American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Pulsatile Abdominal Mass**

Radiologic Procedure	Rating	Comments	RRL*
CTA abdomen	8	Prefer MDCTA. Accurately defines the anatomy of the aorta and its branches and the adjacent organs and tissues.	Med
US aorta	8	The definitive screening modality but only measures aortic diameter accurately.	None
INV aortography	7	Accurately defines extent and branch involvement but less accurate in defining diameter. Expensive and invasive.	IP
CT abdomen with contrast	7	Accurately defines aortic size and useful in defining extent. Relatively quick with acceptable cost.	Med
MRI abdomen	6	Better than CT in defining extent but more expensive and time consuming. Can diagnose an inflammatory aneurysm.	None
CT abdomen without contrast	6	If contrast injection contraindicated or for rapid and accurate screening.	Med
MRA abdomen	6	Accurately defines the anatomy of the aorta and its branches and the adjacent organs and tissues.	None
CTA abdomen	6		Med
INV arteriography lower extremity	5	Important if there are signs or symptoms of peripheral vascular disease.	Low
X-ray abdomen	5	Easily performed and inexpensive, but not accurate in estimating diameter of the aorta. Lateral is more accurate than the frontal radiograph in estimating aortic diameter.	Med
US abdomen	4	May miss small aneurysm. Useful if aorta found normal on aortic US.	None
X-ray intravenous urography	3	Only indicated if additional information needed about the urinary tract. May be a supplement to contrast-enhanced CT studies.	Med
US aorta with Doppler	3	Useful only if signs or symptoms of peripheral vascular disease are present and angiography not planned.	None
INV aortography abdomen	3	Rarely indicated. Risky in patients with large aneurysms.	Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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Summary of Literature Review

Clinical palpation of a pulsating abdominal mass alerts the clinician to the presence of a possible abdominal aortic aneurysm (AAA), a common vascular disorder seen in older individuals. Although AAA is found more commonly in men, women are also afflicted, especially after age 70. However, the finding of a pulsatile abdominal mass can also be caused by a tortuous abdominal aorta and transmitted pulsations from the aorta to a nonvascular mass.

An AAA may be defined as a localized arterial dilatation of at least 50% greater than the normal diameter. Arteriomegaly, a variation of the same disease process, is a diffuse aneurysmal dilatation also greater than 50% of the expected normal diameter (some would accept the diagnosis of arteriomegaly at a diameter somewhat less). Although any arterial dilatation greater than the normal diameter is pathologically considered an aneurysm, the term ectasia is commonly applied to dilatations less than 50%.

Imaging studies are important in diagnosing the cause of a pulsatile abdominal mass and, if an AAA is found, to determine its size, extent, involvement of its branches and associated significant stenotic visceral, renal, and peripheral arteries. Confirmation of the presence of an AAA is extremely important because the mortality of ruptured AAA is greater than 50% when the patient reaches the hospital and probably greater than 90% if pre-hospital deaths are included. Currently elective repair is recommended for aneurysms 5.5 cm or greater in diameter. Ultrasound (US) surveillance is recommended for aneurysms less than 5.5 cm in diameter because survival is not improved by surgery. Imaging studies commonly described in the literature include, in the order of their development: abdominal radiographs, intravenous urography, catheter aortography, US, computed tomography (CT), magnetic resonance imaging (MRI), CT angiography (CTA), and MR angiography (MRA). The rapid recent technological advances in MRI and, particularly, CT have led to changes in the approach to the evaluation of both suspected and confirmed AAA.

Abdominal Radiograph

Radiographs are simple and inexpensive to obtain and, in past decades, were the classic imaging method to determine whether an AAA was present. The presence of calcification in the abdominal aortic wall, although common in patients with an AAA, is not invariably present but is necessary to positively identify a mass as vascular. Furthermore, a tortuous, calcified aorta can mimic an AAA unless both lateral walls can be seen. Generally, a supine anteroposterior abdominal radiograph is obtained, but a lateral projection may be helpful and has been recommended by some as the sole radiographic diagnostic modality. Although radiographs may be helpful in the diagnosis of the presence of a possible AAA, they are very unreliable for diameter measurement, an important deficiency because the diameter is predictive of the likelihood of rupture.

Intravenous Urography

Intravenous urography has the same limitations in the diagnosis of AAA, but it can give some information about the presence of urinary tract involvement. The additional expense does not justify its routine use for the diagnosis of AAA. Therefore, this procedure is recommended only if additional information about the urinary tract is needed. Further, contrast-enhanced CT of the abdomen may be obtained if obstructive uropathy is identified on the CT study.

Ultrasound

US is the most commonly recommended screening imaging modality because, if properly performed, CT can accurately measure the aortic anteroposterior diameter. Also, it can be performed portably. Aortic US specifically should be requested if evaluation is for a pulsating abdominal mass, because general “abdominal US” may fail to disclose a small AAA. Abdominal US is then requested only if aortic US reveals a normal diameter aorta. Color flow duplex US is useful for the diagnosis of concomitant peripheral vascular disease when there are symptoms of claudication and the peripheral pulses, especially femoral, are decreased or absent.

If aortography is to be performed, duplex scanning is superfluous unless concomitant renal insufficiency limits the contrast medium load. Aortic US is limited in its ability to delineate the craniad and caudad extent of the AAA as well as its involvement of the visceral, renal, and iliac arteries. Transesophageal echocardiography may

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define the thoracic extension of an AAA but is not recommended as a routine diagnostic modality.

Nuclear Medicine

Although blood pool radionuclide imaging can visualize AAAs, there is no real role for this technique as a routine method in the evaluation of pulsatile abdominal masses. Renal function evaluations such as with the Captopril challenge renal scan may have rare indications if there is severe, difficult to control systemic hypertension. However, these studies have no place in the routine evaluation of a pulsatile abdominal mass.

Computed Tomography

CT has emerged as an accepted diagnostic imaging modality for an AAA. In addition to accurate diameter measurement, it can delineate its extent, justifying the significant expense above that of US. Many papers have proposed CT as the initial diagnostic modality, suggesting that in the absence of clinical findings of severe systemic hypertension, claudication, or decreased peripheral pulses, no further preoperative imaging would be necessary.

Helical (spiral) CT can be performed rapidly and can be substituted for both radiographs and US. Intravenous iodinated contrast injection is necessary to obtain the full benefit of this modality, although noncontrast CT will accurately measure the diameter and delineate its extent. Helical CT with contrast (CTA) is a technological advance that better defines the anatomic pathology and has significantly decreased the need for angiography. Three-dimensional reconstructions using maximum intensity projections, curved planar reformations, and shaded surface displays are yielding superb diagnostic images of the abdominal aorta.

Multidetector or multislice CT (MDCT) scanners, with 4 to 64 detector rows are faster and produce even better anatomical definition of the aorta and adjacent organs and tissues and, with new techniques, allow concomitant evaluation of renal, pelvic, and peripheral vasculature. Electron beam CT (EBCT) angiography has been successfully used to image the abdominal aorta, but EBCT scanners are not widely available. Virtual CT endoscopy of the aorta and its branches is an emerging technique that awaits validation and requires special software.

Magnetic Resonance Imaging

MRI and especially MRA define the anatomic extent of AAAs better than CT. The absence of iodinated contrast and ionizing radiation is a further advantage of this modality. Also, this modality is less costly than conventional angiography.

MRA specifically can image the visceral, renal, and iliac arteries. With rapid improvement in MRA technology, including reconstruction techniques, the ability to completely image an AAA and show its relationship to and involvement of its immediate aortic branches is improving. Gadolinium-enhanced 3-dimensional MRA is proving to be superior to angiography in the diagnosis and delineation of AAA. Newer blood pool agents may add further information and increase convenience and speed.

Catheter Angiography

The routine use of catheter angiography (CA) in the imaging of pulsatile abdominal masses and even AAAs confirmed by other modalities, previously controversial, is now rarely necessary. CA does not accurately measure the diameter of an AAA and rarely may even misdiagnose its absence. It is no longer the “gold standard” in defining the pathologic anatomy of an AAA and its branch and peripheral arteries. The use of CA is now limited to institutions without adequate MR or CT technology. Selective visceral, renal, spinal, and coronary arteriography are believed to be indicated only in very specific clinical situations. Much of this information can now be obtained less invasively and probably more accurately with CTA and perhaps MRA.

Summary

The consensus of the literature supports aortic US as the initial imaging modality of choice when a pulsatile abdominal mass is present. If an AAA that may need surgical or endovascular intervention is confirmed by US or screening helical CT, the decision between contrast helical CT/CTA, MDCT, MRI/MRA, or conventional CA depends on the availability of the more sophisticated imaging modalities. Helical CTA and contrast-enhanced MRA clearly are satisfactory replacements for CA except when there are specific unanswered questions about coexistent peripheral vascular, renal, or visceral arterial obstructive disease or involvement by the aneurysm. They now may be performed so rapidly, safely, and accurately that CTA and MRA may now be considered as the initial test in patients with high clinical suspicion.

Anticipated Exceptions

In emergent situations where rupture has already occurred, all the imaging modalities may be bypassed, because the patient will need immediate operation for survival. In urgent situations, where clinical diagnosis is fairly certain and rupture is impending, CTA or MRA may be the initial and only examination requested, bypassing US.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective

dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations	
Relative Radiation Level*	**Effective Dose Estimate Range**
None	0
Minimal	< 0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv
*RRL assignments are not included for some examinations. The RRL assignments for the IP (in progress) exams will be available in future releases.	

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