



## Use of Ultrasound As An Alternative to CT

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In light of concern over radiation dose in CT, it is helpful to remember that ultrasound is the imaging modality of choice for a number of abdominal, pelvic, and cardiovascular indications. Because ultrasound does not use ionizing radiation it is particularly useful in children and in women of child-bearing age when CT would otherwise expose the patient to pelvic radiation. This is particularly important in pregnancy (see [The Pregnant Patient: Alternatives to CT and Dose-Saving Modifications to CT Technique](#)). The following document illustrates scenarios for using ultrasound instead of CT.

### Ultrasound instead of CT in assessment of pelvic pain

Since ovarian cysts, hemorrhagic cysts, ovarian torsion, ectopic pregnancy, and pelvic inflammatory disease are all common etiologies of pelvic pain in women of reproductive age and are also well evaluated by ultrasound, ultrasound is the imaging modality of choice for assessing women with acute pelvic pain [1]. In addition to allowing for information regarding the uterus and adnexa in women, ultrasound can be used to assess the bowel (for example, for appendicitis [2]) and urinary tract (for example, for ureteral stones) in patients of both genders. Imaging of appendicitis is dependent on operator experience, with studies showing approximately 78% sensitivity and 83% specificity [3].

### Ultrasound instead of CT in assessment of abdominal pain

ACR appropriateness criteria rank ultrasound highest as the modality for initial imaging in patients with right upper quadrant pain, acute pancreatitis, severe abdominal pain with elevated lipase (without fever), and acute abdominal pain with jaundice [4,5,6]. Ultrasound is particularly helpful in detection of

gallstones and biliary obstruction, as well as for the identification or exclusion of alternative diagnoses [7,8,9,10].

### **Ultrasound instead of CT in assessment of blunt abdominal trauma**

In unstable trauma patients, a Focused Assessment with Sonography for Trauma (FAST) scan can be used to assess for free fluid [11]. This can quickly provide information that can support a decision to operate immediately, with the caveat that the false negative rate is at least 15% [12,13,14,15,16].

### **Ultrasound instead of CT in assessment of clinically suspected adnexal mass**

Ultrasound is the imaging modality of choice in assessing clinically suspected pelvic masses [17].

Ultrasound is used to determine the cystic or solid nature of the mass and to assess septations, solid elements, internal echogenicity, and vascularity that are used to predict if a mass is benign or malignant.

These internal characteristics can be used to determine if an adnexal mass can be ignored, safely followed by ultrasound, or if surgery is warranted [18].

### **Ultrasound instead of CT for cardiovascular imaging**

When an asymptomatic patient has a pulsatile abdominal mass and aortic aneurysm is suspected, ultrasound is the initial imaging modality of choice [19]. Population-based ultrasound screening studies have been recommended for male patients over the age of 65 [20]. For abdominal aortic aneurysms between 3 and 5.5cm in diameter, periodic imaging (typically with ultrasound) at 6- to 12- month intervals (dependent on rate of aneurysm enlargement on prior studies) is recommended [19].

In patients with acute or chronic chest pain and in patients with dyspnea of suspected cardiac origin, ultrasound (with or without pharmacologic stress, with or without transesophageal echocardiography) can be used to assess abnormalities of ventricular wall motion, pericardial effusion, valve dysfunction, cardiac thrombus, and aortic pathology such as dissection [21,22,23].

In patients with acute chest pain and suspected pulmonary embolism, ultrasound of the lower extremity can be utilized to assess for deep venous thrombosis, to aid in triage of patients to therapy, no therapy, or additional imaging [24].

In patients with suspected bacterial endocarditis, transesophageal echocardiography is the clinical reference standard. It can demonstrate vegetations on cardiac valves, valvular regurgitation, and perivalvular abscess [25].

Assessment of the extracranial carotid arteries is typically performed with ultrasound rather than CT. A recent meta-analysis shows that ultrasound has a higher sensitivity (89%) than does CTA (77%) for 70–99% stenosis [26].

## CONCLUSION

The descriptions above are common examples of using ultrasound where CT might be considered as an alternative imaging modality. There are of course many other indications for ultrasound. The prudent use of ultrasound will allow for appropriate patient care and diminish unnecessary exposure of patients to ionizing radiation from CT.

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