1	617-732-7192	
Remote/Vascular/QA station	617-732-7208	
Remote coordinator	617-732-7169	
L1 Ultrasound FAX	617-264-5205	
H1 in High Risk	617-732-8436	
H2 in High Risk	617-732-8039	
High Risk reading room	617-732-7797	
850 radiologist	617-732-9715	
850 sonographers	617-732-9815	
850 FAX	617-731-8064	
850 CT/MRI secretary	617-732-9821	
Foxboro sonographers	508-718-4163	
Faulkner sonographers	617-983-7149	66471 (beeper)
Faulkner chief sonographer		63309 (beeper)

APPENDIX A: SCANNING PROTOCOLS AND GUIDELINES

OBSTETRICAL ULTRASOUND PROTOCOL:
Documentation and Reporting

OVARIES:

An attempt should be made to evaluate both ovaries for all first trimester obstetrical ultrasounds and all complete or detailed second and third trimester obstetrical ultrasounds, and the findings should be documented in the report (e.g., right ovary normal, left not seen).

I. FIRST TRIMESTER

Uterus and gestational sac location: transverse/coronal and sagittal images
Report gestational sac shape

Placental location (if visible): transverse and coronal or sagittal images
For CRL up to 35 mm, report as "Too early to assess due to gestational age"
For CRL ≥ 36 mm, report location. If placental location cannot be determined, report as "Too early to assess due to gestational age"

Report amniotic fluid volume (usually normal) and uterus on all first trimester exams

Gestational sac contents:
CRL (measure up to 14 weeks or 80 mm): 2 images with measurement
Heartbeat: M-mode with measurement of heart rate (< 10 weeks)
Dynamic clip of fetal heart motion
Yolk sac (if visible)

Nuchal translucency should be measured on all 10-14 weeks gestations or with CRL 36-79 mm, even if measured on a prior exam.
Sagittal view
If the nuchal translucency is ≥3.0 mm, it should be called "Abnormal" and the patient should not be sent to have blood drawn. Instead, the clinician should be alerted as to the abnormal finding.
If the patient is in the First Look program and has a CRL of 42-79 mm, she can have her blood drawn on the day of the sonogram. If the CRL is 36-41 mm, her blood will have to be drawn at a later date (4 days-3 weeks later) without the need for a repeat ultrasound.

Adnexa: transverse/coronal and sagittal images of each ovary, if possible
A statement about the ovaries should be included on all examinations
Ovaries with simple cysts <25 mm should be reported as normal.
A structure in the ovary that is thought to represent the corpus luteum should not be listed in the report if it measures less than 25 mm. This will include most simple cysts, thick-walled cysts, and cysts with ill-defined internal echoes. Rather, the ovary should be reported as "Normal". Lesions 25 mm or greater should be reported, as should cysts measuring less than 25 mm with characteristics of a lesion other than a corpus luteum (such as, hyperechoic or shadowing components suggestive of dermoid, or nodular soft tissue components worrisome for malignancy).

Multiple gestations:
fetal number
Note: Fetal number should be assigned at the first scan after 10 weeks. Fetal number should be assigned based on distance from the cervix without taking into consideration fetal numbers from scans prior to 10 weeks gestation. Once fetal number is assigned, it should never be changed to allow for meaningful comparison of each fetus's size and anatomy over sequential scans.
document and report amnionicity and chorionicity.

I. SECOND AND THIRD TRIMESTERS

Fetal position (≥ 24 weeks): image labeled for orientation and location

Dynamic clip of fetal heart motion

Lower uterine segment and cervix: sagittal image

14.0-15.9 weeks: report findings related to the uterus (normal, fibroids, etc.)

16.0-32.0 weeks: measure and report the cervical length on all obstetrical ultrasounds. If the cervix cannot be imaged, report cervix as "Unevaluable" or "Obscured by fetal parts" or perform transvaginal scan:

a) when it is requested by the referring clinician (no matter what the gestational age)
b) if the cervix has been shortened on a prior scan
c) if the cervix appears shortened transabdominally

After 32.0 weeks: Report the cervix as "Normal", "Unevaluable" or "Obscured by fetal parts" for Complete Obstetrical Ultrasounds (i.e., those when the fetal survey is performed). No need to report the cervix on other Obstetrical Utrasounds when the fetal survey is not performed (e. g., Follow-up Obstetrical Ultrasound, Biophysical Profile, Doppler studies), unless it is requested by the referring clinician.

Note 1: Transvaginal scans should not be performed in patients with ruptured membranes or suspected ruptured membranes or with membranes bulging through the external os.

Note 2: When reporting the cervical length, report only the shortest length, even if the cervix is dynamic or shortens with fundal pressure.

Adnexa: transverse/coronal and sagittal images of each ovary, if possible

A statement about the ovaries should be included on all complete obstetrical examinations

Placental location: image labeled for orientation and location

In evaluating for suspected placenta previa, translabial or transvaginal scanning may be useful.

Terminology concerning placenta previa:

Before 16 weeks, do not report placenta previa or low-lying placenta

16.0-23.9 weeks

No previa = placenta ends >20 mm from internal os
Low-lying = placenta extends to the internal os or ends <20 mm from internal os
Previa = placenta covers internal os

24.0 weeks onward

No previa = placenta ends >20 mm from internal os
Low-lying = placenta ends 11-20 mm from internal os
Marginal previa = placenta ends 0-10 mm from internal os
Complete previa = placenta covers internal os
Possible previa: use this term after 24.0 weeks for any placenta that is not unequivocally no previa, low-lying, or previa

A comment should be added if the placenta appears to be centrally located over the internal os

For low-lying placentas and marginal previas, a comment should be added describing the distance from the lower edge of the placenta to the internal cervical os.

Amniotic fluid: image largest pocket, assess volume subjectively

Umbilical cord: cross-sectional image of isolated loop or color Doppler image of the fetal pelvis demonstrating two umbilical arteries, one on either side of the bladder.

Umbilical cord insertion into the placenta: image and report as normal, marginal (i.e., umbilical cord inserts into the placenta peripherally, ≤1 cm from its margin), or velamentous (i.e., umbilical cord inserts away from the placenta into the chorioamniotic membrane)

Measurements:

Head: two images with BPD and OFD measured with calipers
Abdomen: two images with AP and transverse diameters measured
Femur: two images with measurements
Nuchal fold: 16.0-20.0 weeks, angled axial view through posterior fossa

Gestational age should be reported on all scans (see attached)
Measurements should be performed on all scans <22 weeks unless previously performed within 7 days.
Estimated fetal weight and weight percentile should be reported for all scans at ≥ 22 weeks, unless an estimated weight has been previously reported within 14 days, or if an estimated weight has been previously reported within 14 days but the clinician requests another estimated fetal weight.

Fetal survey (16 weeks onward; up to twice, at least once ≥ 18 weeks; see attached): Document the following structures for all fetal surveys done:

- Head
  - lateral ventricles/choroid plexus: axial view (NOTE: choroid plexus cysts should be diagnosed when there is an anechoic area ≥ 3mm in diameter that has either a well-defined posterior wall or a sharp distinction from the surrounding choroid plexus. If choroid plexus cysts are seen in the absence intracranial abnormalities, the Head should be listed as "Normal" in OBUS, but the choroid plexus cysts should be mentioned in Comments.)
  - cavum septum pellucidum and falx: usually visible on the BPD view
  - posterior fossa: axial view
- Face
  - nose and lips: coronal view
  - profile demonstrating nasal bone: sagittal view
  - orbits: coronal or axial view
- Spine
  - sagittal or coronal views of entire length
  - entire spine should be examined transversely in real-time; record one transverse image at the level of the lower lumbar or upper sacral spine
- Neck
  - nuchal fold 16-20 weeks (should be < 5 mm to report as normal)
- Thorax
  - transverse view at the level of the heart
  - longitudinal view of diaphragm showing it is intact
- Heart
  - four-chamber view
  - left ventricular outflow tract and proximal aorta
  - right ventricular outflow tract and proximal pulmonary artery and its bifurcation into the ductus arteriosus and right or left pulmonary artery.
  - Note: For detailed scan, also image
    - aortic arch
    - superior and inferior vena cava
    - 3-vessel view
- Abdomen
  - stomach
  - both kidneys: transverse view(s)
  - [NOTE: Genitourinary findings should be classified as
    - "Possibly Abnormal"
      - 16-27.9 weeks for AP measurement of renal pelvis of 4-6 mm without significant calyceal dilation or dilated ureter
      - ≥28.0 weeks for AP measurement of renal pelvis of 7-9.9 mm without significant calyceal dilation or dilated ureter
    - "Abnormal"

16-27.9 weeks for AP measurement of renal pelvis of ≥7 mm OR significant calyceal dilation OR abnormal parenchyma OR dilated ureters OR abnormal bladder (e.g., dilated or absent)
≥28.0 weeks for AP measurement of renal pelvis of ≥10 mm OR significant calyceal dilation OR abnormal parenchyma OR dilated ureters OR abnormal bladder (e.g., dilated or absent)]
urinary bladder
umbilical cord insertion
two umbilical arteries in color, one on either side of the bladder
Extremities
one image of each extremity showing the distal portion of the extremity and at least part of the hand or foot
label each image as RUE, LUE, RLE, or LLE
Extremities should be reported to be "Normal" when all four extremities are seen, and the hands and feet appear normal. Visualization of five digits in each hand and foot is not necessary.
Extremities should be reported to be "All present" when all four extremities are seen, including the presence of hands and feet.

Fetal survey reporting: List findings for all anatomic parts as Normal, Possibly abnormal, or Abnormal. If a structure is unevaluable, report as defined below:
14.0-15.9 weeks: if a structure is unevaluable, report as "Gestational age too early to evaluate"
16.0 weeks onward: if a structure is unevaluable, report as "Unevaluable" unless the structure has previously been reported as normal, in which case report it as "Unevaluable but previously reported normal"
If any structure is reported as "Unevaluable" or "Unevaluable but previously reported normal", the reason for being unevaluable should be listed in the OBUS report.

Multiple gestations
Fetal number
Amnionicity: image membrane(s)
Chorionicity: document with images; these might include membrane thickness, placental number, fetal sexes

Monochorionic gestations:
In addition to our other protocols
Starting at 16 weeks, to be performed at every scan
Single deepest pocket in each sac
Starting at 20 weeks and continuing every 4 weeks until 34 weeks gestation
Middle cerebral artery Doppler: report the peak systolic velocity, as well as the multiples of the median (MoM) for gestational age
(http://www.perinatology.com/calculators/MCA.htm)

In addition,
if any of the following apply:
- Single deepest pocket of amniotic fluid measures ≤ 2 cm or ≥ 8 cm in at least one fetus
- Oligohydramnios or polyhydramnios in at least one fetus
- Abnormal umbilical artery Doppler in at least one fetus
- Abdominal circumference difference between twins is >24mm before 24 weeks
- Estimated fetal weight <10th percentile for at least one fetus
- Discordant estimated fetal weights of >20% at 24 weeks or later, calculated as follows:
(EFW larger twin - EFW smaller twin)
EFW larger twin

then, perform the following at every scan thereafter:

Umbilical artery Doppler on both fetuses, reported as Normal, Diminished diastolic flow, Absent end diastolic flow or Reversed diastolic flow and include the value of the S/D ratio in Comments.

Ductus venosus Doppler on both fetuses, reported as Normal (antegrade flow throughout the cardiac cycle), Absent flow during part of cardiac cycle, or Reversed flow during part of cardiac cycle

DETAILED (TARGETED) OBSTETRICAL INDICATIONS

Detailed Obstetrical Ultrasounds (as opposed to Routine Obstetrical Ultrasounds) should be performed for the first fetal survey if the indication for the scan is any of the following:

- Previous child with a congenital, genetic, or chromosomal abnormality
- Family history of genetic disorder
- Known or suspected fetal anomaly or growth disorder in the current pregnancy
- Fetus at increased risk for congenital anomaly, such as
    - Maternal pregestational diabetes or gestational diabetes diagnosed before 24 weeks gestation
    - Pregnancy conceived via assisted reproductive technology
    - Maternal BMI ≥35 kg/m^2
    - Multiple gestation
    - Elevated maternal serum alpha fetoprotein level
    - Teratogen exposure
    - First trimester nuchal translucency measurement ≥3.5mm
- Fetus at increased risk for genetic or chromosomal abnormality, such as
    - Parental carrier of chromosomal or genetic abnormality
    - Parent or sibling with congenital heart disease
    - 1st degree relative with congenital anomaly
    - Maternal age ≥35 years at delivery
    - Positive screening test for aneuploidy
    - Soft aneuploidy marker noted on ultrasound
    - First trimester nuchal translucency ≥3.5mm
- Other conditions affecting the fetus, including
    - Congenital infections
    - Maternal drug dependence
    - Isoimmunization
    - Oligohydramnios
    - Polyhydramnios

The second fetal survey for a pregnancy with the same indication from the above list should not be a Detailed Obstetrical Ultrasound, but rather a Routine Obstetrical Ultrasound unless:

- A new abnormality is identified during the sonogram
- The fetus has undergone an intervention
- A maternal condition has arisen that might affect fetal development

If the first fetal survey was a Routine Obstetrical Ultrasound, the second fetal survey should only be a Detailed Obstetrical Ultrasound if:

- A new abnormality is identified during the sonogram
- A maternal condition has arisen that might affect fetal development

If all the structures to be included in an indicated Detailed Obstetrical Ultrasound were not seen at the time of that study, those structures should be assessed and reported when the patient next comes for a scan that includes her second fetal survey, but the scan should not be billed as a Detailed Obstetrical Ultrasound unless one of the above conditions apply.

OBSTETRICAL ULTRASOUND PROTOCOL:
Risk Reduction for Down Syndrome

A statement regarding the risk of Down Syndrome should be included in the OBUS report on all patients undergoing an obstetrical ultrasound between 16 and 20 weeks gestation in whom the following criteria are met:

– All fetal anatomic structures are adequately visualized and appear normal
– None of the following nonspecific signs of Down syndrome are present:
  echogenic intracardiac focus
  echogenic bowel
  pyelectasis ≥ 4 mm
  absent nasal bone
  thickened nuchal fold (≥ 5 mm). Note: nuchal fold should be imaged on all 16-20 week sonograms.
  femur length more than 1.6 SD's below the mean for gestational age. Note: this corresponds to a femur length below the tenth percentile

If the above criteria for normalcy are met, the following statement should be added in OVERALL COMMENTS to the OBUS report:

"None of the following soft markers for Down syndrome were seen in this fetus: echogenic intracardiac focus, echogenic bowel, pyelectasis, absent nasal bone, thickened nuchal fold (5 mm or more), or femur more than 1.6 SDs below the mean for gestational age."

OBSTETRICAL ULTRASOUND PROTOCOL:
Repeat Fetal Surveys

If a patient has had two fetal surveys at or beyond 16 weeks, at least one of which is at or beyond 18 weeks, and all structures have been seen at least once, no further surveys need be performed, imaged, or reported. Fetal structures need to be imaged for each fetal survey.

If a structure is reported as normal on the first 16+ week scan and is not seen on the next scan, that structure should be listed on the OBUS report as as “Unevaluable but previously reported normal”. Regardless of the number of prior surveys, if a fetal structure has been "unevaluable" on all prior scans, an attempt should be made to image that structure, and that structure should be listed on the OBUS report of the current scan. If any structure is reported as “Unevaluable” or “Unevaluable but previously reported normal”, the reason for being unevaluable should be listed in the OBUS report.

Notwithstanding the above, it is the prerogative of the attending sonologist to perform and document a fetal survey on any obstetrical ultrasound.

OBSTETRICAL ULTRASOUND PROTOCOL:
Doppler: Indications and Interpretation

Doppler of the umbilical cord should be performed only when it has been requested or when there is a specific indication for it. This will both avoid excessive false positives (e.g, diminished diastolic flow in an otherwise normal patient, which is almost always a false positive) and also save time. Indications for Doppler starting at 24 weeks include:

- — Maternal hypertensive disorders
- — Maternal autoimmune disorders (SLE, antiphospholipid antibody)
- — Maternal sickle cell disease
- — Measurements suggesting IUGR (estimated fetal weight ≤10th %ile) on current or prior scans
- — BPP score ≤ 4/8 on current scans
- — Oligohydramnios with intact membranes

Note that post-dates, in the absence of any of the above, is not an indication for Doppler.

When Doppler is performed, the waveform must be of good technical quality to be considered interpretable. In particular, unless the waveform has clear, well-defined contours and fills as much of the spectral graph as possible, it should be ignored. The waveform should be obtained with the fetus at rest and in the absence of fetal breathing. Using such a waveform, the diagnosis of "diminished diastolic flow" should be made when the S/D ratio is:

>4.0 prior to 30 weeks
>3.5 at 30-34 weeks
>3.0 after 34 weeks

Prior to 24 weeks, umbilical artery Doppler is considered normal if end diastolic flow is > 0.
If there is more than one technically acceptable waveform, the lowest S/D ratio should be used.
Report reason Doppler was performed.

Middle cerebral artery (MCA) Doppler of the fetus

- The exam must be ordered by the patient's clinician
- Image the circle of Willis and as long a segment of the MCA as possible. Place spectral Doppler gate near the origin of the MCA from the circle of Willis. Obtain at least 3 waveforms.
- Select the best waveform to report peak systolic velocity. Always angle correct when reporting velocities.
- A separate accession number and report is generated for this study
- Include the statement in the Overall Comments: "Fetal intracranial Doppler was performed" or “Middle cerebral artery Doppler performed” and report the peak systolic velocity, as well as the multiples of the median (MoM) for gestational age. (http://www.perinatology.com/calculators/MCA.htm)
- Note: Elevated MCA peak systolic velocity for gestational age has been reported to indicate fetal anemia.

Monochorionic gestations Doppler studies (see full monochorionic gestation protocol):

- Starting at 16 weeks the following should be performed every 14+ days (unless clinician requests this be done with greater frequency)
  - Umbilical artery Doppler on both fetuses and reported as Normal, Diminished diastolic flow, Absent diastolic flow or Reversed diastolic flow and include the value of the S/D ratio in Comments.
  - Ductus venosus Doppler should be performed on both fetuses and reported as Normal (antegrade flow throughout the cardiac cycle), Absent flow during part of cardiac cycle, or Reversed diastolic flow during part of cardiac cycle.
- Starting at 20 weeks and continuing until 34 weeks, the following should be performed every 14+ days (unless clinician requests this be done with greater frequency)
  - Middle cerebral artery peak systolic velocity: report the peak systolic velocity, as well as the multiples of the median (MoM) for gestational age (http://www.perinatology.com/calculators/MCA.htm).
  - If the single deepest pocket of amniotic fluid measures ≤ 2 cm or ≥ 8 cm in one or both of the fetuses, umbilical artery and ductus venosus Doppler should be performed on both fetuses at every scan for the rest of the pregnancy.

OBSTETRICAL ULTRASOUND PROTOCOL:
Gestational Age Assignment

The following guidelines describe how to assign gestational age (GA) at the time of the initial ultrasound in a pregnancy. On any follow-up scan, gestational age must be based on the initial ultrasound via the formula:

Current GA = GA at initial ultrasound + number of intervening weeks.

I. FIRST TRIMESTER

1. Prior to visualization of a measurable crown-rump length, base GA on ultrasound findings:

Findings	GA Assignment (wks)
Gestational sac only	5
Gestational sac and yolk sac, no embryo or heartbeat	5.5
Gestational sac with heartbeat but no measurable embryo	6

2. Crown-rump length 1-70 mm: base GA on CRL

3. For IVF patients, base GA on retrieval date + two weeks. In OBUS, enter the retrieval date or embryo transfer date under IVF under DATA. For frozen embryo transfer patients, base GA on transfer date + 2.4 weeks (17 days). In OBUS, enter the embryo transfer date under IVF under DATA.

4. In infertility patients, transvaginal, in addition to transabdominal, scans should be done routinely for all early first trimester ultrasounds up to 8 weeks gestation. Transvaginal scanning is not required for early pregnancies scans in patients who were not treatment for infertility, but are done at the discretion of the radiologist or sonologist assistant.

II. SECOND AND THIRD TRIMESTERS

1. Prior to 24 weeks or ≥ 24 weeks with unreliable dates: base GA on fetal measurements in this order of preference:

   Corrected BPD
   BPD (if OFD not obtainable)
   FL (if BPD not obtainable)

2. ≥ 24 weeks with reliable dates (good LMP and/or outside ultrasound)

   - if current measurements are within 3 weeks of dates: base GA on LMP/EDC
   - if current measurements are not within 3 weeks of dates: these cases must be treated individually, as no one statement applies to all. Judgment must be used to determine if the pre-existing dates are incorrect (in which case GA should be based on our ultrasound) or if the fetal size is abnormal.

Note: (i) For twins: date each as above and average the two GA values (unless twins are discordant). Enter this average value in "Clinical GA" in OBUS, and base the GA on "Clinical GA".
If twins are discordant, base the gestational age on the GA of the larger twin.

(ii) On the initial scan, write the GA on front of the OB folder.

OBSTETRICAL ULTRASOUND PROTOCOL:
Biophysical Profile

BPP Parameter	Criterion for a score of 2*
Fetal breathing movements	one 30-second episode within 30 minutes
Fetal body movements	three body/limb movements within 30 minutes
Fetal tone	one episode of flexion & extension within 30 minutes
Amniotic fluid volume	at least mild oligohydramnios (i.e., not moderate or severe oligohydramnios)

* Score = 0 if criterion is not met

Note: For a biophysical profile, the startle response to stimulation should not be counted at fetal movement. Stimulation can be used to "wake" the fetus, but only subsequent movements should be counted for fetal movement and tone.

OBSTETRICAL ULTRASOUND PROTOCOL:
Policy Regarding Sonographic Evaluation and Reporting of Nuchal Cords

We do not routinely evaluate the relationship between the umbilical cord and the fetal neck during obstetrical ultrasound examinations. If a single or double nuchal cord is identified incidentally, there is no need to report it because this is considered to be a normal finding that has been shown to have no effect on clinical outcome. If a triple (or greater) nuchal cord is identified incidentally, the finding should be reported and the ordering clinician notified.

OBSTETRICAL ULTRASOUND PROTOCOL:
Emergency Obstetrical Ultrasounds

When an emergency obstetrical ultrasound is performed by a sonographer after hours, the scan should address the questions of the referring physician and include pictures of fetal position, placenta, amniotic fluid, fetal measurements, and an M-mode of the fetal heart in the first trimester. A formal anatomic survey should not be performed.

In the infrequent situation in which the referring clinician asks for an anatomic survey to rule out anomalies, a fetal survey can be performed.

OBSTETRICAL ULTRASOUND PROTOCOL:
Imaging of the Fetus During Non-Obstetrical Ultrasounds

If a pregnant patient is having a non-obstetrical ultrasound examination, no scanning or images of the pregnancy or fetus should be taken EXCEPT when the patient is in the 2nd or 3rd trimester AND having a scan of any part of the abdomen or pelvis (e.g., renal, abdomen, RUQ, appendix). In such cases, a clip of the fetal heart should be taken and, in the Comments field of UltraSTAR, the statement "Live intrauterine gestation seen" should be included. Pictures of the fetus should not be taken for the patient during such examinations.

OBSTETRICAL ULTRASOUND PROTOCOL:

Fetal Demise

When fetal demise is found unexpectedly, or a previously suspected demise is confirmed by ultrasound, the scan should be performed quickly and with sensitivity. As soon as the sonographer observes a dead fetus, he or she should cease scanning and get a physician. The physician should do an abbreviated examination, taking one or more measurements needed to assign a gestational age at the time of demise (CRL in the first trimester, FL usually best thereafter if there are overlapping skull bones), noting placental position, and briefly looking for the cause of death. While it is usually appropriate to tell the patient of the finding, the physician should judge how best to deal with each individual patient.

OBSTETRICAL ULTRASOUND PROTOCOL:
Notification of Referring Obstetrician about Abnormal Ultrasound Findings

When there is a new significant ultrasound finding that may affect patient management, a responsible person from the office of the referring provider should be notified by phone. This responsible person may be the referring obstetrician, a partner providing coverage, a resident or fellow, a midwife, or a nurse in the office who is willing to take responsibility for the call. Whenever a call is made, document in ANCR not only who was called, but also who made the call (talked to the clinician) and at what time and date. In the COMMENTS of the OBUS report, or in the notification box of UltraSTAR, include the comment that "Results were communicated and documented in ANCR."

Indications for a call include, but are not limited to:

Suspected ectopic pregnancy or failed

Abnormal fetal heart rate

Oligohydramnios, unless SROM

Suspected IUGR (e.g., weight ≤10th %tile).

BPP ≤ 6/8

Abruption or placenta previa ≥ 20 weeks

Moderate or large subchorionic hematoma ≥ 20 weeks

Absent or reversed Doppler flow

Any fetal anomaly

Any aneuploidy marker at 16-20 weeks

Breech position at ≥35 weeks gestation if patient is sent from Labor and Delivery, Triage, or a Midwife practice

Breech Version Procedure Protocol

- Pregnancy must be at least 36 weeks of gestation
- Patient is brought to ultrasound room. Sonographer performs ultrasound exam as requested per ordering physician. If ordering physician did not request complete survey and measurements sonographer will document placental location, fetal position, amniotic fluid volume and dynamic clip of fetal cardiac activity.
- If fetus is vertex, NST RN is notified and procedure is cancelled.
- If amniotic fluid is low, and attending sonologist confirms, sonographer notifies the obstetrician doing the version. Obstetrician decides whether appropriate to offer version.
- NST is then performed to assess fetal status and presence of contractions.
- If NST is reactive, NST nurse will page the physician doing the version.
- After MD approves plan and availability to proceed with version, RN will administer terbutaline 0.25 mg subcutaneously.
- Patient returns to ultrasound room for version, not more than 15 minutes after terbutaline dose (1st in line for next US room).
- When physician arrives, Universal Protocol is followed to confirm patient identification, procedure to be performed and signed consent. The ultrasound table is then placed in Trendelenberg position. Sonographer shows the physician the fetal position, placental location, fluid pockets.
- Sonographer monitors the fetal heart rate during the procedure. If the fetal heart rate becomes bradycardic, sonographer notifes the physician by saying “brady”.
- After procedure, sonographer documents the fetal position and a clip of fetal cardiac activity.
- NST is to be performed after the version attempt, whether successful or not. Sonographer will notify NST nurse and guide patient to NST room.

Revised 1/24//2013

POLICY REGARDING VIDEOTAPING DURING OBSTETRIC ULTRASOUND

For patients *who ask* to take pictures or video of their obstetric ultrasound study:

Taking pictures or videos of the ultrasound examination is up to the discretion of the interpreting physician for that exam. Patients may not take pictures or videos during the medical portion of the ultrasound, done by the sonographer. Following completion of image acquisition for medical purposes**,** if time permits and with the consent of the patient, **the interpreting physician** may permit the family to record a short clip illustrating the fetus. The physician should not be included in the family's recorded video or picture.

Text (make available to Patients who request to video and want to know policy):

OBSTETRIC ULTRASOUND RECORDING POLICY

We understand that families enjoy the opportunity to see images of their unborn baby in the womb during an obstetric ultrasound, and that they may want to share images with other family members. However, it is important to keep in mind that your ultrasound study is a medical test ordered to be sure that your pregnancy is proceeding normally and that there are no unforeseen problems. The sonographers and doctors who perform and read your ultrasound study need to be able to optimize images for interpretation and concentrate without distraction.

We are glad to give you some printed images at the end of your study for you to take home.

If time allows, at the end of the study we can give you an opportunity to take a short photograph or video clip of the ultrasound screen upon request. This is at the discretion of the physician interpreting your ultrasound, and may not always be possible if the unit is busy. We ask that you not include images of the medical staff when taking your video. Thank you for your understanding.

Policy date: December 15, 2015

FEMALE PELVIS ULTRASOUND PROTOCOL

The following images should be documented:

- Uterus: transverse/coronal and sagittal images including the body and cervix
  - Measure uterus in all three planes: Sagittal, transverse and AP and report measurements
  - Document and report uterine orientation
- Endometrium: sagittal image with endometrial thickness measured AP perpendicular to the axis of the endometrium, from endometrial-myometrial margin anterior to endometrial-myometrial margin posterior
- Adnexa: transverse/coronal and sagittal images of each ovary

Reporting ovarian cysts:

- In premenopausal women, simple ovarian cysts with at least one dimension 25 mm or greater and complex cysts with at least one dimension 20 mm or greater should be reported. Simple cysts <25 mm, and most complex-appearing cysts <20 mm, are considered to be normal physiologic cysts and, therefore, need not be reported and no follow-up scan is necessary.
- In postmenopausal women, only cysts with at least one dimension 10 mm or greater should be reported.
- Note: Any cyst with sonographic features that raise concern for malignancy or are suggestive of nonphysiologic lesions (e.g., dermoid, endometrioma) should be included in the report, no matter what its dimensions.

Reporting endometrial thickness in women with postmenopausal bleeding and not taking hormones:

- < 4.0 mm — report as "Normal"
- 4.0-4.9 mm — report as "Borderline thickened"
- ≥ 5.0 mm — report as "Abnormally thickened"

Baseline Infertility studies

- Uterus: transverse/coronal and sagittal images including the body and cervix
  - Measure uterus in all three planes: Sagittal, transverse and AP and report measurements
  - Document and report uterine orientation
- Endometrium
  - Measure thickness (AP measurement on a sagittal image)
  - Report appearance as:
    - – thin echogenic line (up to 4 mm)
    - – homogeneously echogenic (>4 mm)
    - – multilayered (outer echogenic layer, inner hypoechoic layer, central thin echogenic line)
- Measure all follicles ≥ 11 mm in two dimensions (on a single image) up to a total of 10 follicles.
- Report any simple cyst with one dimension ≥ 25 in three dimensions, instead of two.
- Report in three dimensions all complex cysts with at least one dimension ≥ 11mm.
- Report antral follicle count for each ovary as the total number of follicles 2-10 mm in size, up to a total of 10 follicles. If there are more than 10 follicles, these should be listed as >10 follicles.

Follicular monitoring studies

- Endometrium
  - Measure thickness (AP measurement on a sagittal image)
  - Report appearance as:
    - – thin echogenic line (up to 4 mm)
    - – homogeneously echogenic (>4 mm)
    - – multilayered (outer echogenic layer, inner hypoechoic layer, central thin echogenic line)
- Measure all follicles ≥ 11mm in two dimensions (on a single image) up to a total of 10 follicles. If there are more than 10 follicles measuring ≥ 11mm, count the number of remaining follicles without measuring them, and list the number in Comments below the measured follicles.
- Report small follicles (5-10mm) as "One", "Few", or "Multiple"
- Report in three dimensions all complex cysts with at least one dimension ≥ 11mm.

Cryo Cycle studies

- 2 Sagittal images of endometrium with AP measurement of thickness
- Coronal image of endometrium
- Sagittal image of cervix

Polycystic ovary syndrome:

- Follow our usual protocol for evaluation of the uterus.
- Ovaries
  - Measure the ovary in 3 dimensions (AP, SAG, & COR)
  - Estimate the number of small follicles (2-10 mm) as <12 follicles or ≥ 12 follicles
    - Calculate ovarian volume using cm as
    - 0.5 x AP x SAG x COR
  - Criteria for Polycystic Ovaries: Ovarian volume >10mL and/or ≥ 12 follicles
  - Report the ovarian volume and whether or not ≥ 12 follicles were seen
  - Only one ovary fitting the definition above is sufficient to diagnose PCO

- Exceptions, do not follow above protocol:
  - Oral contraceptive use
  - Presence of a simple or complex cyst >10mm

INTRAOPERATIVE ULTRASOUND PROTOCOL

The following images should be documented whenever possible, with the understanding that, in some cases, the sonographer is not called to the operating room until the procedure is already underway:

- Preintervention images in transverse and sagittal, e.g., endometrial cavity for dilatation and curettage procedures, renal collecting system for renal stent placement
- Procedure images and or clips showing instrument or device
- Postprocedure images in transverse and sagittal, e.g., endometrial cavity after procedure, stent in renal pelvis after stent placement

The name of the physician performing the procedure should be included in the report.

ABDOMEN ULTRASOUND PROTOCOL

The following images should be documented:

Liver
- transverse views to include:
  - right lobe at dome
  - hepatic veins
  - left lobe with ligamentum teres
  - right and left branches of portal vein
  - inferior right lobe showing right kidney
- sagittal/coronal views
  - left lobe
  - right lobe including inferior vena cava
  - right lobe including diaphragm and pleural space
  - right lobe including right kidney

Gallbladder and Biliary Tree
- long axis view of gallbladder
  - supine
  - left lateral decubitus
- transverse view of gallbladder
- long axis view of common bile duct and portal vein

Pancreas
- transverse views to include:
  - head
  - body
  - tail (if possible)

Spleen
- transverse view
- sagittal/coronal view to include diaphragm and pleural space and upper pole of left kidney

Kidneys
- transverse views to include:
  - upper pole
  - mid pole
  - lower pole
- long axis view(s):
  - full renal length measured with calipers

Aorta
- long axis: 2 views showing entire length (if possible)
- transverse views:
  - mid-abdominal aorta
  - bifurcation

Inferior Vena Cava
- long axis: 2 views showing intrahepatic portion and entire length (if possible)
- transverse: view within the liver at the level of the hepatic veins

Limited abdominal scans (scheduled as U021) may be performed in the following situations:

Portable or emergency scans should be restricted to the region of clinical concern and related organs.

Repeat scans done within 3 months of a prior complete abdominal ultrasound in our department: the scan should be restricted to the region of clinical concern and related organs, as well as follow-up of abnormalities seen on prior scan.

Scans requested within 1 month of a CT or MR to clarify a question raised on abdominal CT or MR: the scan should be restricted to the region of clinical concern and related organs.

LIVER DOPPLER

The following images and Doppler images should be documented

Hepatic veins
- Color and spectral Doppler waveforms of right, middle, and left hepatic veins

Portal veins
- Color and spectral Doppler waveforms of the main portal vein and right anterior, right posterior, and left portal vein branches
- Measure peak velocity in main portal vein with angle correction

Inferior vena cava
- Color or spectral Doppler of intrahepatic portion of the inferior vena cava

TIPS
- Color and spectral Doppler waveforms
- Measure velocity of main portal vein inflow
- Measure velocity at portal end, mid, and hepatic end of TIPS
- Color or spectral Doppler of hepatic vein outflow (velocity measurement not required)

DIAGNOSTIC CRITERIA FOR LIVER DOPPLER INCLUDING TIPS

I. Portal vein

A. Primary criteria: waveform direction and appearance; main, right and left portal veins

Antegrade flow throughout cardiac cycle with mild respiratory and cardiac fluctuations	Normal (peak >15 cm/sec)
Exaggerated pulsatility with reversed flow during part of cardiac cycle	Abnormal, suggests high venous pressure such as from CHF or tricuspid regurgitation
Reversed flow	Abnormal, indicates portal hypertension
Absent flow	Thrombosed

II. Hepatic veins

A. Primary criteria: waveform direction and appearance

Pulsatile flow, primarily antegrade with some retrograde flow during atrial contraction	Normal
Flattened waveform	Suggests hepatic parenchymal disease
Absent flow	Thrombosed

III. TIPS (transjugular intrahepatic portovenous shunt)

A. Normally functioning TIPS

Shunt velocity	90-190 cm/sec
Main portal vein velocity	≥20 cm/sec
Left portal vein flow	Retrograde
Right portal vein flow	Retrograde

B. TIPS stenosis

Shunt velocity	<90 or >190 cm/sec
Main portal vein velocity	<20 cm/sec (or reversed)
Left portal vein flow	Antegrade
Right portal vein flow	Antegrade

C. TIPS occlusion

Shunt flow	absent
Main portal vein velocity	<20 cm/sec (or reversed)
Left portal vein flow	Antegrade
Right portal vein flow	Antegrade

ABDOMINAL AORTIC PROTOCOL

I. Diagnostic examination:

The following images and Doppler should be documented:

Abdominal aorta

- Long axis: 2-3 views showing entire length
- Transverse views with AP and transverse measurement:
  - upper abdominal aorta
  - mid-abdominal aorta
  - distal abdominal aorta
- Transverse image of bifurcation
- Transverse image with AP and transverse measurement
  - Each common iliac artery at its widest
- Spectral Doppler waveforms and velocity measurements
  - upper abdominal aorta above renal arteries
  - mid-abdominal aorta
  - distal abdominal aorta
  - both common iliac arteries

II. Screening examination for abdominal aortic aneurysm:

The following images and Doppler should be documented:

Abdominal aorta

- Long axis: 2-3 views showing entire length
- Transverse views with AP and transverse measurement:
  - upper abdominal aorta
  - mid-abdominal aorta
  - distal abdominal aorta
- Transverse image of bifurcation

DIAGNOSTIC CRITERIA

I. Criteria for abdominal aortic aneuryms

AP or transverse measurement is ≥3.0 cm

OR

AP or transverse measurement ≥1.5 times proximal measurement

II. Criteria for iliac artery aneurysm

AP or transverse measurement is ≥1.5 cm

LIVER ELASTOGRAPHY PROTOCOL

Technique:

- 4-6 hours fasting
- Supine or slight left lateral decubitus position
- Right arm above the head
- Shallow breath hold
- Place elastography box in right lobe about 2 cm beneath capsule, avoiding large vessels, bile ducts, and rib shadowing
- Acquire 5-10 measurements
- Report the median (middle measurement), not the mean (average)

Diagnostic criteria

	Young modulus kilopascals (kPa)	Shear wave velocity m/sec
Minimal risk fibrosis stage ≤F2)	<7 kPa	<1.5 m/sec
Moderate risk of fibrosis (stage 2 & some stage 3)	7-15 kPa	1.5-2.2 m/sec
High risk of fibrosis (stage 4 and some stage 3)	>15kPa	>2.2 m/sec

How to do it on the Logiq E9:

1. Use C1-6 in room 2 or room 8
2. Select Elasto preset
3. Press Elasto button on keyboard
4. Position box in liver
5. Press START (button next to track ball)
6. Press Freeze when you have a reading you like
7. Hit caliper and adjust cursors to position circle over a uniform area of color
8. Hit set and Print
9. Unfreeze to acquire new elastography map

You can acquire more than one measurement from an acquired scan, provided there are good enough areas of color to sample.

AORTIC ENDOLUMINAL STENT GRAFT PROTOCOL

I. Limited Abdominal Ultrasound

Abdominal aorta and common iliac arteries

Long axis: 2-3 views showing entire length of aorta and graft

Graft is typically a double barrel style with both barrels in the distal aorta until they split to extend down each common iliac artery

Transverse views:

upper abdominal aorta
mid-abdominal aorta
distal abdominal aorta
bifurcation

Measure anterioposterior and transverse diameters of the aneurysm at widest part, outer to outer, on transverse image. Make sure to compare the size of the aneurysm sac to prior imaging (Ultrasound, CT or MR) to make sure the sac is not enlarging.

II. Color and Spectral Dopplers

Abdominal aorta and common iliac arteries

Color Doppler of the entire graft longitudinal demonstrating patency throughout (typically high velocity)
Spectral Doppler tracing in lumen of graft
Color Doppler of graft in transverse
Color images of the aneurysm lumen, looking for a leak (typically lower velocity than aorta).

Note: To avoid artifact, exclude the graft lumen from the color box if possible

If type II endoleak is identified, obtain spectral Doppler of leaking vessel

III. Reporting

Size of aortic aneurysm compared to prior
Graft patency
Migration or kinking of graft
Presence and type of endoleak, including vessels involved (Types II and III are most common postoperative)

ENDOLEAK TYPES

Exclusion of the aneurysm sac is the main goal of the stent-graft treatment, and clinical success is defined by the "total exclusion" of the aneurysm. However, at times, failure of the stent-graft to totally exclude blood flow to the aneurysm sac may occur. Endoleak is the major cause of complications, and failure in endoluminal treatment of AAA. When an endoleak occurs, it causes continued pressurization of the aneurysm sac and may leave the patient at risk of an AAA rupture.

Endoleak is defined as a persistent blood flow outside the lumen of the endoluminal graft but within an aneurysm sac or adjacent vascular segment being treated by the device. Endoleaks are due to incomplete sealing, or exclusion of the aneurysm sac, and thus cause reflux of blood flow into the sac. Four types of endoleaks are currently known and categorized.

Type I endoleak: blood flow into the aneurysm sac due to incomplete seal or ineffective seal at the end of the graft. This type of endoleak usually occurs in the early course of treatment, but may also occur later.

Type II endoleak: blood flow into the aneurysm sac due to opposing blood flow from collateral vessels. In some circumstance when there are two or more patent vessels (typically lumbar or inferior mesenteric arteries), a situation of inflow and outflow develops, creating active blood flow within a channel in the aneurysm sac.

Type III endoleak: blood flow into the aneurysm sac due to inadequate or ineffective sealing of overlapping graft joints or rupture of the graft fabric. This endoleak may occur early after treatment, due to technical problems, or later due to device breakdown.

Type IV endoleak: blood flow into the aneurysm sac due to the porosity of the graft fabric, causing blood to pass through from the graft and into the aneurysm sac.

MESENTERIC DOPPLER – PROTOCOL

The following images and Doppler should be documented:

- Abdominal aorta
  - Long axis
    - upper abdominal aorta
    - mid-abdominal aorta
  - Transverse views:
    - upper abdominal aorta
    - mid-abdominal aorta
  - Spectral Doppler waveforms and velocity measurements
    - upper abdominal aorta above celiac artery
    - mid-abdominal aorta
- Celiac artery
  - Transverse view showing origin to bifurcation (hepatic and splenic arteries)
  - Spectral Doppler waveforms and velocity measurements
    - Celiac artery origin
    - Splenic artery origin (when appropriate)
    - Hepatic artery origin (when appropriate)
- Superior mesenteric artery (SMA)
  - Longitudinal view
  - Transverse view inferior to origin
  - Spectral Doppler waveforms and velocity measurements
    - SMA origin
    - SMA proximal
    - SMA mid
- Attempt to assess inferior mesenteric artery (IMA) when clinically indicated (e.g., evaluation of chronic mesenteric ischemia)
  - Longitudinal view
  - Transverse view inferior to origin (if possible)
  - Spectral Doppler waveforms and velocity measurements
    - IMA origin
    - IMA proximal

MESENTERIC DOPPLER – DIAGNOSTIC CRITERIA

I. Superior or inferior mesenteric artery Doppler for stenosis

A. Primary criteria: Peak systolic velocity (PSV) (fasting)

≤275 cm/sec	No significant stenosis
>275 cm/sec	≥70% stenosis
No flow identified	Occluded

B. Secondary criteria: End diastolic velocity (EDV) (fasting)

≤45 cm/sec	No significant stenosis
>45 cm/sec	≥50% stenosis

C. Other criteria: ratio of superior mesenteric artery PSV to aortic PSV

≤3.0	No significant stenosis
>3.0	Hemodynamically significant stenosis

D. Other criteria: response to food

PSV increase ≥15%	No significant stenosis
PSV increase <15%	Hemodynamically significant stenosis

II. Celiac artery for stenosis

A. Primary criteria: Peak systolic velocity (PSV) (fasting)

≤200 cm/sec	No significant stenosis
>200 cm/sec	≥70% stenosis
No flow identified	Occluded

B. Secondary criteria: End diastolic velocity (EDV) (fasting)

≤55 cm/sec	No significant stenosis
>55 cm/sec	≥50% stenosis

C. Other criteria: flow in hepatic artery

Antegrade	Normal
Retrograde	Severe stenosis

ADULT AND NEONATAL RENAL AND RENAL TRANSPLANT ULTRASOUND AND DOPPLER PROTOCOLS

RENAL scans:

- Kidneys
  - transverse views to include:
    - upper pole
    - mid pole
    - lower pole
  - long axis view(s):
    - full renal length measure with calipers – include measurement in report
- Urinary bladder
  - transverse views
  - long view
- Include renal size in the report
- Doppler should be performed in both kidneys in cases of unilateral or bilateral newly diagnosed hydronephrosis and the resistive index should be calculated from the spectral waveform for:
  - upper pole
  - mid pole
  - lower pole
- Report a single number for the RI (not a range or average), selecting the most representative value, unless the RIs are discrepant (difference of >0.10) within the kidney, in which case further evaluation is warranted to look for a cause of the discrepancy.

NEONATAL RENAL scans:

- Kidneys
  - transverse views to include:
    - upper pole
    - mid pole
    - lower pole
    - measure width of fluid in the renal pelvis with calipers, anteroposterior (AP)
      - AP pelvis <10 mm — Normal (do not report measurement)
      - AP pelvis 10-14.9 mm, no peripheral calyceal dilation — Mild dilation (report measurement)
      - AP pelvis ≥15mm or peripheral calyceal dilation — Moderate or severe dilation depending on other findings (report measurement)
  - long axis view(s):
    - full renal length, measure with calipers – include measurement in report
- Urinary bladder
  - transverse views
  - long view
- Adrenal glands
  - transverse views
  - long view

RENAL TRANSPLANT scans:

- Transplant Kidney
  - transverse views to include:
    - upper pole
    - mid pole
    - lower pole
  - long axis view(s):
    - full renal length measure with calipers
- Doppler should be performed and the resistive index should be calculated from the spectral waveform for
  - upper pole
  - mid pole
  - lower pole

Report a single number for the RI (not a range or average), selecting the most representative value, unless the RIs are discrepant (difference of >0.10) within the kidney, in which case further evaluation is warranted to look for a cause of the discrepancy

Assess flow throughout the kidney with color or power Doppler

Main renal artery

Color and spectral Doppler showing flow

Measure peak systolic velocity when indicated (e.g., suspected renal artery stenosis)

Spectral Doppler waveforms and velocity measurements when indicated (e.g., suspected renal artery stenosis)

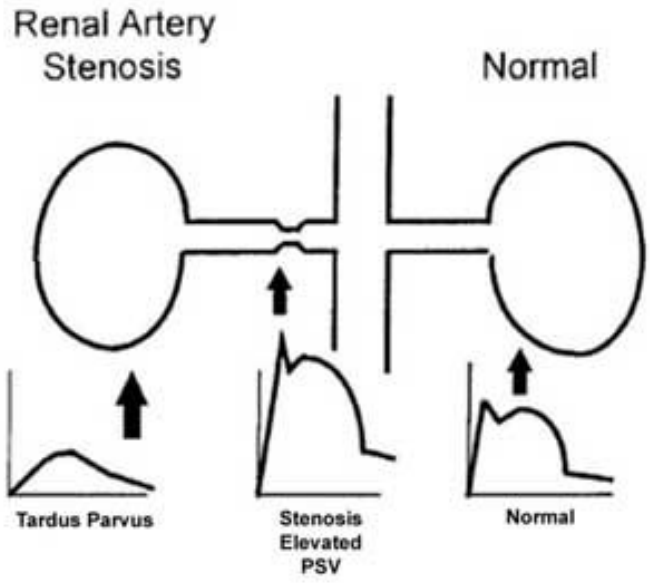
Renal vein

Color and spectral Doppler (velocity measurement not required)

Diagnostic criteria for transplant renal artery stenosis

Significant stenosis should be reported as present if at least two of the following are seen

- Peak systolic velocity >300 cm/sec
- Ratio of PSV in renal artery to iliac artery is >3.0
- Abnormal waveform with turbulence (e.g., aliasing at the site of stenosis with color Doppler) and/or tardus parvus (slow rise and diminished peak velocity, see image below) distal to the stenosis



RENAL ARTERY STENOSIS STUDY PROTOCOL

To accompany a full Renal Ultrasound

Dopplers (angle correct < 60 degrees for all velocities)

Aorta

Measure peak systolic velocity (m/sec)

For each Kidney

Main renal artery (and accessory renal artery when present), measure peak systolic velocity (normal is <1.8 m/sec)
- origin
- proximal
- mid
- distal

Calculate highest renal artery to aorta ratio (renal artery PSV/aortic PSV) (normal is <3.5)

Doppler should be performed and the resistive index should be calculated from the spectral waveform for
- upper pole
- mid pole
- lower pole

Main renal vein with color Doppler (velocity measurements not required)

Reporting
- List PSVs and indicate if abnormal
- List renal artery to aortic PSV ratio and indicate if abnormal
- Report a single number for the RI (not a range or average) for each kidney, selecting the most representative value, unless the RIs are discrepant (difference of >0.10) within the kidney, in which case further evaluation is warranted to look for a cause of the discrepancy
- Describe intrarenal waveforms as "Normal" (rapid upstroke) or "Abnormal with tardus parvus" (delayed upstroke)

RENAL DOPPLER DIAGNOSTIC CRITERIA

I. Intrarenal Doppler

A. Primary criteria: Resistive index (RI)

>0.45 and ≤0.70	Normal
>0.70	Elevated
≥0.80	Elevated, suggests permanent renal damage
≤0.45	Abnormal, suggests blunting from proximal stenosis

B. Secondary criteria: difference in RI between kidneys

≤0.10	Normal
>0.10	Abnormal, typically due to pathology in the kidney with the higher RI

II. Renal artery Doppler to evaluate for renal artery stenosis

A. Primary criteria: Peak systolic velocity (PSV)

<200 cm/sec	Normal
200-300 cm/sec	Mild
>300 cm/sec	Moderate to severe
No flow identified	Occluded

B. Secondary criteria: ratio of renal artery PSV to aortic PSV

<3.5	Normal
≥3.5	Hemodynamically significant stenosis

NATIVE KIDNEY BIOPSY PROTOCOL FOR ULTRASOUND

I. Sonographer set-up
   1. Bring patient into the room.
   2. Scan both kidneys. In particular, make note of renal size, and assess for hydronephrosis, cysts, and masses. If the patient has had an unremarkable ultrasound within the last three months, a complete renal ultrasound need not be performed.
   3. Put guide attachment onto transducer.
   4. Bring renal biopsy cart into the room
   5. Position patient for biopsy prone with towels or pillow under abdomen.
   6. Get attending Radiologist when the attending nephrologist arrives.

II. Radiologist
   1. Scan kidneys and mark the skin insertion site for the biopsy. The site should be selected so that the biopsy sample will contain predominantly cortex from the lower pole of the kidney. Renal cysts and focal lesions should be avoided.
   2. Cover transducer and snap in place the plastic 14g or 15g needle guide.
   3. Guide the Nephrologist to inject lidocaine at the skin site and along the intended biopsy needle track. The Nephrologist should attach a 22g spinal needle to the lidocaine syringe and be directed through the guide to inject along the needle tract.
   4. Inform the Nephrologist at what phase of respiration (usually end expiration) the biopsy should be taken, so that the Nephrologist can give breathing instructions later, during the biopsy.
   5. Be sure the Nephrologist makes an adequate nick in the skin with the scalpel blade at the insertion site for the biopsy.
   6. Have the Nephrologist insert the biopsy needle through the guide and place the tip in the skin insertion site.
   7. Estimate on the ultrasound screen the distance from the skin surface to the renal capsule and instruct the Nephrologist to advance the biopsy needle the appropriate distance to 1 cm from the renal capsule. The Nephrologist should use the cm markers on the biopsy needle (when present) to measure the distance. Follow the needle with ultrasound, adjusting the focal zone as needed.
   8. The Radiologist should then give the patient breathing instructions.
   9. For the biopsy, the Radiologist instructs the Nephrologist to advance the biopsy needle to the renal capsule and tells the Nephrologist when to fire the biopsy gun.
   10. The Radiologist should put pressure at the biopsy site with a 4 x 4 sterile gauze pad while the Fellow transfers the biopsy specimen to the pathologist.

III. Sonographer completion of the procedure
   1. Arrange for transport of the patient to the floor.
   2. Clean up the ultrasound room.
   3. Restock the biopsy kit and return it to the cabinet

PANCREATIC TRANSPLANT ULTRASOUND AND DOPPLER PROTOCOL

Pancreatic Transplant scans:

Ultrasound

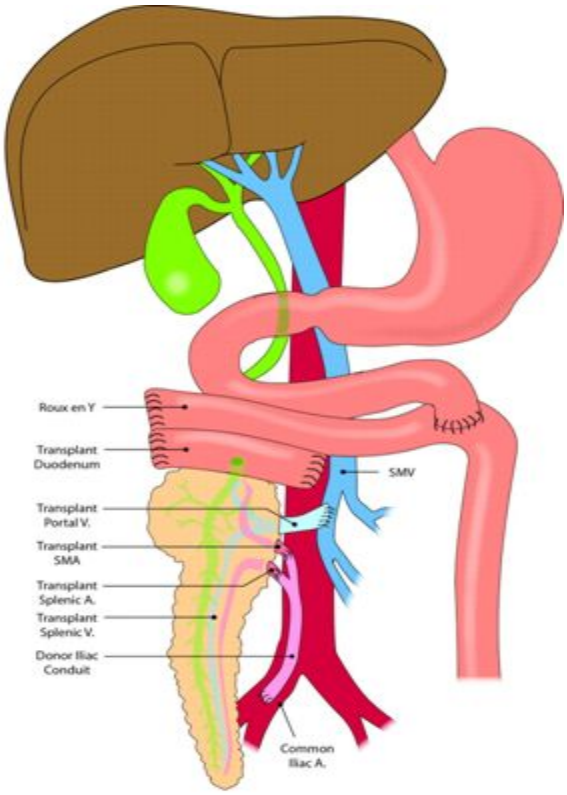
transverse views to include:
head, body, and tail
long axis view(s):
full pancreatic length
Assess for fluid collections around the transplant

Color and Spectral Doppler

Assess flow throughout the pancreas with color or power Doppler
Measure Resistive Index (RI)
head, body, and tail
Splenic artery (to body and tail) and superior mesenteric artery (to head)
color Doppler
spectral Doppler, measure peak systolic velocity at hilum (angle corrected)
Splenic vein
color and spectral waveform
Portal vein
color and spectral Doppler

Include Doppler information in the same report as the information about the transplant pancreas.

Note: The position of the transplant and the location and types of anastamoses may vary from patient to patient. It is important to discuss the anatomy with the covering surgeon, particularly for new transplants.



POLICY FOR ULTRASOUND EXAMS ON NEW RENAL OR PANCREAS TRANSPLANTS IN THE PACU

- All patients undergoing renal or pancreatic transplants will have an immediate postoperative ultrasound with Doppler.

- To ensure that this is done in an expeditious manner, as the surgery begins, the surgical resident will enter an order in Percipio for an ultrasound. The resident will include an estimated time for the completion of the case. When the surgery is complete and the patient is ready to leave the OR, the resident will page the Ultrasound Coordinator beeper (pager 14462).

- The page to the Ultrasound Coordinator beeper should be sent as "STAT" and should include the patient's name and medical record number, and should state that the study is for a new transplant.

- The ultrasound service will be at the bedside within 30 minutes of the notification page.

- If the sonographer cannot identify adequate blood flow in the transplant kidney or pancreas within 15 minutes, the sonographer should call for help, if available, from the radiologist, sonologist assistant or a senior sonographer.

- Patients may require an immediate surgical re-exploration if compromised flow (arterial/venous obstruction; reduced flow to the periphery) is detected. The decision will be based on detailed clinical examination and further imaging if required.

Confirmed with Drs. Benson/Frates/Tullius (November 2011, rev. March, 2012)

SCROTAL ULTRASOUND PROTOCOL

The following images should be documented:

- Testicles
  - transverse views to include:
    - both testicles side-by-side to compare echogenicity
    - each testicle
      - upper pole
      - mid pole with TRV measurements
      - lower pole
  - long axis view(s):
    - each testicle
      - lateral
      - mid with SAG and AP measurement
      - medial
  - color or power Doppler views to include:
    - both testicles side-by-side to compare flow
    - full color or power Doppler image of each testicle, transverse or longitudinal

- Epididymis on each side
  - head adjacent to testicle, to evaluate size, echogenicity and, relationship to the testicle
  - body
  - tail

APPENDIX ULTRASOUND PROTOCOL

Right lower quadrant: transverse and sagittal views obtained with compression
abnormal if appendix is noncompressible with wall >2mm or diameter >6mm

Gallbladder: one image

Right kidney: one image

Pelvis:
Male patients: one image (full bladder not necessary)
Female patients:
one image of the bladder
transverse and sagittal image of right ovary (or right adnexa, if ovary not seen)

NEONATAL INTRACRANIAL ULTRASOUND PROTOCOL

Coronal images: six, anterior to posterior
- Interhemispheric fissure and anterior parenchyma
- Interhemispheric fissure and frontal horns of lateral ventricles
- Corpus callosum, cavum septum pellucidum, frontal horns, germinal matrix, sylvian fissures
- Corpus callosum, bodies of lateral ventricles, third ventricle, thalami, caudate nuclei, choroid plexus, sylvian fissures, cerebellum, cisterna magna
- Occipital horns and trigone of lateral ventricles with choroid plexus
- Posterior parenchyma

Coronal clips
- Frontal through parietal-temporal
- Magnified through the germinal matrix bilaterally

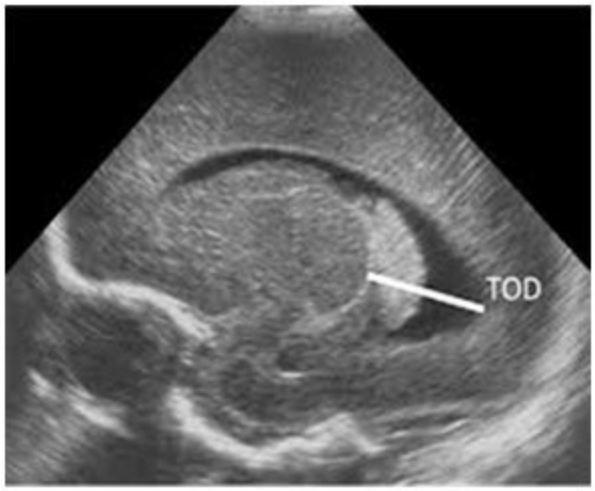
Sagittal images: eight, midline to lateral on each side
- Midline, 2 images:
  - corpus callosum, cavum septum pellucidum, cavum vergae, thalamus, third ventricle, fourth ventricle, cerebellar vermis, cisterna magna
- Right and Left:
  - frontal horn and body of lateral ventricle, caudothalamic notch
  - frontal , body, trigone, occipital horns of lateral ventricle, choroid plexus
  - lateral parenchyma with sylvian fissure
  - occipital horn from posterior
- Axial view of posterior fossa from mastoid region

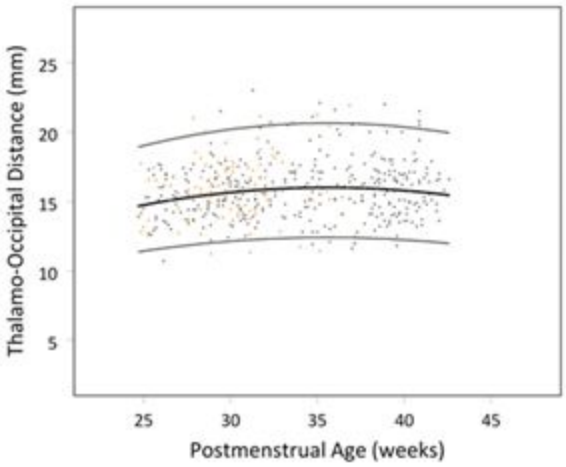
Sagittal clips
- Midline through right side
- Midline through left side

INTRACRANIAL HEMORRHAGE, Grade III or Grade IV
- Thalamo-occipital distance (TOD) on each side
  - Measure TOD (distance between the outermost point of the thalamus at its junction with the choroid plexus and the outermost part of the occipital horn in the parasagittal plane) on sagittal image on each side twice.
- Ventricular Index (VI) on each side
  - Measure from the midline to the farthest lateral border of the anterior horn of the lateral ventricle on coronal image twice on each side
- Anterior Horn Width (AHW) on each side
  - Measure width of anterior horn at widest point from medial wall to floor of lateral ventricle on coronal image twice on each side
- Report technically best TOD, WI, and AHW for right and left sides

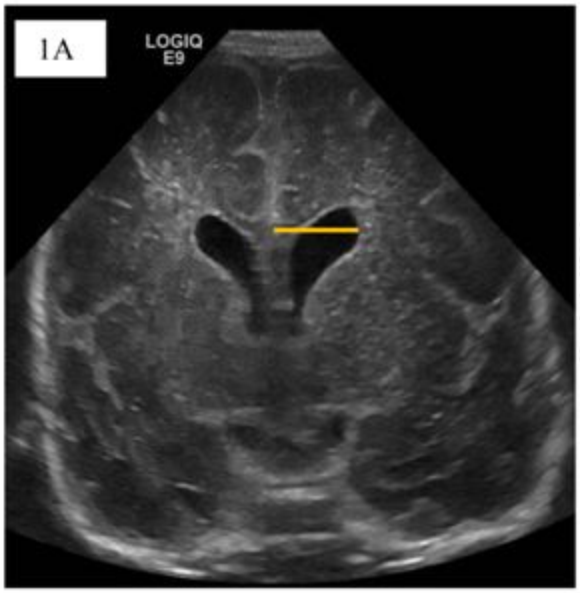
DOPPLER (if requested) *be performed as the first images of the study, before other images are obtained*
- Baseline: use light contact with surface of anterior fontanelle; take 3 sagittal images of the pericallosal artery with Color and spectral Doppler with RI measured
- Compression: apply moderate pressure to anterior fontanelle; take 3 sagittal images of the pericallosal artery with Color and spectral Doppler with RI measured
- Abnormal baseline: RI $\geq$ 0.85
- Abnormal compliance:
  - i) increase in RI from baseline to compression by > 20% of baseline RI
    (compression RI - baseline RI)/baseline RI
  - ii) absent or reversed end diastolic flow with compression

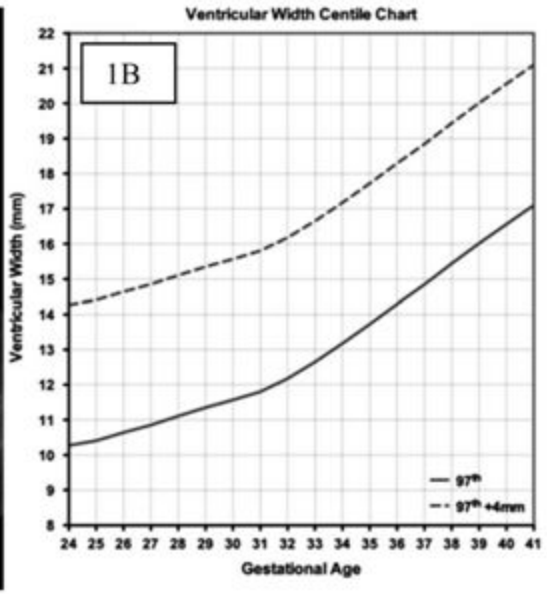
Thalamo-Occipital Distance



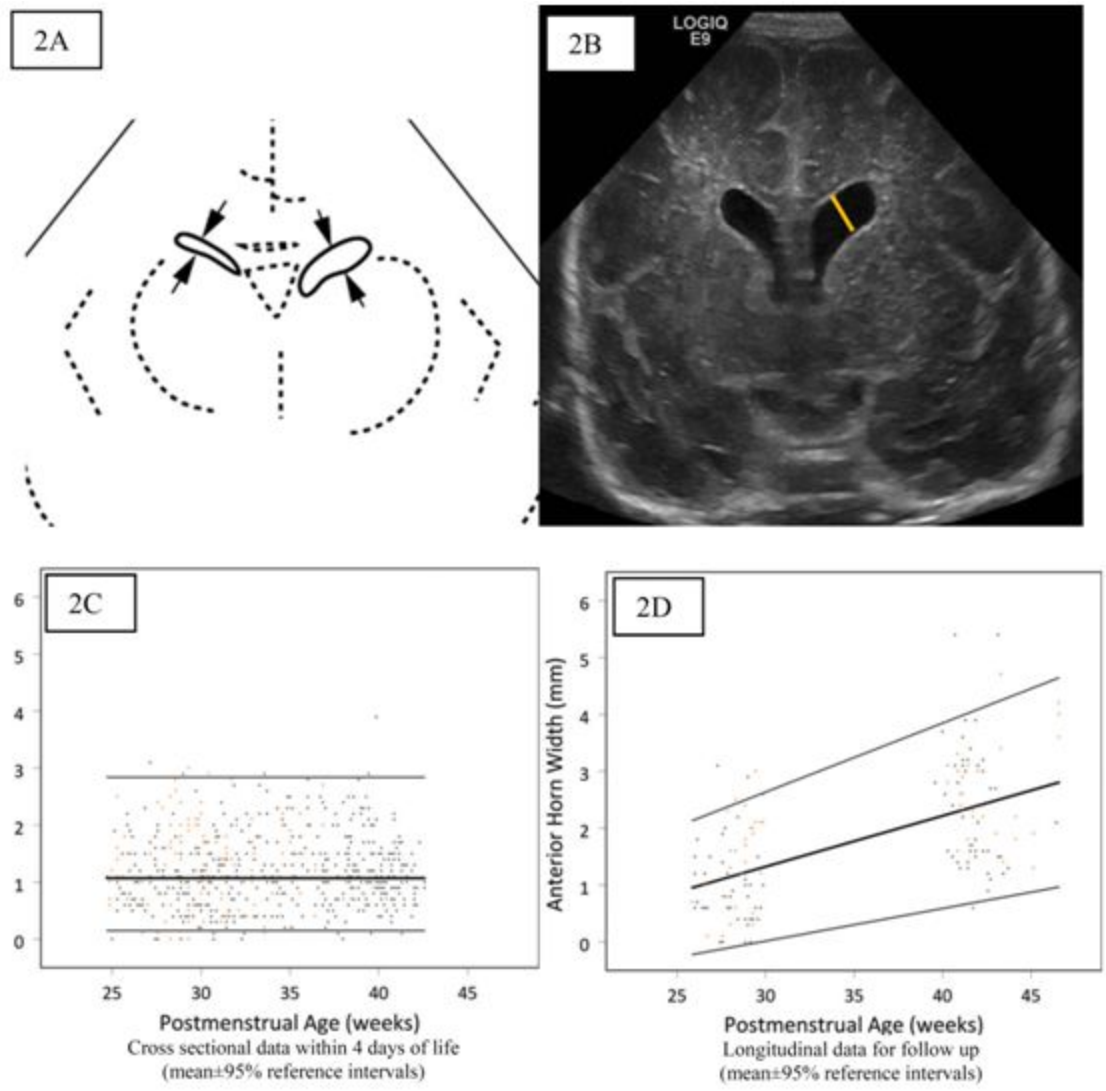


Ventricular Index





Ventricular Index



References:

Boyle M, Shim R, Gnanasekaran R, et al. Inclusion of extremes of prematurity in ventricular index centile charts. J Perinatol 2015;35(6):439-443

Brouwer MJ, de Vries LS, Groenendaal F, Koopman C, Pistorius LR, Mulder EJH, Benders MJNL. New reference values for the neonatal cerebral ventricles. Radiology 2012; 262:224-233

Davies MW, Swaminathan M, Chuang SL, Betheras FR. Reference ranges for the linear dimensions of the intracranial ventricles in preterm neonates. Archives of Disease in Childhood: Fetal and Neonatal Edition 2000;82(3):F218-F223

THYROID PROTOCOL

Thyroid gland
- Long axis view of right and left lobe
  - measure length and anterior-posterior dimension of each lobe
- Transverse views of each lobe to include:
  - upper pole
  - mid pole
  - lower pole
  - measure lobe transversely
- Nodules should be measured in three dimensions (see below)

Lymph nodes
- Assess all neck lymph nodes inferior to the submandibular gland

Reporting of ultrasound findings:
- Nodules should be listed on each side from superior to inferior, anterior to posterior.

- Each thyroid lobe and the isthmus are considered separately. In each area, all nodules measuring ≥ 10 mm in one dimension should be individually listed. In lobes with zero or one nodule ≥ 10 mm and other smaller nodules, individually report only one (the largest) nodule measuring 5-9 mm. With two or more nodules measuring ≥ 10 mm in one dimension, no nodules measuring 5-9 mm need to be reported individually. All other nodules measuring < 10 mm should be reported under the category "Nodule(s) 5-9 mm…" or under the category of "Nodule(s) < 5 mm…", as appropriate. (See Table below)

- For each nodule measuring ≥ 10 mm in one dimension, list size, location, and sonographic characteristics from each of the 5 sections: composition, calcifications, echogenicity (if <50% cystic), margins, & vascularity.
  - Taller than wide should be selected when the AP dimension is larger than the transverse dimension.
  - A "spongiform nodule" is one that is >50% cystic with small cystic spaces involving the entire nodule.
  - Echogenicity for nodules <50% cystic should be compared with the surrounding thyroid parenchyma and reported as "markedly hypoechoic", "hypoechoic", "isoechoic", or "hyperechoic".
  - Vascularity should be assessed for flow encircling the nodule and reported as "peripheral flow" when flow encircles at least 25% of the nodule. In addition, nodule vascularity should also be compared to the surrounding thyroid parenchyma and reported as "no internal flow", "minimal internal flow" if it is the same or less vascular, "moderate internal flow" if it is slightly more vascular, and "extensive internal flow" if the nodule is much more vascular.

- For nodules <10 mm listed individually, size, location, composition (cystic vs. solid), and type of calcifications, if present, should be reported.

- On follow-up scans of nodules biopsied on a prior visit, select the comment "Previously biopsied".

- When a patient has a thyroid nodule biopsy, but does not have a full thyroid ultrasound, the biopsied nodule should be listed in the report with the same number (e.g., Right Nodule 2) as on the last full ultrasound.

- Individual lymph nodes should be listed in the report with their size and location (e.g., lateral to the jugular vein, high, mid, or low) if they are enlarged (≥ 7 mm in short-axis [transverse or AP] dimension) or appear sonographically abnormal (whether or not the patient has had thyroid cancer). In the absence of lymph nodes ≥ 7 mm in short-axis dimension or lymph nodes with abnormal architecture, the report should state

"No enlarged lymph nodes seen." Enlarged, benign appearing lymph nodes should be listed in the body of the report, but not in the Impression.

Report Sonographic Findings for Nodules Based on Largest Dimension (repeat for each area of the gland)

	No nodules ≥ 10 mm	1 nodule ≥ 10 mm	2 nodules ≥ 10 mm
Report of nodules ≥ 10 mm		Report all nodules ≥ 10 mm individually	Report all nodules ≥ 10 mm individually
Report of nodules 5-9 mm	Report the largest one individually Report the others under "Nodule(s) 5-9 mm…"	Report the largest one individually Report the others under "Nodule(s) 5-9 mm…"	Report under "Nodule(s) 5-9 mm…"
Report of nodules <5 mm	Report under "Nodule(s) <5 mm…"	Report under "Nodule(s) <5 mm…"	Report under "Nodule(s) <5 mm…"

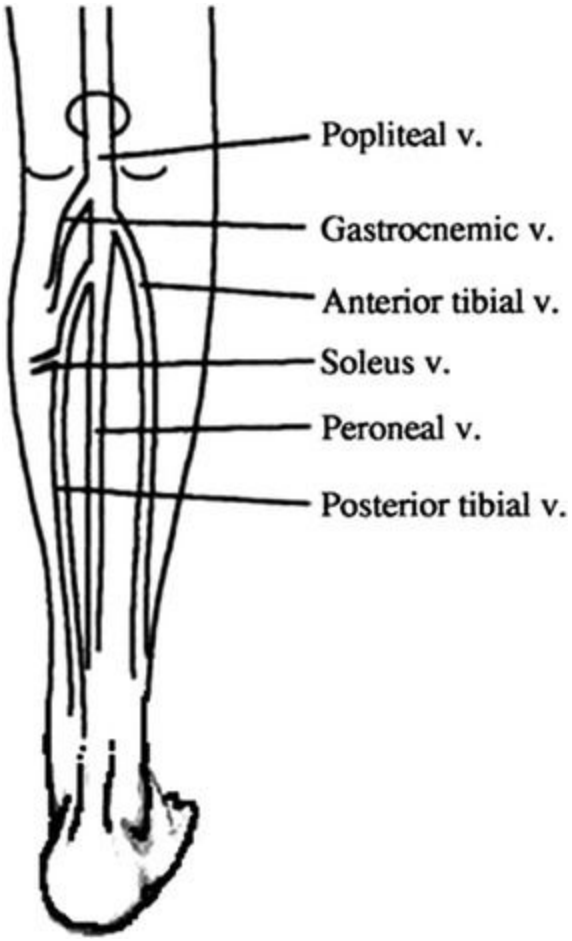
LOWER EXTREMITY VENOUS ULTRASOUND PROTOCOL

For both legs, the following veins should be evaluated with
- Transverse compression view with clips
- Color Doppler
- Spectral waveform with respiratory variation
- Spectral waveform demonstrating augmentation with calf compression:

Common femoral vein (groin)
Femoral vein (medial thigh)
- Proximal
- Mid
- Distal

Popliteal vein (behind knee)

For symptomatic leg or both legs if neither or both legs are symptomatic, the following veins should be evaluated to mid calf with compression, transverse clips:
- Gastrocnemius veins (Muscular)
- Posterior tibial veins (paired with artery, two veins per artery)
- Peroneal veins (paired with artery, two veins per artery)



Appendix B

Goals and Objectives for Residents on Ultrasound Rotations
Brigham and Women's Hospital

A complete list of Goals and Objectives for each year can be found on New Innovations: www.new-innov.com

Schedule of rotations

1. First year	7 weeks*
2. Second year	3 weeks*
3. Fourth year elective	2-4 weeks

*A resident may miss a maximum of 1 week from the 10 required weeks.

1. First year, initial 7 week rotation

Knowledge Base
- Learn basic principles of ultrasound; understand how to apply these principles to optimize image quality
- Recognize normal anatomy
- Recognize common pathologic entities

Scanning skills

First week, paired with sonographer
- How to hold transducer
- Appropriate choice of transducer
- Machine and keyboard: labeling, gain settings, frequency selection, calipers
- Scan with supervision: abdomen, pelvis, early OB

Second week, paired with sonographer
- Abdomen: concentrate on gallbladder and kidneys
- Pelvic: concentrate on transvaginal scanning
- Obstetrical: transvaginal for early pregnancy, measurements, M-mode, amniotic fluid volume

Third week, paired with sonographer
- Abdomen: liver, biliary tree, pancreas, spleen, aorta, inferior vena cava
- Obstetrical: basic fetal anatomy, biophysical profiles
- Scrotum
- Mark for taps: ascites, pleural effusion

Fourth through seventh week, scanning alone
- Obstetrical including transvaginal scanning: first trimester confirmation of pregnancy, and cervical and placental evaluation, fetal anatomy
- Pelvic ultrasound including transvaginal scanning, for assessment of endometrium and ovaries
- Gallbladder, biliary tree, liver
- Kidneys
- Scrotum
- Thyroid
- Upper and lower extremity venous: spend 2 days in the vascular lab
- Doppler, color and spectral: indications and techniques

Other

UltraSTAR
OBUS
Epic: begin, end, complete with appropriate exam code
Folder and report management
Transport of inpatients
Transducer, machine, and room functions and maintenance, including: converting exam table for vaginal studies, disinfecting and cleaning transducers, disconnecting and reconnecting machine for portable exams

2. Third year (3 weeks)

Reinforce scanning skills

Add

Fetal echocardiography
Neonatal head and abdomen
Hepatic Doppler
Renal Doppler
Mark for thoracentesis and paracentesis

One week in High Risk Obstetrical Ultrasound unit

3. Fourth year elective (2-4 weeks)/ Mini-fellowship

Rotation can be taken in High Risk OB, vascular lab, and/or L1
Volume of cases should increase
Hone scanning skills and diagnostic ability
Participate in and observe procedures performed by radiologists: paracentesis, thoracentesis, intraoperative cases, renal biopsy, thyroid biopsy
One day per week, typically Thursday, the resident is not assigned to a room, but rather follows the attendings into rooms to see interesting or unusual cases ("pseudocheck" day).
Present morning conference weekly

Required Readings for Residents on Ultrasound

(average of 3 chapters per week, books available to borrow from Paula, x26280)

First Year:

Read introductory packet ASAP including

ACR Appropriateness Criteria: Abnormal Vaginal Bleeding & Acute Pelvic Pain

SRU -- Diagnostic Criteria for Nonviable Pregnancy in the Early 1st Trimester

Start with:

Gyn

Normal Anatomy of the Female Pelvis	Callen Chapter 26
Uterus	Callen Chapter 27
Abnormal bleeding	Callen Chapter 28
Ovaries	Callen Chapter 30
Management of asymptomatic ovarian and other adnexal cysts imaged at US	Levine 2010

Follow in any order with:

Abdomen

Liver	US Requisites Chapter 3
Biliary Tree	US Requisites Chapters 2,4
Renal/ GU	US Requisites Chapter 5
Pancreas	US Requisites Chapter 7
Spleen	US Requisites Chapter 8
Appendix	Rumack pages 303-306

Obstetrics

First Trimester	Callen Chapter 6
Diagnostic Criteria for Nonviable Pregnancy Early in the First Trimester	Doubilet 2013
Fetal Measurements and Growth	Rumack Chapter 45
Biophysical Profile	Callen pages 780-784
Ectopic Pregnancy	Callen Chapter 32
Cervix	Callen pages 698-708
Placenta	Callen pages 721-744
Fetal Anatomy: Normal, CNS, GI, GU	Callen Chapter 9,10,15,16

Small Parts

Scrotum	US Requisites Chapter 6

Vascular

Deep Vein Thrombosis	Rumack Chapter 29

Third Year Rotation (any order)

Fetal Anatomy: Thorax	Callen Chapters 13
Fetal Anatomy: Heart	Rumack Chapter 40
Artifacts, Pitfalls, and Normal Variants	Callen Chapter 35
Thyroid and Parathyroid	Rumack Chapter 21 and 22 *OR* US Requisites Chapter 10
SRU: Management of thyroid nodules detected at US	Frates 2005
Carotid Doppler	Rumack Chapter 27
Neonatal Heads	Rumack Chapter 51

Fourth Year Vascular Electives

Introduction to Vascular Sonography	Zwiebel and Pellerito
Remaining OB	Callen

Recommended Reading

Primary texts:

Callen PW. Ultrasound in Obstetrics and Gynecology, 5th edition. Philadelphia: Saunders, 2007. ISBN 1416032649. $134.00

Kurtz AB, Middleton WD. Ultrasound: The Requisites, 2nd edition. St Louis: Mosby, 2004. ISBN 0323017029. $102.00

Rumak CM, Wilson SR, Charboneau JW, Levine D. Diagnostic Ultrasound, 4th edition. St Louis: Mosby, 2011. ISBN-13: 978-0323053976

Other texts:

Bluth EI, Benson CB, Ralls PW, Siegel MJ. Ultrasound, a Practical Approach to Clinical Problems. New York City: Thieme Publishers, 2007. ISBN: 9781588904058

Doubilet PM, Benson CB. Atlas of Ultrasound in Obstetrics and Gynecology, A Multimedia Reference. Philadelphia, Wolters Kluwer Health, 2012. ISBN-13: 9781451153651

Kremkau FW. Diagnostic Ultrasound: Principles, Instruments, and Exercises, 8th ed. Philadelphia: W B Saunders, 2010. ISBN-13: 978-1437709803

Nyberg DA, McGahan JP, Pretorius DH, Pilu G, eds. Diagnostic Imaging of Fetal Anomalies. Philadelphia, Lippincott Williams & Wilkins, 2002. IBSN 0781732115, $225

Pellerito J, Polak JF. Introduction to Vascular Ultrasonography: Expert Consult - Online and Print, 6e (Zwiebel, Introduction of Vascular Ultrasonography). Philadelphia:W. B. Saunders 2012: ISBN-13: 978-1437714173

Orientation Sheet For Residents And Fellows

I. All Trainees:

- Link to online trainee schedule: **http://tinyurl.com/2016-2017UStrainees**
- and overview of how to read it
- Link to Ultrasound Policies and Protocols: http://tinyurl.com/US-Protocols-Policies
- How to read the Protocols and Policies
- Slots in reading room to leave items (although security not guaranteed)
- Food may be left in the refrigerator. Anything left after Friday without a name label and date will be thrown out
- Coats and bags can be left on the hooks and shelf by the entryway. Do not leave anything in that area over the weekend. Security is not guaranteed ever.
- Computers: Partners PCs are reserved for specific MDs at specific times and should not be used by trainees. E and W stations: 8a-5p; L9a-6p; Endocrinology TC session, Renal/Aiello mornings; Coordinator 7a-6p. IMacs may be used to access email (www.partners.org/email). Do not use imaging workstations to access the web.
- Interactions with staff: Role of coordinator; role of training sonographer
- Hours: 8a-5p. Residents off for conference noon-2p. Fellows off for lunch noon-12:45p except for Grand Rounds, when they return at 1p.
- Absences: if you need to leave the department any time during the hours above, inform the coordinator. If you need to miss a day for vacation, meeting, sickness, inform the coordinator (by phone) and Carol Benson and Mary Frates by email.
- Update UltraSTAR password
- Morning conference runs 8-8:30a. On some days, the fellow is assigned to give conference. Refer to the online schedule
- End of the day: do not take a late case (after 4:30p) without checking with the coordinator and L radiologist.
- Training with sonographers and scan times – 20 minutes
- Be sure to add your name to the report in UltraSTAR
- Red sheet to be attached to the front of the paperwork indicating the case was done with a trainee

II. First Year Residents

- Specifics of training with sonographers, then scanning on their own
- Goals for each week
- How to read the schedule
- Scan with Sonologist Assistant (Susan Stober or Mara Giovani) one day the first week

- Reading list
- Books and articles available to sign out from Paula
- Meet with Mary Frates (or Carol Benson) at halfway point to review progress and check case count
- OSCE: closed book, pick up from Paula on Monday of last week, arrange time to review the test with Carol Benson (or Mary Frates) at the end of the last week.
- Of the 10 total weeks of ultrasound (1st and 3rd year), only 1 week of time may be taken for vacation or meetings.

III. Third Year Residents

- Specifics of training with sonographer then scanning on their own
- Goals for each week
- How to read the schedule
- One week in High Risk scanning, a few days for neonatal heads
- Reading list
- Books available to sign out from Paula
- OSCE: closed book, pick up from Paula on Monday of last week, arrange time to review the test with Carol Benson (or Mary Frates) at the end of the last week.

IV. Fellows

- Specifics of training with sonographer then scanning on their own
- Tuesday and Wednesday morning conference assignments
- How to read the schedule
- Accompany Sonologist Assistant and radiologist on OR cases
- Research opportunities
- Women's Imaging Fellows to High Risk
- Abdominal Imaging Fellows: schedule interim meeting after 3 weeks for feedback and to discuss the rest of the rotation