Kofinas Perinatal

Providing Care to the Unborn ®

Alexander D. Kofinas, MD

Director, Kofinas Perinatal

Associate Professor, Clinical Obstetrics and Gynecology

Cornell University, College of Medicine

Obstetrical & Gynecological Ultrasound Imaging Protocol

Each study performed will be documented in the following ways:

1. Due to the uncertainty of the life expectancy of magnetic tapes, permanent documentation of the studies should be obtained by means of digital image storage.
   1.1. Images are captured directly from the ultrasound machine and archived in digital form via DICOM server on the main server.
2. Paper will be used only as a temporary means for entrance in the computer terminal.
3. The following guidelines will be followed for proper documentation of all studies as appropriate:

First trimester imaging

4. Maternal anatomy
   4.1. Cervix in mid-sagital view.
   4.2. Uterine corpus in mid-sagital and coronal views (document uterine position and any pathology noted).
   4.3. Adnexa (document normal ovaries or any pathology). Measurements of normal and pathologic ovaries should be obtained.
   4.4. Color Doppler, power Doppler and PW Doppler should be used for the uterine and adnexal vasculature as indicated.
5. Pregnancy specific findings
   5.1. Document number of gestational sacs and their location (document intrauterine sac location).
   5.2. Placental location if discernible – especially in multiple gestations.
   5.3. Pregnancy viability (document heart rate by means of Doppler or M-mode recording.

5.4. The presence or absence of yolk sac and quality (translucent or opaque) should be documented.

5.5. Between 9 and 13 weeks gestation, look for fetal anatomy and document the presence or absence of hydro-thorax and other major anatomical structures (cranium, heart, kidneys, abdominal wall and extremities).

5.6. Obtain crown-ramp length for gestational age. The fetus should be transected in a mid-sagital plane. (Appears as a letter "C"). Avoid measurements when the fetus appears extended or hyper-flexed.

5.7. Document two feet and two hands

5.8. Document any fetal structural defects noted.

A minimum of 10 pictures should be obtained in every 1st trimester ultrasound for proper documentation. More pictures have to be obtained as necessary in case of any abnormal findings.

Second trimester for anatomical evaluation (Targeted imaging)

6. Maternal anatomy

6.1. All patients undergoing second trimester US regardless of the indication should have cervical evaluation abdominally. If indicated vaginal exam should be performed in mid-sagital view (measure length, evaluate for funneling, evaluate membrane position in patients with funneling)

6.2. Adnexa to be evaluated abdominally. Any pathology to be documented.

6.3. Uterine body (corpus) pathology to be documented. The presence of leiomyomata should be documented and their location in relation to the placenta.(sub-placental or away from the placental site and in relation to the cervix).

7. Pregnancy related findings

7.1. Fetal number and viability.

7.2. Amniotic fluid assessment (subjective volume assessment and AFI).

7.3. Fetal presentation.

7.4. Placenta location (previa or not and laterality).

7.5. Placental parenchyma evaluation (degenerative changes, abnormal thickness, villous edema, etc.).

7.6. Fetal biometry for gestational age and fetal growth evaluation (BPD, OFD, HC, AC, FL). Generate computerized growth evaluation by means of Clicks ™ . In twin

gestations, note the degree of twin-twin discordance. Discordance of >20 % should be noted.

8. Fetal anatomy.
   - 8.1. Fetal head (CNS).
   - 8.2. Fetal face (orbital anatomy, mouth, nose, chin, and forehead)
   - 8.3. Neck and spinal cord evaluation (coronal, sagital, and cross section views).
   - 8.4. Chest evaluation (Four chamber view, short axis view great vessels, and long axis view great vessels, cardiac size, and position of the heart in the thorax)
   - 8.5. Evaluate lungs for lesions and evidence of pleural effusion, and the diaphragm to r/o diaphragmatic hernia. Pay attention to r/o the presence of any intra-abdominal organs in the chest cavity.
   - 8.6. Abdomen (abdominal wall defects, situs, GI echogenicity, kidneys, bladder, spleen and liver). Document cord insertion site, number of cord vessels, fetal stomach and fetal bladder function.
   - 8.7. Document the presence of normal extremities (upper and lower). Evaluate for hand abnormalities (syndactyly etc.) and foot abnormalities (club foot etc.). Number of fingers and toes should be noted and counted.
   - 8.8. Genital should be evaluated for gross genital abnormalities. Gender to be recorded when medically indicated.

Second trimester for growth evaluation

9. Maternal anatomy
   - 9.1. All patients undergoing second trimester US regardless of the indication should have cervical evaluation abdominally. If indicated vaginal exam should be performed in mid-sagital view (measure length, evaluate for funneling, evaluate membrane position in patients with funneling)
   - 9.2. Adnexa to be evaluated abdominally. Any pathology to be documented.
   - 9.3. Uterine body (corpus) pathology to be documented. The presence of leiomyomata should be documented and their location in relation to the placenta. (sub-placental or away from the placental site).
10. Pregnancy related findings
    - 10.1. Fetal number and viability.
    - 10.2. Amniotic fluid assessment (subjective volume assessment and AFI).

10.3. Fetal presentation.

10.4. Placenta location (previa or not and laterality).

10.5. Placental parenchyma evaluation (Gross thrombotic lesions, abnormal IVS flow patterns, fetal chorionic villi degeneration and fetal thrombotic vasculopathy, abnormal thickness, villous edema, etc.).

10.5.1. All thrombotic lesions should be measured in the two largest dimensions and the average of the two measurements added for the total thrombotic size number.

10.6. Fetal biometry for gestational age and fetal growth evaluation (BPD, OFD, HC, AC, FL). Generate computerized growth evaluation by means of Clicks ™ . In twin gestations; note the degree of twin-twin discordance. Discordance of >20 % should be noted.

11. Fetal anatomy (in the absence of a previous targeted study, attempt to complete as many as possible of the items below – if a recent previous study is available there is no need to repeat the documentation although an effort should be made to examine all anatomical structures)

11.1. Fetal head (CNS).

11.2. Fetal face (orbital anatomy, mouth, nose, chin, and forehead)

11.3. Neck and spinal cord evaluation (coronal, sagital, and cross section views).

11.4. Chest evaluation (Four-chamber view, short axis view great vessels, and long axis view great vessels.

11.5. Evaluate lungs for lesions and evidence of pleural effusion, and the diaphragm to r/o diaphragmatic hernia.

11.6. Abdomen (abdominal wall defects, situs, GI echogenicity, kidneys, bladder, spleen and liver). Document cord insertion site, number of cord vessels, fetal stomach and fetal bladder function.

11.7. Document the presence of normal extremities (upper and lower). Evaluate for hand abnormalities (syndactyly etc.) and foot abnormalities (club foot etc.). Number of fingers and toes should be noted and counted.

11.8. Genital should be evaluated for gross genital abnormalities. Gender to be recorded when medically indicated.

Third trimester for growth evaluation

12. Same as second trimester evaluation (sections 10, 11, and 12)

13. The previous report and images should be reviewed prior to the current visit in order to achieve continuity of care and maximize quality of problem solving and imaging.

14. Multiple gestations

Prior to any evaluation, previous studies should be reviewed for labeling of the fetuses. The goal is to ascertain the consistency of fetal labeling. Twin A for example should always be called twin A even though it is not the presenting twin. If need, explanation in the comments section should be furnished for proper communication.

14.1. Use the corresponding directions above for each fetus

14.2. Maternal findings as above

14.3. Particular attention should be paid regarding the fetal position for all fetuses, placental type (monoamniotic – monochorionic, diamniotic -monochorionic, and dichorionic), twin-twin discordance, and amniotic fluid volume in both fetal sacs.

15. Biophysical profile

15.1. Duration of study should be for 30 min unless the appropriate findings are evident in shorter time. The following should be seen and recorded:

15.1.1. Fetal breathing (at least 30 seconds of sustained fetal breathing). Document digitally by means of M-mode imaging of the abdominal/thoracic region or with Doppler of the fetal vessels. If the above means are not available, the cine loop may be stored.

15.1.2. At least 2 vigorous body movements (usually involving one or more major extremities).

15.1.3. Evidence of fetal tone by demonstration of extension followed by flexion in any of the extremities- finger only movement is sufficient if flexion and extension are demonstrated.

15.1.4. Amniotic fluid evaluation AFI methodology in singleton gestations and by the largest pocket for each fetus in multiple gestations.

16. Utero-placental Doppler

16.1. Umbilical artery should be visualized with gray scale or with CDI and a good quality waveform should be recorded using pulsed wave Doppler. The sampling should be obtained from a free loop between the placental and the fetal insertion sites (our normative values have been derived by this technique).

16.2. The absence of diastolic flow velocities or inverse patterns should be recorded and reported immediately while the patient is waiting in the office for further instructions from her physician.

16.3. Uterine arteries should be evaluated for the presence of diastolic notch. Uterine notch is classified as mild or severe. The notch is characterized as severe when it is present along with an abnormal S/D ratio (>2.5) and mild when the notch is present in the presence of a normal uterine artery S/D ratio (=<2.5).

17. Complete Doppler

17.1. Complete Doppler is performed when fetal hypoxia is suspected at any gestational age >24 wks. Usually, it is indicated in cases with severe IUGR or severe twin-twin discordance and any other condition that may cause fetal hypoxia (abruptio, uncontrolled IDDM, oligohydramnios, placental thrombosis, nuchal cord etc.). The following measurements should be included in the study:

17.1.1. Umbilical artery S/D ratio, RI and PI. The presence or absence of diastolic flow velocity or the presence of reverse diastolic flow velocity should be documented.

17.1.2. Uterine arteries should be evaluated as in section 16.3.

17.1.3. Middle cerebral artery (MCA) and descending aorta (DsAo) PI measurements should be obtained for the calculation of the various vascular ratios for fetal brain sparing assessment.

17.1.4. Evaluation of the inferior vena cava for presence of reverse flow (indication for increased central venous pressure and congestive right ventricular dysfunction).

17.1.5. Evaluation of ductus venosus as indicated for additional evidence of increased right ventricular pressure as evidenced with increased pulsatility in the ductus venosus Doppler waveform.

18. Fetal echocardiography

18.1. The completion of fetal echocardiography may require either or all of the following modalities:

18.1.1. 2D-echocardiography (always done)

18.1.2. M-mode echocardiography (as needed)

18.1.3. Color Doppler echocardiography (as needed)

18.1.4. Pulsed wave echocardiography (as needed)

18.2. Two dimensional echocardiography should provide the following views:

18.2.1. 4CV long axis.

18.2.2. 4CV apical.

18.2.3. Short axis view ventricles.

18.2.4. Short axis view great vessels.

18.2.5. Long axis view great vessels.

18.2.6. Aortic and ductul arches

18.2.7. Five chamber view (not absolutely necessary).

18.2.8. Evaluation for pericardial effusion.

18.2.9. Evaluation of the A-V valves, the atrial septum and foramen ovale.

18.2.10. An attempt should be made to identify the pulmonary veins entering the left atrium.

18.3. M-mode may be used to evaluate rhythm disturbances, and obtain biometric measurements.

18.4. Pulsed wave Doppler should be used to evaluate flow patterns across the major cardiac openings when indicated.

18.5. Color Doppler should be used for identification of structures and flow patterns.

19. Amniocentesis / Chorionic Villus Sampling (CVS)

19.1. Patients undergo proper ultrasonic evaluation prior to the procedure according to the indication. Either a first trimester US or 2nd trimester US is performed and documented as mentioned above.

19.2. If the patient comes only for the procedure per se, fetal viability prior to and after the procedure should be documented by means of real time 2-D imaging or Doppler or M-mode recording.

19.3. Placental location with power Doppler for identification of major uterine and placental vessels to be avoided during the procedure. This decreases the risk of the procedure by avoiding the potential of uterine/placental clots that in turn may cause uterine contractility and pregnancy loss.

19.4. Like wise, the origin of the umbilical cord should be identified with color and PW Doppler in order to minimize the risk of accidental cord injury during the procedure.

19.5. For patients undergoing CVS only, power Doppler of the placenta should be used to identify abnormal intervillous flow patterns with lack of villi. These spaces should be mapped and avoided during the CVS because other wise, the specimen will be heavily contaminated with maternal blood that clots in the tube and traps the chorionic tissue. This renders the specimen inadequate for analysis.

20. Gynecologic imaging

20.1. All patients are scanned by both, abdominal and trans-vaginal modes.

20.1.1. Abdominal imaging is necessary to be done to get a more complete idea of the pelvic and abdominal areas since vaginal sonography is limited in depth to the immediate pelvic structures and one may miss major pathology un-intentionally.

20.2. The following structures should be documented in normal or abnormal form.

20.2.1. Cervix. The length should be assessed along with any structural abnormalities, such as, Nabothian cysts, masses or any other lesions.

20.2.2. Uterine corpus. Evaluate endometrial echo (consistency and thickness)

20.2.3. Search for leiomyomata or other myometrial lesions.

20.2.4. Evaluate endometrial cavity for possible polypoid lesions.

20.2.5. Evaluate the posterior cul-de-sac for abnormal fluid.

20.2.6. Evaluate uterine position (retroverted, neutral, anteverted, and acutely anteflexed).

20.2.7. Evaluate adnexa. Document normal adnexa or any pathology.

20.3. Measurements should be obtained as follows:

20.3.1. Uterine measurements in three dimensions: anteroposterior, transverse, and longitudinal. These measurements should be obtained from views in the coronal and sagital planes.

20.3.2. Endometrial echo thickness from a mid-sagital view.

20.3.3. The ovaries and any other pathology should be measured in at least two dimensions and if large in three dimensions.

20.4. When pathology is noted to be in the cul-de-sac and effort should be made to identify its origin (adnexa or other).

20.5. Power and conventional color Doppler should be utilized for further clarification of pathology in the uterine corpus and adnexa.

20.6. I patients with recurrent early pregnancy loss and history of infertility, endometrial vascular penetration with power Doppler should be assessed. In addition, evidence of corpus luteum as well as vascularization should be assessed with color Doppler and PW Doppler when indicated.