SOUND DIAGNOSTICS
OF NORTHWEST FLORIDA

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SOUND DIAGNOSTICS

OF

NORTHWEST FLORIDA

ULTRASOUND EXAM

SCANNING PROTOCOL

DOCUMENTATION:

Adequate documentation is essential for high-quality patient care. Images of all appropriate areas, both normal and abnormal, are to be recorded in an appropriate format. Variations from normal size are to be accompanied by measurements.

The Demographic Page MUST include:

- **Patient's name and other identifying information**
- **Facility identifying information**
- **Date the exam is completed**
- **Image orientation when appropriate**

A worksheet MUST be utilized and retained; documentation should include:

- **Patient's name and other identifying information**
- **Date of the ultrasound examination**
- **Relevant clinical information and/or ICD 10 Code**
- **Specific ultrasound examination requested**
- **Name of patient's health care provider and contact information as appropriate**

ABDOMEN AND/OR RETROPERITONEUM

A. Abdomen

1. Liver

The examination of the liver should include long-axis and transverse views. The liver parenchyma should be evaluated for focal and/or diffuse abnormalities. If possible, the echogenicity of the liver should be compared with that of the right kidney. In addition, the following should be imaged:

a. **The major vessels in the region of the liver, including the Inferior Vena Cava (IVC), the hepatic veins, the main portal vein, and, if possible, the right and left branches of the portal vein.**

b. **The hepatic lobes (Right, Left, and Caudate) and, if possible, the Right Hemidiaphragm and the adjacent pleural space.**

c. **For vascular examinations of the native or transplanted liver, doppler evaluation should be used to document blood flow characteristics and blood flow direction. The structures that may be examined include the hepatic arteries, hepatic veins, portal veins, the intrahepatic portion of the IVC, collateral venous pathways, and transjugular intrahepatic portosystemic shunt stents.**

2. Gallbladder and Biliary Tract

The gallbladder evaluation should include long-axis and transverse views obtained in the supine position; other positions, such as the left lateral decubitus, erect, and prone positions, may be necessary to evaluate the gallbladder and the surrounding area completely, particularly when stones and/or sludge are observed. Measurements may aid in determining gallbladder wall thickening. If the patient presents with pain, tenderness to transducer compression should be assessed.

The intrahepatic ducts can be evaluated by obtaining views of the liver demonstrating the right and left branches of the portal vein. Doppler imaging may be used to differentiate hepatic arteries and portal veins from bile ducts. The intrahepatic and extrahepatic bile ducts should be evaluated for dilatation, wall thickening, intraluminal findings, and other abnormalities. The size of the bile duct in the porta hepatis should be documented. When visualized, the distal common bile duct in the pancreatic head should be evaluated.

A routine gallbladder examination should be conducted on an adequately distended gallbladder. In most cases, fasting for 8 hours before the examination shall permit adequate distention of a normally functioning gallbladder in adults and children.

3. Pancreas

Whenever possible, all portions of the pancreas – head, uncinate process, body, and tail – should be identified. Orally administered contrast or water may afford better visualization of the pancreas. The following should be assessed in the examination of the pancreas:

a. Parenchymal Abnormalities.

b. The distal common bile duct in the region of the pancreatic head.

c. The pancreatic duct for dilatation and any other abnormalities, with dilatation confirmed by measurement.

c. The peripancreatic region for adenopathy and/or fluid.

4. Spleen

Representative views of the spleen in long-axis and transverse projections should be obtained. Doppler imaging may be used to determine the presence and direction of flow in the splenic vein and artery. Splenic measurement may be helpful in assessing enlargement. Echogenecity of the left kidney should be compared to splenic echogenicity when possible. An attempt should be made to demonstrate the left hemidiaphragm and the adjacent pleural space.

5. Peritoneal Fluid

Evaluation for free or loculated peritoneal fluid should include documentation of the extent and location of any fluid identified. Longitudinal and transverse plane images should be obtained.

6. Abdominal Wall

The examination should include images of the abdominal wall in the location of symptoms or signs. The relationship of any identified mass to the peritoneum should be demonstrated. Any defect in the peritoneum and abdominal wall musculature should be documented. The presence or absence of bowel, fluid, or other tissue contained within any abdominal wall defect should be noted. A Doppler Examination may be useful to define the relationship of blood vessels to a detected mass.

B. Retroperitoneum

1. Kidneys

The examination should include long-axis and transverse views of the upper poles, midportions, and lower poles of the kidneys. The renal cortex and renal pelvises should be assessed. A maximum measurement of renal length should be recorded for both kidneys. When possible, renal echogenicity should be compared to the echogenicity of the adjacent liver or spleen. The kidneys and perirenal regions should be assessed for abnormalities.

For vascular examination of the kidneys, Doppler Imaging is to be used.

a. **To assess renal arterial and venous patency.**

b. **To evaluate adults suspected of having renal artery stenosis. For this application, single-adjusted measurements of the peak systolic velocity should be made proximally, centrally, and distally in the extrarenal portion of the main renal arteries when possible. The peak systolic velocity of the adjacent aorta (or iliac artery in transplanted kidneys) should also be documented for calculating the ratio of renal to aortic peak systolic velocity. Spectral Doppler evaluation of the intrarenal arteries from the upper to lower portions of the kidneys, obtained to evaluate the early systolic peak, may be of value as indirect evidence of proximal stenosis in the main renal artery.**

2. Adrenal Glands

The adrenal glands are infrequently visualized in adults. When visualized, the size of the gland should be documented, as well as the presence of hemorrhage, masses, or other abnormalities.

3. Urinary Bladder and Adjacent Structures

When performing a complete ultrasound evaluation of the urinary tract, transverse and longitudinal images of the distended urinary bladder and its wall should be included, if possible. Bladder lumen or wall abnormalities should be noted. Dilatation or other distal ureteral abnormalities should be documented. Longitudinal and transverse scans are to be used to demonstrate any postvoid residual. This is to be quantitated and documented.

4. Inferior Vena Cava

Longitudinal and transverse images of the IVC should be obtained. Patency and abnormalities may be evaluated with Doppler Imaging. Vena Cava filters, interruption devices, or catheters may need to be localized with respect to the renal and/or hepatic veins.

5. Aorta

1. Abdominal Aorta

a. Longitudinal images without and with anteroposterior (AP) measurements:
- **i. Proximal (near diaphragm)**
- **ii. Mid**
- **iii. Distal**

b. Transverse images without and with measurements:

i. **Proximal (near diaphragm)**
ii. **Mid**
iii. **Distal**

2. Common iliac Arteries

a. Longitudinal images without and with anteroposterior (AP) measurements of the proximal right and left common iliac arteries at the bifurcation.

b. Transverse images of proximal common iliac arteries without and with measurements at the bifurcation.

3. Color Doppler Imaging

Color Doppler Imaging and/or Spectral Doppler Imaging with waveform analysis, as indicated. This portion of the exam is critical when assessing patients who have had placement of an endoluminal graft.

4. Documentation of a mural thrombus, if present

All measurements are made from outer wall to outer wall perpendicular to the long axis of the aorta. If an aneurysm is seen, the maximal AP Diameter should be recorded. The transverse diameter is also to be measured when the margins of the aneurysm are clearly seen. The relationship of the dilated segment to the renal arteries should also be determined if possible.

BREAST EXAMINATION

1. **The breast sonogram should be correlated with mammographic and other appropriate breast imaging studies as well as with a physical examination directed to the area in question. If sonography has been performed previously, the current examination should be compared with prior sonograms, as appropriate. A lesion or any area of the breast being studied should be viewed in 2 perpendicular projections; one view is insufficient.**

2. **At least one set of images of a lesion should be obtained without calipers. The maximal dimensions of a mass should be recorded in at least 2 dimensions.**

3. **The images should be labeled as to the right or left breast, The lesion's location, and the orientation of the transducer with respect to the breast. The location of the lesion should be recorded; the quadrant should be specified, and the location is to be indicated by using clock notation and distance from the nipple or shown on a diagram of the breast.**

   Several sonographic features may be helpful in characterizing breast masses. These features are to be noted: size, shape, echogenicity, margin features, orientation, and attenuation (e.g., shadowing or enhancement).

   Proper depth, gain, and focal zone settings should be optimized to obtain high-quality images. The patient should be positioned to minimize the thickness of the portion of the breast being evaluated. For evaluation of superficial lesions, a standoff device or a thick layer of gel may be helpful.

THYROID / PARATHYROID EXAM

A. The Thyroid Examination

The thyroid examination should be performed with the neck in hyperextension. The right and left lobes of the thyroid gland should be imaged in at least two projections, in longitudinal and transverse planes. Recorded views of the thyroid should include longitudinal images medial, mid, and lateral portions of both lobes; transverse images of the superior, mid, and inferior portions of the right and left lobes; and at least a transverse image of the isthmus without and with a measurement. The size of each thyroid lobe is to be recorded in 3 dimensions (longitudinal, anteroposterior, and transverse). The thickness (anteroposterior measurement) of the isthmus on the transverse view should be recorded. Visualized thyroid abnormalities should be documented. The location, size, number, and character of significant abnormalities should be documented, and measurements should be made in at least 2 and preferably in 3 dimensions. Abnormalities of the adjacent soft tissues, when encountered, such as abnormal lymph nodes or thrombosed veins, should be documented.

Whenever possible, comparison should be made with other appropriate imaging studies. Spectral, color, and/or power doppler ultrasound may be useful to evaluate the vascularity of the thyroid gland and of localized masses.

B. The Parathyroid Examination

Examination for suspected parathyroid enlargement should include images in the region of the anticipated parathyroid gland location. The examination should be performed with

the neck hyperextended and should include longitudinal and transverse images from the carotid arteries to the midline bilaterally and extending from the carotid artery bifurcation superiorly to the thoracic inlet inferiorly. As parathyroid glands may be hidden below the clavicles in the lower neck and upper mediastinum, it may also be helpful to have the patient swallow during the examination with constant real-time observation. The upper mediastinum may be images with an appropriate probe by angling under the sternum from the sternal notch. Although the normal parathyroid glands are usually not visualized with available sonographic technology, enlarged parathyroid glands may be visualized. When visualized, the location, size, and number should be documented. Measurements are to be made in 3 dimensions. The relationship of any visualized parathyroid gland(s) to the thyroid gland should be documented if applicable.

Whenever possible, comparison should be made with other appropriate imaging studies. Spectral, color and/or power doppler ultrasound may be helpful.

TESTICLE

1. **The testes should be studied in at least 2 projections, long axis and transverse. Views of each testis should include the superior, mid, and inferior portions, as well as, its medial and lateral portions. Each testis and epididymis should be evaluated in its entirety. The size and echogenicity of each testis and epididymis should be compared with its opposite side, when possible. Scrotal skin thickness should be evaluated. If a palpable abnormality is reported by the patient, that area should be directly imaged.**

2. **Blood flow in the testes and surrounding scrotal contents is to be evaluated with color or power doppler, and pulse wave doppler. The flow in the symptomatic testis should be compared with that of the asymptomatic side, and any asymmetry is to be noted.**

3. **Any abnormality is to be documented. All extratesticular structures should be thoroughly evaluated. Additional techniques, such as the valsalva maneuver or upright positioning can be utilized as needed.**

TRANSABDOMINAL PROSTRATE

The transabdominal approach is useful in obtaining an estimate of the size of the prostate gland. As with a pelvic, the patient must drink a minimum of 32 ounces of water one hour prior to the appointment time.

The prostate should be imaged in its entirety in at least two orthogonal planes, saggital and axial or saggital and coronal, from the apex to the base of the gland. An estimated volume is determined from measurements in 3 orthogonal planes. The volume of the prostate may be correlated with the PSA Level.

The Prostate Gland is to be evaluated for a focal mass, echogenicity, symmetry, and continuity of margins. Color and Power Doppler sonography may be helpful in detecting areas of increased vascularity that can be used to select sites for potential

biopsy. The periprostatic fat and neurovascular bundle should be evaluated for symmetry and echogenicity.

PERIPHERAL VASCULAR EVALUATION

1. Venous Thromboembolic Disease

For Lower extremity evaluation, the common femoral vein, femoral vein, proximal greater saphenous vein, and popliteal vein should be examined using an appropriate duplex technique and patient position. Doppler evaluation should be used to support the presence or absence of an abnormality. A noncompressible segment of the vein should be interrogated with spectral or Color Doppler sonography for the presence or absence of flow. Focal calf pain will generally require evaluation of the localized region.

The femoral and popliteal veins should be imaged to the fullest extent possible, and images should be recorded at each of the following levels: common femoral vein; junction of the common femoral vein with the greater saphenous vein; proximal deep femoral, proximal, mid, and distal femoral vein; a popliteal vein, and a posterior tibial vein. Vascular and nonvascular abnormalities, if found, should be reported but mat require additional imaging for diagnosis or further characterization. Symptomatic areas generally require additional views if the cause of the symptoms is not already elucidated by the standard examination. When using compression as a diagnostic criterion for deep vein thrombosis, real-time imaging should be performed in the transverse plane along the full length of the femoral and popliteal veins, with and without pressure in an effort to

completely oppose the venous walls. Images with and without compression should be recorded at each of the levels listed above. The extent and location of sites where the veins fail to compress should be clearly recorded.

2. Upper Extremity Evaluation

Upper extremity duplex evaluation consists of assessment of the subclavian, innominate, jugular, and axillary veins. Basilic, cephalic, and brachial veins, forearm veins, and focal symptomatic areas may be examined as indicated.

Duplex Doppler or Color Doppler techniques are used to assess venous compressibility, thrombus, wall thickening, spontaneous venous flow, and venous filling defects.

3. Compression ultrasound findings are the main criteria to diagnose or exclude venous thrombosis. These can be supplemented by Doppler evaluation. Doppler ultrasound criteria should be used to diagnose or exclude venous insufficiency.

EVALUATION OF EXTREMITY ARTERIES

Continuos Wave Doppler Waveforms

Continuos Wave Doppler Waveforms can be obtained from 1 or more arteries. In the lower extremity, the arteries most

commonly assessed are the common femoral, superficial femoral, popliteal, posterior tibial, and the dorsalis pedis. In the upper extremity, the arteries most commonly assessed are the subclavian, axillary, brachial, radial, and ulnar. There should be strict adherence in attempting to maintain as close to a 60 degree Doppler angle as possible.

Ultrasound Examination Of The Female Pelvis

A. General Pelvic Preparation

For a pelvic sonogram performed transabdominally, the patient's bladder should be distended adequately. This is generally accomplished by having the patient drink 32 – 36 ounces 1 hour prior to the exam.

For a transvaginal sonogram, the urinary bladder needs to be emptied. If a male examiner is performing the exam, a female staff member must be present during the entire examination to

serve as a chaperon. The female staff member's name must be written on the worksheet.

B. **Uterus**

The vagina and the uterus provide anatomic landmarks that can be used as reference points for the remaining normal and abnormal pelvic structures. In evaluating the uterus, the following should be documented: (1) the uterine size, shape, and orientation; (2) the endometrium; (3) the myometrium; and (4) the cervix. The vagina may be imaged as a landmark for the cervix and lower uterine segment.

Uterine length is evaluated in the long axis from the fundus to the cervix (the external os if it can be identified). The depth of the uterus (anteroposterior dimension) is measured in the same long axis view from its anterior to posterior walls, perpendicular to the length. The width is measured from the transaxial or coronal view.

Abnormalities of the uterus should be documented. The endometrium should be analyzed for thickness, focal abnormality, and the presence of fluid or a mass in the endometrial cavity. Assessment of the endometrium should allow for variations expected with phases of the menstrual cycle. If the endometrial stripe is difficult to define or is ill defined, a comment is to be noted on the worksheet. The myometrium and cervix are to be evaluated for contour changes, echogenicity, and masses. Masses, if identified, should be imaged with and without measurements in at least two dimensions and their locations recorded. Also, Color Doppler should be used to evaluate for vascularity involvement.

C. **Adnexa (Ovaries and Fallopian Tubes)**

When evaluating the adnexa, an attempt should be made to identify the ovaries first since they serve as a major point of reference for assessing the presence of adnexal pathology. The ovaries should be measured, and ovarian abnormalities should be documented. Ovarian size can be determined by measuring by

measuring the ovary in 3 dimensions (width, length, and depth), on views obtained in two orthogonal planes.

The normal fallopian tubes are not commonly identified. This region should be surveyed for abnormalities, particularly dilated tubular structures.

If an adnexal mass is noted, its relationship to the ovaries and uterus should be documented. Its size, shape, and internal characteristics (cystic, solid, or complex) should be determined. Doppler or Color Doppler ultrasound may be useful in determining the vascular nature of the pelvic structures.

D. **Cul-de-sac**

The cul-de-sac should be evaluated for the presence of free fluid or a mass. If a mass is detected, its size, shape, position, echogenicity, internal characteristics (cystic, solid, or complex), and relationship to the ovaries and uterus should be documented.

TRANSTHORACIC ECHOCARDIOGRAM

A. Complete M-Mode and 2 Dimensional Examination

This portion of the examination includes views from multiple planes including views of all cardiac structures and selected extracardiac structures. These include, but are not limited to:

1. **Left Ventricle**
2. **Right Ventricle**
3. **Left Atrium**
4. **Right Atrium**
5. **Aortic Valve**
6. **Pulmonic Valve**
7. **Tricuspid Valve**
8. **Mitral Valve**
9. **Proximal Ascending Aorta**
10. **Aortic Arch**
11. **Main Pulmonary Artery and Proximal Branches**
12. **Inferior Vena Cava**
13. **Pericardium**

B. **Complete Doppler Study**

This portion of the exam includes spectral doppler and/or color flow interrogation of all normal and abnormal flows within the heart including the valves, the great vessels and the atrial and ventricular septa.

C. **Limited Examination**

A Limited Study is generally only performed when the patient has undergone a complete recent examination and there is no clinical reason to suspect any changes outside the specific area of interest. A limited study generally examines a single area of the heart or answers a single clinical question.

The complete examination must include (except where technically unobtainable), but not limited to:

(A) **The following standard 2 Dimensional views:**

1. **Parasternal Long Axis View**
2. **Parasternal Short Axis Views (basal, mitral valve, left ventricle at the mid papillary muscle level, left ventricular apex)**
3. **Right Ventricular Inflow View**
4. **Apical Four Chamber View**
5. **Apical Five Chamber View**
6. **Apical Two Chamber View**
7. **Apical Three Chamber View**
8. **Apical Long Axis View**
9. **Subcoatal Four Chamber View**
10. **Subcostal Short Axis View (when indicated)**
11. **Subcostal IVC/Hepatic Vein View**
12. **Suprasternal Notch View (when indicated)**

(B) **The following 2-D or M-Mode Measurements of the left heart:**

1. **The left ventricular internal dimension at end diastole.**
2. **The left ventricular internal dimension at end systole.**
3. **The left ventricular posterobasal free wall thickness at end diastole.**
4. **The left ventricular septal thickness at end diastole.**
5. **The left atrial at end systole.**
6. **The aortic root dimensions at end diastole.**

(C) The following standard Doppler Flow evaluations:

1. **The Four Cardiac Valves – forward flow spectra for each valve, and any regurgitation, shown in at least two imaging planes with Color Doppler.**
2. **For Aortic Stenosis, the systolic velocity must be evaluated from multiple transducer positions (e.g., apical, suprasternal and right parasternal) This must include interrogation from multiple views with a dedicated nonimaging Continuous Wave Doppler transducer (at least one clear envelope must be obtained).**
3. **The tricuspid regurgitation spectrum must always be sought for estimation of right ventricular pressure when tricuspid regurgitation is present.**
4. **Atrial and Ventricular Septa – Color Doppler screening for defects**
5. **Left Ventricular outflow tract velocity**
6. **Velocity – time integrals and hepatic and pulmonary vein flow spectra are optional.**
7. **Optional Doppler studies include: tissue Doppler, strain, strain-rate.**