Akron Radiology Inc.
Technique Manual
For
Ultrasonography

Version 2022b

Summa Health System
CCOC
Western Reserve Hospital
All Affiliated Imaging Centers: Green, Hudson, White Pond, Medina

Version 2012
Version 2015 – 1/2015
Version 2015b – 5/2015
Version 2015c – 8/2015
Version 2016 – 8/2016
Version 2017 – 2/2017
Version 2017b – 6/2017
Version 2018, 2019, 2020 – no changes

Table of Contents

Note - All exams have standard worksheets. See attached.

COMPLETE ABDOMEN

**Complete study includes images and reported description of:
Liver, Biliary tree, GB, Pancreas, Bilateral kidneys, Spleen, Aorta, IVC
**Limited ultrasound abdomen includes anything less than above

Liver:
Sagittal: need at least 3 gray scale images of each lobe
Right lobe - several images to include dome
Right lobe - image to include right kidney to compare echogenicity
Right lobe - measurement longitudinal at the midclavicular line
Left lobe - medial
Let lobe - lateral
Transverse: need at least 3 gray scale images of each lobe
Right lobe - several images superior to inferior
Left lobe - superior
Left lobe - inferior
Hepatic veins - show veins and confluence
Portal vein - show main and branches

Gallbladder: Complete documentation in longitudinal and transverse in two different patient positions
Supine:
Longitudinal - several images including neck
Transverse - fundus, body and neck. Document wall thickness (if > 3mm)
Left lateral decubitus:
Longitudinal - few images including neck
Transverse - fundus, body and neck
Assess for pain with imaging (Sonographic Murphy sign)

Common Hepatic Duct/Common Bile Duct:
Longitudinal - image without and with measurement at largest caliber (inner luminal caliber perpendicular to long axis)
Assess common hepatic and common bile duct with measurement of lumen

Pancreas
Complete documentation to include head, body and tail
Transverse (long axis) views of the pancreas - several views head/body/tail
Image of distal CBD at largest dimension in pancreatic head.
Pancreatic duct measurement

(Complete Abdomen – continued)
Right Kidney:
Longitudinal: at least 3 gray scale images (images without and with calipers represent 1 image)
Lateral

Mid with longitudinal measurement
Medial
Transverse: complete documentation (at least 3 gray scale images)
Mid pole with AP and transverse measurement

Left Kidney:
Longitudinal: at least 3 gray scale images (images without and with calipers represent 1 image)
Lateral
Mid with longitudinal measurement
Medial
Transverse: complete documentation (at least 3 gray scale images)
Mid pole with AP and transverse measurement

Spleen:
Longitudinal with measurement
Transverse with AP and transverse measurements

Aorta:
Sagittal upper abdominal aorta - measure transverse if greater than 3 cm (perpendicular to the lumen - outer wall to outer wall)
Longitudinal documentation – proximal, mid and distal

IVC:
Sagittal image

Assess for free fluid:
Document extent and location

*Annotate all images
*Measure all pathology sagittal, transverse and AP on consecutive images
*Included color flow image of each pathological finding

ABDOMEN LIMITED (RIGHT UPPER QUADRANT)

Liver - as above
Gallbladder - as above
CHD/CBD - as above
Pancreas - as above
Right Kidney - as above

ABDOMEN - LIMITED - OTHER

May be limited to single organ as per specific request or FAST exam of the four quadrants

ABDOMINAL SPECTRAL DOPPLER OF PORTAL SYSTEM

Document color flow and spectral Doppler waveforms in longitudinal:
Portal vein and branches and identify flow direction:
- Main PV, Right, Left
- MPV Velocity

Hepatic veins:
- Right, Middle, Left

Hepatic artery:
- Main hepatic artery
- Resistive index of main hepatic artery

Collateral veins if demonstrated
IVC
Document liver – several images in sagittal and transverse
TIPS (if present) – document portal, middle and hepatic ends with color flow, spectral Doppler

- Reminder to do Doppler measurements at 30-60 degrees

RETROPERITONEAL - COMPLETE

**Complete study includes images and reported description of either

1. Kidneys, Visualized ureters, Bladder (when urinary tract pathology suspected)

OR

2. Kidneys, Aorta, IVC, Iliac vessels

Right Kidney:
- Longitudinal:
  - Lateral
  - Mid with longitudinal measurements, include liver to compare echogenicity
  - Color image to show perfusion
  - Medial

Transverse:
Upper pole
Mid pole with AP and transverse measurement
Lower pole

Left Kidney:
Longitudinal:
Lateral
Mid with longitudinal measurements, include liver to compare echogenicity
Color image to show perfusion
Medial

Transverse:
Upper pole
Mid pole with AP and transverse measurement
Lower pole

Bladder:
Sagittal:
Right
Midline
Left
Transverse:
Upper
Mid, including color image of ureteral jets if visible
Lower
Prostate:
Measure sagittal, transverse, AP

(Retroperitoneal compete – continued)
Aorta (may be included if requested):
Sagittal - measure AP
Proximal
Mid
Distal
Transverse - measure if abnormal (outer to outer perpendicular to long axis)

IVC (may be included if requested):
Sagittal image including color

*Measure prostate sagittal, transverse, AP
*Measure cysts and stones
*If hydronephrosis present, apply color
*If hydronephrosis present show bladder jets with color flow if present
*Pre and postvoid bladder measurements at midline with calculated volumes if requested

RETROPERITONEAL - LIMITED

Limited study includes anything less than noted as #1 or #2 above

RENAL TRANSPLANT EVALUATION

- Longitudinal:
  - Lateral
  - Mid with longitudinal measurements
  - Color image to show perfusion
  - Medial
- Transverse:
  - Upper pole
  - Mid pole with AP and transverse measurement
  - Lower pole
- Doppler assessment - color flow and spectral Doppler
  - Iliac artery and vein
  - Renal artery and vein
  - Intrarenal arteries
  - Resistive index measurements
- Bladder:
  - Sagittal
  - Transverse

AORTA

Measurements taken from outer edge to outer edge

Two diameter measurements at each level are obtained and listed on worksheet

- Proximal:
  - Longitudinal without and with measurements
  - Transverse without and with measurements
- Mid:
  - Longitudinal without and with measurements
  - Transverse without and with measurements
- Distal:
  - Longitudinal without and with measurements
  - Transverse without and with measurements
- Bifurcation:
  - Transverse with measurements
  - Transverse with Color flow
- Common Iliac arteries:
  - Transverse with measurements
  - Longitudinal with and without color flow

If Aneurysm present:

- Measure outer diameter in longitudinal (outer to outer)
- Measure inner lumen diameter in transverse
- Identify renal arteries with and without color flow and spectral Doppler

PELVIS-TRANSABDOMINAL

Uterus

Sagittal and transverse views with measurements (on TA or TV). Views should include size, shape and orientation.

Endometrial measurement in a sagittal view.

Look posterior to uterus for pathology

Color flow of sagittal midline including endometrium

Cervix:

Sagittal and transverse views

Adnexa including ovaries

Sagittal and transverse views with measurements.

Color flow and Spectral Doppler arterial of ovaries (or venous if arteries not identified)

Include image of RUQ to show Morison's pouch if more than trace fluid present

PELVIS - TRANSVAGINAL

Uterus:

Sagittal and transverse views with measurements (on TA or TV). Views should include size, shape and orientation.

Endometrial measurement in a sagittal view.

Image posterior to uterus

Color flow of sagittal midline including endometrium

Cervix:

Sagittal and transverse views

Adnexa including ovaries

Sagittal and coronal views of the ovaries with measurements.
Color flow and Spectral Doppler arterial and venous.
Document prominent vessels within adnexa using color flow if present
Ovaries

- Complete documentation in longitudinal (at least 2 gray scale images, images without and with calipers represent 1 image) and complete documentation in transverse (at least 2 gray scale images, images without and with calipers represent 1 image)

OR

- Cine clips throughout both ovaries (1 longitudinal cine from side to side and 1 transverse cine from top to bottom of each ovary) **AND** at least 1 static longitudinal gray scale image and at least 1 static transverse gray scale image of each ovary (images without and with calipers represent 1 image)

PELVIS-MALE

Sagittal and transverse views of the bladder and prostate.
Measure prostate (Sag, trans, AP)
If requested: Pre and post void residual bladder views with measurements (dimensions and volume)

APPENDIX/RLQ WITH GRADED COMPRESSION

Image the area of maximum point of tenderness (patient uses one finger)
Begin imaging in the transverse plane at a level slightly higher than the umbilicus
Gradually start to compress the transducer and slowly slide it to the area of interest, imaging along the way
Show dual images of compressed and not compressed
Measure transverse (outer to outer perpendicular to long axis) (>6mm abnormal)
Show images in the sagittal plane just lateral to the gas shadow from colon with and without compression, gradually sliding toward the area of interest
Color flow images appendix and iliac artery vessels (appendix is most frequently anterior to vessel)
*May need to perform transvaginal pelvis imaging in female with RLQ pain

THYROID

Requested that technologists please import an path from prior thyroid nodule biopsy, and note if the nodule has been stable over time (ie., nodule unchanged over 5 years)

Only including nodules >=5 mm

Sagittal and transverse views of lobes with measurements at the mid level.
Transverse views of the isthmus with AP measurement.
Transverse panoramic views of both lobes if technically feasible
Sagittal panoramic views if larger than field of view if technically feasible

Nodules: (Updated based on TI-RADS categorization 2017)
Specify the following for each nodule of 7-8 mm or greater - up to 4 largest or most suspicious nodules and number each nodule on both images of accompanying worksheet. Images should be documented in split screen format (transverse and longitudinal) for measurements:

Composition:
- 1 - mixed cystic and solid
- 2 - solid

Echogenicity:
- 1 - hyperechoic or isoechoic
- 2 - hypoechoic
- 3 - very hypoechoic

Shape:
- 3 - taller than wide

Margin:
- 2 - lobulated or irregular
- 3 - extrathyroidal extension

Echogenic foci:
- 1 - macrocalcifications
- 2 - rim calcification
- 3 – microcalcifications

Measure AP x trans on axial image. Only measure sagittal on longitudinal image.
Taller-than-wide determined on axial image
Spongiform: predominantly (>50%) small cystic spaces

Spongiform and predominantly cystic nodules are TI-RADS 1
Hypoechoic is more hypoechoic than strap muscles, but is not equivalent to anechoic. Reminder hypoechoic is 3 points, anechoic is 0 points

Risk for malignancy – add all points for each nodule in all categories above:
TI-RADS 1 - 0 points - (benign) <2% risk
TI-RADS 2 - 2 points - (not suspicious) <5%
TI-RADS 3 - 3 points - (mildly suspicious) <5% - FNA >/= 2.5cm; Follow >1.5cm 1, 3 and 5 years
TI-RADS 4 - 4-6 points - (moderately suspicious) 5-20% - FNA >/=1.5cm; Follow >1cm at 1, 2, 3 and 5 years
TI-RADS 5 - 7+ points - (highly suspicious) >20% - FNA >/= 1cm; Follow >0.5cm every year for up to 5 years

Document visualized extrathyroidal findings - cervical nodes (greater than 1cm) when suspicious nodule detected or any lymph nodes with abnormal morphology (see below), other neck masses or cysts

NECK LYMPH NODE SURVEY (for papillary thyroid or head/neck carcinoma)

Document short and long dimension all lymph nodes 1 cm or greater in either dimension at the following levels on right and left as noted on worksheet

Please confirm presence or absence of fatty hilum in all nodes

Document abnormal morphology nodes (**regardless of size**) on worksheet by stating "**abnormal**" next to dimensions. These characteristics may include: loss of its reniform shape, increase in size from prior, replacement of fatty hilum, irregular margins, heterogeneous echotexture or an echotexture replicating the thyroid gland, presence of calcifications and cystic areas, and vascularity throughout the lymph node instead of normal central hilar vessels

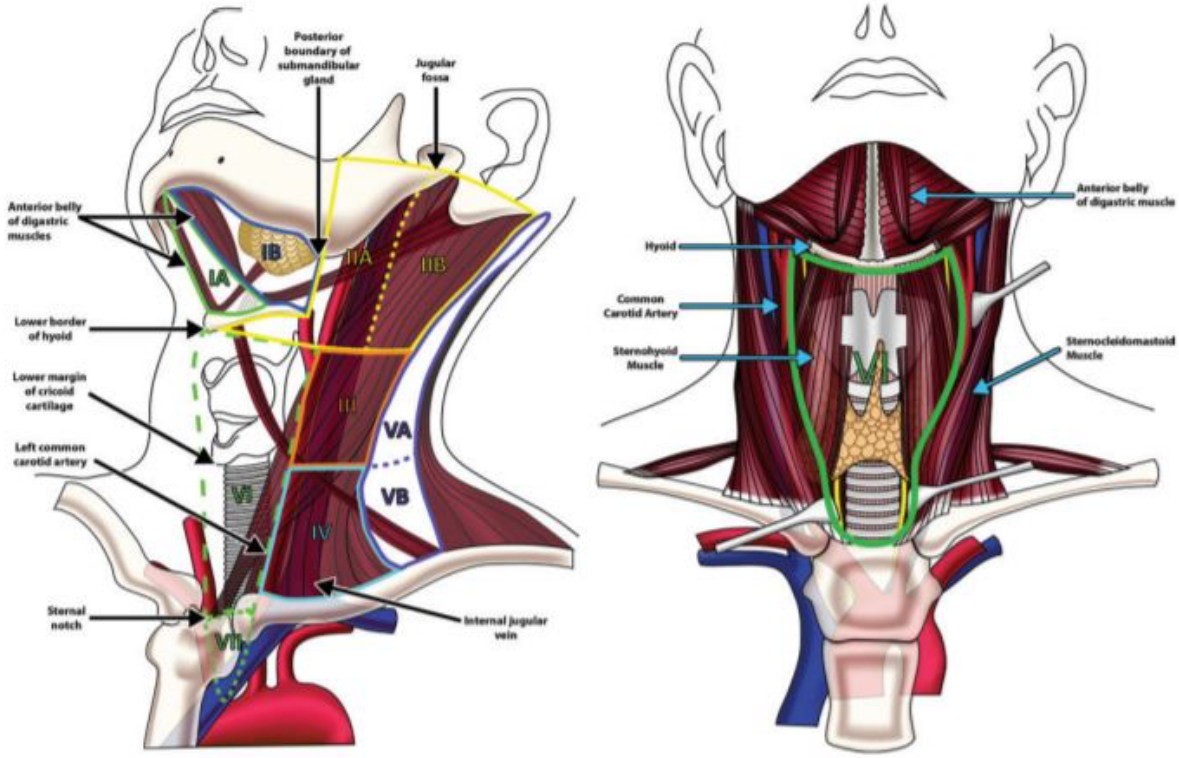
IA - Submental
IB - Submandibular
II - Anterior cervical or upper jugular
IIA or IIB - posterior margin of internal jugular vein
III - Middle jugular
IV - Lower jugular
V - Posterior compartment
VA or VB - inferior margin of cricoid
VI - Visceral or central compartment (most common site for thyroid CA mets)
VII - Superior mediastinal, Retropharyngeal, Intraparotid, Supraclavic

(see detail chart and diagrams on next page)

Table 1: Anatomic Boundaries of Cervical Lymph Node Levels I–VI

Cervical Level	Superior	Inferior	Anterior (Medial)	Posterior (Lateral)
IA	Mandible	Hyoid bone	Anterior belly of the contralateral digastric muscle	Anterior belly of the ipsilateral digastric muscle
IB	Mandible	Hyoid bone	Anterior belly of the digastric muscle	Stylohyoid muscle
IIA	Skull base	Horizontal plane of the inferior body of the hyoid bone	Stylohyoid muscle	Vertical plane of the spinal accessory nerve
IIB	Skull base	Horizontal plane of the inferior body of the hyoid bone	Vertical plane of the spinal accessory nerve	Lateral border of the SCM
III	Horizontal plane of the inferior body of the hyoid bone	Horizontal plane of the inferior border of the cricoid cartilage	Lateral border of the sternohyoid muscle	Lateral border of the SCM
IV	Horizontal plane of the inferior border of the cricoid cartilage	Clavicle	Lateral border of the sternohyoid muscle	Lateral border of the SCM
VA	Apex of the SCM and trapezius muscles	Horizontal plane of the lower border of the cricoid cartilage	Posterior border of the SCM	Anterior border of the trapezius muscle
VB	Horizontal plane of the lower border of the cricoid cartilage	Clavicle	Posterior border of the SCM	Anterior border of the trapezius muscle
VI	Hyoid bone	Suprasternal	Common carotid artery	Common carotid artery

Note.—SCM = sternocleidomastoid muscle.



SCROTUM

Testes:

Sagittal and transverse views with measurements at the mid level.
Comparison views of the testis.
Color flow and spectral Doppler of the testis at all three levels (sup, mid and inf.)

Epididymi:

Sagittal and transverse views with measurements of head
Sagittal and transverse views of body and tail when technically feasible
Color flow in sagittal for hypervascularity

Vessels:

Color flow and spectral Doppler of prominent vessels with and without Valsalva
(Note: If Right varicocele is present due to short course of gonadal vein, renal tumor should be considered and sagittal image of right kidney should be included)

Extratesticular structures:

Document fluid, masses, hernias, etc

BREAST

Document three dimensions of all lesions in AP, sagittal and transverse (or AP, radial and antiradial).
Document location of all lesions in distance from the nipple and clock face location
Color flow and spectral Doppler (if applicable) of lesions
When solid mass detected, document axillary lymph nodes

CHEST US FOR BREAST ABSCESS

*Indication: Only performed after daytime hours or on weekends specifically for emergency evaluation for breast abscess
*Patient must be referred for a complete breast US examination on the next business day
Document three dimensions of collection(s) in AP, sagittal and transverse (or AP, radial and antiradial).
Document location of collection(s) in distance from the nipple and clock face location
Color flow and spectral Doppler (if applicable)
Use Unspecified worksheet for documentation

OB-FIRST TRIMESTER

Endovaginal technique is preferred

Avoid using color flow and spectral Doppler as much as possible in early stage

Gestational sac:

AP, Long, Trans views including views with measurements

Yolk sac:

Image with and without measurement

Fetus:

Image with and without crown-rump measurement (multiple gestation - label and measure all separately e.g. twin A, twin B)

When CRL identified, gestational age is based on CRL rather than mean sac diameter

Fetal heart:

Document heart rate - M-mode Doppler

Document subchorionic hemorrhage if present

Uterus:

AP, sagittal and transverse with measurements

Ovaries:

Image and document corpus luteum cyst if identifiable

- Complete documentation in longitudinal (at least2 gray scale images, images without and with calipers represent 1 image) and complete documentation in transverse (at least 2 gray scale images, images without and with calipers represent 1 image

OR

- Cine clips through both ovaries (1 longitudinal cine from side to side and 1 transverse cine from top to bottom of each ovary) **AND** at least 1 static longitudinal gray scale image and at least 1 static transverse gray scale image of each ovary (images without and with calipers represent 1 image)

Adnexa, Free fluid, Morison's pouch - document abnormalities

OB-SECOND OR THIRD TRIMESTER

Scan using transabdominal approach. Endovaginal approach may be used for cervical assessment and placental tip location. For ED patients limit study

Cervix:

Sagittal **with measurements**

Open vs. closed,

Presence of fluid in canal

Placenta:

Sagittal and transverse views noting location and distance of tip from cervix

Fetal position

Fetal heart rate

Measure biparietal diameter

Measure head circumference

Measure abdominal circumference - at the level of the portal sinus and the liver making sure the trunk is round at the point of measurement and not ovoid

Measure femur length - showing femoral head and condyles

Measure lateral ventricles - width

Posterior fossa and cerebellum
Four chamber heart
(OB second trimester – continued)
Stomach
Cord insertion at the abdominal wall
Three vessel cord - at the level of the bladder in transverse
Kidneys - transverse and sagittal, include color flow to show renal arteries in coronal
Bladder
Spine - sagittal and transverse views
Amniotic fluid in all four quadrants

Document as much of the following fetal anatomy as possible:
hands, feet, legs, angulation of feet in relation to legs, arms, orbits, maxilla, lips, ears, nose, diaphragm, genitalia, neck/cervical spine, aortic arch, LVOT, RVOT, liver, spleen

OB-BIOPHYSICAL PROFILE

Document and assess the placenta in sagittal and transverse views noting the location
Document the fetal heart rate
Document and measure the amniotic fluid in all four quadrants with and without color Doppler
Use clip store for documentation of fetal tone, gross body movements, and fetal breathing movements

OB – LIMITED

Focused 'quick look' exam limited to the assessment of one or more of the elements listed
Note: At least one measurement should be obtained for gestational age

- Fetal heart beat
- Placental location
- Fetal position
- Qualitative amniotic fluid volume

NONSPECIFIC SOFT TISSUE

Document area of interest in sagittal and transverse views with and without color

Measure any pathology or structures of interest in 3 planes
Draw a diagram of proportionate size and location on worksheet
Document any surrounding landmarks in relationship to area of interest
Use standoff pad for superficial regions of interest

LOWER EXTREMITY - DVT

Transverse grayscale images without and with transducer compressions (when anatomically possible or not contraindicated) for assessing venous patency of the lower extremity must be documented as required by the protocol and must include at a minimum:

i. common femoral vein
ii. saphenofemoral junction
iii. proximal femoral vein (previously termed “superficial” femoral vein)
iv. mid femoral vein
v. distal femoral vein
vi. popliteal vein
vii. posterior tibial veins
viii. peroneal veins
ix. additional images to document areas of suspected thrombus

Spectral Doppler waveforms for assessing venous patency of the lower extremity showing variations with respiration and/or flow augmentation must be documented as required by the protocol and must include at a minimum:

i. right and left common femoral veins;
ii. popliteal vein;

Representative color flow images must be documented

UPPER EXTREMITY - DVT

Transverse grayscale images without and with transducer compressions (when anatomically possible or not contraindicated) for assessing venous patency of the upper extremity must be documented and include:

i. internal jugular vein
ii. subclavian vein
iii. axillary vein

iv. brachial vein(s)
v. basilic vein
vi. cephalic vein
vii. additional images to document areas of suspected thrombus

Spectral Doppler waveforms for assessing venous patency of the upper extremity showing variations with respiration and/or flow augmentation must be documented as required by the protocol and must include at a minimum:

i. internal jugular vein
ii. right and left subclavian veins
iii. axillary vein

Representative color Doppler images must be documented

PSEUDOANEURYSM POST ANGIOGRAPHY

Document sagittal and transverse, including color flow and spectral Doppler
If pseudoaneurysm present, measure maximum caliber of pseudoaneurysm and caliber of neck
If present, document hematoma and surrounding lymph nodes

UPDATES:

Version 2015:

1. Added Neck lymph node survey
2. Updated Aorta Ultrasound in regard to measurements
3. Updated Scrotal Ultrasound to include right kidney when right varicocele present

Version 2015b:

1. Add grey scale images of liver when performing spectral Doppler of portal system and document TIPS with color flow and Doppler when present
2. Breast US – document color flow and spectral Doppler of lesions, document axillary lymph nodes if breast mass is detected
3. Gestational age should be based on CRL only when identified in first trimester
4. Renal Transplant – include resistive index measurements, bladder images

Version 2015c:

1. Retroperitoneal – when hydronephrosis present document jets at ureteral insertions into bladder with color flow
2. Add – Limited OB

Version 2016:

1. Limited OB should include at least one measurement for gestational age
2. Neck lymph node survey – sonographers are encouraged to add word “abnormal” next to the dimensions of nodes when abnormal morphology is detected
3. Add – Chest US for emergency breast abscess evaluation

Version 2017a:

1. Thyroid nodules – include split screen images (transverse and longitudinal) with electronic calipers for measurements
2. Neck lymph nodes – chart and diagram included for detail of node levels.

Version 2017b:

1. Biophysical profile – do not need to measure cervix details
2. Nonspecific soft tissue – use stand-off pad for superficial regions of interest
3. Thyroid – update for TI-RADS risk stratification; Remove color flow images

Version 2018: No changes

Version 2021:

Head/neck: please confirm presence or absence of fatty hilum in all nodes

Thyroid: reminders re: measurement technique including taller-than-wide definition, very hypoechoic versus anechoic, definition and scoring of spongiform lesions. Also requested that techs import pathology from any prior nodule biopsy and make comparisons to old, prior studies

2021b:

Complete abdomen
Liver: need at least 3 gray scale images of each lobe in sagittal and transverse
Gallbladder: Complete documentation in longitudinal and transverse in two different patient positions
Pancreas: Complete documentation to include head, body and tail
Kidneys:

- Longitudinal: at least 3 gray scale images (images without and with calipers represent 1 image)
- Transverse: complete documentation (at least 3 gray scale images)

Aorta: Longitudinal documentation – proximal, mid and distal

Female pelvis:
Ovaries:

- Complete documentation in longitudinal (at least 2 gray scale images [images without and with calipers represent 1 image]) & complete documentation in transverse (at least 2 gray scale images)

OR

- Cine clips through both ovaries (1 longitudinal cine from side to side + 1 transverse cine from top to bottom of each ovary) **AND** at least 1 static longitudinal gray scale + at least 1 static transverse gray scale image of each ovary

First trimester
Ovaries:

- Complete documentation in longitudinal (at least 2 gray scale images [images without and with calipers represent 1 image]) & complete documentation in transverse (at least 2 gray scale images)

OR

- Cine clips through both ovaries (1 longitudinal cine from side to side + 1 transverse cine from top to bottom of each ovary) **AND** at least 1 static longitudinal gray scale + at least 1 static transverse gray scale image of each ovary