

Children's (Pediatric) Abdominal Ultrasound Imaging

This procedure is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.

What is Abdominal Ultrasound Imaging?

Ultrasound imaging, also called ultrasound scanning or sonography, involves exposing part of the body to high-frequency sound waves to produce pictures of the inside of the body. Ultrasound exams do not use ionizing radiation (as used in x-rays). Because ultrasound images are captured in real-time, they can show the structure and movement of the body's internal organs, as well as blood flowing through blood vessels.

Ultrasound imaging is a noninvasive medical test that helps physicians diagnose and treat medical conditions.

Children's (pediatric) abdominal ultrasound imaging produces pictures of the internal organs and blood vessels located within a child's abdomen.

A Doppler ultrasound study may be part of a child's abdominal ultrasound examination.

Doppler ultrasound is a special ultrasound technique that evaluates blood as it flows through a blood vessel, including the body's major arteries and veins in the abdomen, arms, legs and neck.

What are some common uses of the procedure?

Abdominal ultrasound imaging is performed to evaluate the:

- appendix
- liver
- gallbladder
- spleen
- pancreas
- intestines

- kidneys
- bladder

Abdominal ultrasound images can be used to help diagnose appendicitis in children.

After traumatic injury, appendicitis is the most common reason for emergency abdominal surgery.

Ultrasound imaging can also:

- help a physician determine the source of abdominal pain, such as stones, abscesses or an inflamed appendix
- guide procedures such as needle biopsies, in which needles are used to sample cells from organs for laboratory testing
- help identify the cause of an enlarged abdominal organ
- identify the location of abnormal fluid in the abdomen

Because ultrasound provides real-time images, it also can be used to guide procedures such as needle biopsies, in which needles are used to extract sample cells from an abnormal area for laboratory testing. Ultrasound may also be used to guide the insertion of a catheter or drainage device and helps assure accurate placement.

Doppler ultrasound images can help the physician to see and evaluate:

- blockages to blood flow (such as clots)
- narrowing of vessels (which may be caused by plaque)
- tumors and congenital malformation

How should we prepare?

Your child should be dressed in comfortable, loose-fitting clothing for an ultrasound exam. Other

preparation depends on the type of examination. For some scans, your doctor may ask you to withhold food and drink for as many as 12 hours before your child's appointment. For others, you may be asked to have your child drink up to six glasses of water two hours prior to the exam and avoid urinating so that his or her bladder is full when the scan begins. Sedation is rarely needed for ultrasound examinations.

What does the equipment look like?

Ultrasound scanners consist of a console containing a computer and electronics, a video display screen and a transducer that is used to scan the body and blood vessels. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. The transducer sends out high frequency sound waves into the body and then listens for the returning echoes from the tissues in the body. The principles are similar to sonar used by boats and submarines.



The ultrasound image is immediately visible on a nearby screen that looks much like a computer or television monitor. The image is created based on the amplitude (strength), frequency and time it takes for the sound signal to return from the patient to the transducer.

How does the procedure work?

Ultrasound imaging is based on the same principles involved in the sonar used by bats, ships and fishermen. When a sound wave strikes an object, it bounces back, or echoes. By measuring these echo waves it is possible to determine how far away the object is and its size, shape, and consistency (whether the object is solid, filled with fluid, or both).

In medicine, ultrasound is used to detect changes in appearance of organs, tissues, and vessels or detect abnormal masses, such as tumors.

In an ultrasound examination, a transducer both sends the sound waves and records the echoing waves. When the transducer is pressed against the skin, it directs small pulses of inaudible, high-frequency sound waves into the body. As the sound waves bounce off of internal organs, fluids and tissues, the sensitive microphone in the

transducer records tiny changes in the sound's pitch and direction. These signature waves are instantly measured and displayed by a computer, which in turn creates a real-time picture on the monitor. One or more frames of the moving pictures are typically captured as still images.

Doppler ultrasound, a special application of ultrasound, measures the direction and speed of blood cells as they move through vessels. The movement of blood cells causes a change in pitch of the reflected sound waves (called the Doppler effect). A computer collects and processes the sounds and creates graphs or color pictures that represent the flow of blood through the blood vessels.

How is the procedure performed?

For most ultrasound exams, the patient is positioned lying face-up on an examination table that can be tilted or moved.

A clear gel is applied to the area of the body being studied to help the transducer make secure contact with the body and eliminate air pockets between the transducer and the skin. The sonographer (ultrasound technologist) or radiologist then presses the transducer firmly against the skin and sweeps it over the area of interest.

Doppler sonography is performed using the same transducer.

When the examination is complete, the patient may be asked to dress and wait while the ultrasound images are reviewed. However, the sonographer or radiologist is often able to review the ultrasound images in real-time as they are acquired and the patient can be released immediately.

This ultrasound examination is usually completed within 30 minutes.

What will my child experience during and after the procedure?

Most ultrasound examinations are painless, fast and easy.

Your child will lie on his or her back on an examining table. The radiologist or sonographer will spread warm gel on the skin, then press and move the transducer firmly against the abdomen, moving it back and forth until the desired images are captured. There may be minimal discomfort from pressure as the transducer is pressed against the area being examined.

If scanning is performed over an area of tenderness, your child may feel pressure or minor pain from the procedure.

If a Doppler ultrasound study is performed, your child may actually hear pulse-like sounds that change in pitch as the blood flow is monitored and measured.

Once the imaging is complete, the gel will be wiped off your child's skin.

After an ultrasound exam, children should be able to resume their normal activities.

Who interprets the results and how do we get them?

A radiologist, a physician specifically trained to supervise and interpret radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will share the results with you. In some cases the radiologist may discuss results with you at the conclusion of your examination.

What are the benefits vs. risks?

Benefits

- Most ultrasound scanning is noninvasive (no needles or injections) and is usually painless.
- Ultrasound is widely available, easy-to-use and less expensive than other imaging methods.
- Ultrasound imaging uses no ionizing radiation.
- Ultrasound scanning gives a clear picture of soft tissues that do not show up well on x-ray images.
- Ultrasound causes no health problems and may be repeated as often as is necessary.
- Ultrasound provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as cortisone injections, needle biopsies and needle aspiration of fluid in joints or elsewhere.
- Ultrasound is particularly valuable for evaluating abdominal pain in young children.

Risks

- For standard diagnostic ultrasound there are no known harmful effects to humans.

What are the limitations of Abdominal Ultrasound Imaging?

Ultrasound waves are disrupted by air or gas; therefore ultrasound is not an ideal imaging technique for the bowel or organs obscured by the bowel. In most cases, barium exams, CT scanning, and MRI are the methods of choice in this setting.

Ultrasound waves do not pass through air; therefore an evaluation of the stomach, small intestine and large intestine may be limited. Intestinal gas may also prevent visualization of deeper structures such as the pancreas and aorta. Large patients are more difficult to image because tissue attenuates (weakens) the sound waves as they pass deeper into the body.

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