New 2021

American College of Radiology
ACR Appropriateness Criteria®
Suspected Retroperitoneal Bleed

Variant: 1 Clinically suspected retroperitoneal bleed. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Appropriate	☢☢☢☢
CTA abdomen and pelvis with IV contrast	Usually Appropriate	☢☢☢☢
Aortography abdomen and pelvis	May Be Appropriate (Disagreement)	☢☢☢☢
CT abdomen and pelvis without IV contrast	May Be Appropriate	☢☢☢
US abdomen and pelvis	Usually Not Appropriate	O
Radiography abdomen and pelvis	Usually Not Appropriate	☢☢☢
MRA abdomen and pelvis with IV contrast	Usually Not Appropriate	O
MRA abdomen and pelvis without and with IV contrast	Usually Not Appropriate	O
MRA abdomen and pelvis without IV contrast	Usually Not Appropriate	O
MRI abdomen and pelvis without and with IV contrast	Usually Not Appropriate	O
MRI abdomen and pelvis without IV contrast	Usually Not Appropriate	O
RBC scan abdomen and pelvis	Usually Not Appropriate	☢☢☢

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Summary of Literature Review

Introduction/Background

Retroperitoneal bleeding is a hemorrhage into the retroperitoneal space, the space located posterior to the parietal peritoneum and anterior to the transversalis fascia. Retroperitoneal bleeding can occur spontaneously (Wunderlich syndrome), including in association with anticoagulation therapies, or be secondary to trauma, aortic rupture, or bleeding from a visceral vessel or mass. Retroperitoneal bleeding can also be iatrogenic, as a complication from surgeries or transfemoral catheterization procedures [1,2]. The retroperitoneum contains a portion of the duodenum, kidneys, adrenal glands, proximal ureters, pancreas, and vascular structures, including the abdominal aorta and proximal renal vasculature. This anatomy provides a variable source of potential bleeding. In the setting of trauma, retroperitoneal bleeding can also be the result of pelvic or spine fractures. Recognition of retroperitoneal bleeding from pelvic fractures is important given that it is associated with an increased need for transfusions and rapid intervention [3]. Vascular bleeding in the retroperitoneum can be from aortic aneurysmal rupture or visceral vessel rupture. The latter can be seen, for example, in the setting of pseudoaneurysms secondary to duodenal or pancreatic inflammation or infection [4]. Retroperitoneal bleeding is also the second most common site of major, or clinically relevant, bleeding seen among cancer patients [5]. Bleeding can be due to the malignancy itself or interventions and treatment, including surgery, upper endoscopy, chemotherapy, or anticoagulation. The many causes for retroperitoneal bleeding can make the diagnosis and management clinically challenging.

Assessing for the clinical signs of retroperitoneal bleeding can be difficult given that the location of bleeding is not readily accessible to physical examination and often has an obscured etiology. This can result in the delayed diagnosis of retroperitoneal bleeding [6,7]. Clinically, retroperitoneal bleeding can present with diffuse abdominal, back, or lower quadrant abdominal pain, abdominal distension, and palpation of a flank mass [2,7]. However, these clinical findings are nonspecific for the diagnosis and further contribute to the difficulty in diagnoses. The management of retroperitoneal bleeding depends on the cause and size of bleed, hemodynamic status and stability of the patient, and the presence of active bleeding [6,7]. Treatment options include fluid resuscitation and close monitoring, angiographic embolization, and surgery. Retroperitoneal bleeding of significant volume can be concealed in the potential space and result in hypovolemic shock, necessitating blood transfusions with urgent angiographic or surgical treatment [1].

Special Imaging Considerations

For the purposes of distinguishing between CT and CT angiography (CTA), ACR Appropriateness Criteria topics use the definition in the ACR–NASCI–SIR–SPR Practice Parameter for the Performance and Interpretation of Body Computed Tomography Angiography (CTA) [8]:

"CTA uses a thin-section CT acquisition that is timed to coincide with peak arterial or venous enhancement. The resultant volumetric dataset is interpreted using primary transverse reconstructions as well as multiplanar reformations and 3-D renderings."

All elements are essential: (1) timing, (2) reconstructions/reformats, and (3) 3-D renderings. Standard CTs with contrast also include timing issues and reconstructions/reformats. Only in CTA, however, is 3-D rendering a required element. This corresponds to the definitions that the CMS has applied to the Current Procedural Terminology codes.

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Clinically suspected retroperitoneal bleed. Initial imaging.

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A. Aortography abdomen and pelvis

Angiography of the abdomen and pelvis provides the benefit of being able to simultaneously diagnose active bleeding and treat retroperitoneal bleeding with transcatheter arterial embolization (TAE) [9]. Angiography has high spatial and temporal resolution for evaluating vascular structures and the source of the bleed. Initial utilization of aortography of the abdomen and pelvis in patients with clinically suspected retroperitoneal bleed is best reserved for patients who are hemodynamically unstable with a high index of clinical suspicion for retroperitoneal hemorrhage. Urgent aortography may be appropriate in cases of known active arterial bleeding or when there is a known contained vascular injury that would be amendable to concomitant diagnosis and treatment. In a study by Fitzpatrick et al [4] of patients with retroperitoneal bleeding related to pancreatitis, all angiographic cases were diagnostic of the bleeding vessel with TAE, with success measured by observation of cessation of bleeding and clinical stabilization. In that study, cessation of bleeding with embolization was achieved in all cases as determined by observation on angiography. Detection of active bleeding with conventional angiography requires a bleeding rate of 0.5 to 1.0 mL/min. Limitations of angiography also include that it is invasive, and risks include hematoma or bleeding at access site, iatrogenic dissections, and infection [10].

Variant 1: Clinically suspected retroperitoneal bleed. Initial imaging.
B. CT Abdomen and Pelvis

CT is helpful for the diagnosis of retroperitoneal hematoma given its speed, high spatial resolution, and noninvasiveness. CT can depict blood, localize areas of bleeding, and evaluate for recent or active extravasation of contrast material [7]. Because of its speed and ability to scan large areas, it is especially useful to localize the area of bleeding and identify a possible cause, such as groin access, pelvic fracture, or mass [6]. Noncontrast CT can be appropriate to expeditiously confirm or exclude bleeding and is especially helpful in patients with compromised renal function or when there is concern for additional contrast load if further intervention with angiography may be considered. The attenuation of the hematoma on noncontrast CT can help determine the relative acuity, with high attenuation and mixed attenuation indicating acute to subacute bleeding and rebleeding, and low attenuation suggesting subacute to chronic blood products. Findings such as sentinel clot can be helpful to suggest an area of bleeding if an active blush is not observed at the time of scanning. CT also serves well as the initial examination to follow-up clinically suspected rebleeding or to evaluate for changes in hematoma size or to evaluate for a subsequent complication, such as infection and abscess formation [6]. Given these attributes of CT imaging, it is appropriate for initial imaging in the suspicion of retroperitoneal bleeding. Limitations of CT include the inability to simultaneously intervene.

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C. CTA Abdomen and Pelvis

CT angiography (CTA) is usually performed to detect the site of active retroperitoneal bleeding in cases of known or clinically suspected acute bleeding. Like CT, CTA provides the exact location of hematoma. CTA has better sensitivity than invasive angiography for detecting active bleeding and is known to detect bleeding rates as low as 0.3 mL/min. In evaluation of active bleeding, Tani et al [9] identified active extravasation of contrast in 78.9% to 84.2% of cases, with a sensitivity in CT for detection of active bleeding of 59.5% and positive predictive value compared to TAE of 62.9% to 71.0%. If the bleeding is intermittent, the sensitivity of CTA decreases. In patients with a history of aortic aneurysm and suspected rupture as cause of retroperitoneal hematoma, a CTA examination can provide confirmation and valuable preoperative information for endovascular or surgical repair, including size, extent, visceral disease, and anatomic vessel variants [11]. CTA is appropriate in the initial evaluation of bleeding with the benefit of detecting active bleeding and vascular sources. CTA has the same limitations as CT as a diagnostic modality only, not allowing for intervention as with TAE.

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D. MRA Abdomen and Pelvis

MR angiography (MRA) can provide noninvasive information pertaining to size and site of aneurysms as a potential source of retroperitoneal bleeding. However, because of the length of examination time, it has a limited role and is usually not appropriate in initial diagnosis of acute retroperitoneal bleeding. The use of MRA in the acute setting may delay diagnosis and treatment. MRA is also limited when there is metallic susceptibility artifact and is precluded if the patient has a magnetic field–incompatible implanted device.

Variant 1: Clinically suspected retroperitoneal bleed. Initial imaging.
E. MRI Abdomen and Pelvis

MRI has very high soft-tissue contrast and is very helpful in evaluation of the retroperitoneal structures. However, the length of examination time makes it less than ideal for initial imaging in cases of suspected retroperitoneal bleeding. MRI is helpful in further workup of patients with known hematoma when there is a suspicion of bleeding being from an underlying mass or lesion, such as patients with neoplasm in the pancreas, kidneys, or adrenal glands [12]. MRI in these cases can also be helpful to distinguish anatomically between blood and suspected underlying neoplasm, while characterizing bleeding acuity by differentiating acute and early subacute blood (isointense to hyperintense signal on T1-weighted and dark on T2-weighted sequences) from chronic blood (hypointense signal). MRI can be used to follow size of retroperitoneal hematomas in which sequential examinations may be needed, but the length of examination makes it usually not appropriate for diagnosis of retroperitoneal bleeding when compared to CT for initial diagnosis.

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F. Radiography Abdomen and Pelvis

Abdominal radiography findings are highly nonspecific and have low sensitivity in detecting retroperitoneal bleeding. Radiography is often the initial examination in patients who present with palpable mass or abdominal pain, without clinical suspicion of hemorrhage as the cause of these clinical signs and symptoms [13]. Radiographs can show displacement of bowel loops or obscuration of the psoas muscle contour if there is large volume of retroperitoneal hematoma. Radiographs can evaluate for mispositioned lines or cannula as the potential etiology of bleeding. Two important limitations of radiography include the inability to evaluate if the bleeding is active or not and the limitation in identification of the source of the bleeding. Additionally, up to a moderate volume hematoma may not exert enough mass effect to prompt discovery on radiography. These limitations make radiography usually not appropriate for initial diagnosis of retroperitoneal bleed.

Variant 1: Clinically suspected retroperitoneal bleed. Initial imaging.
G. RBC Scan Abdomen and Pelvis

Tc-99m-labeled red blood cell (RBC) scintigraphy is highly sensitive in detecting active bleeding, with detection of bleeding rates as low as 0.1 mL/min [14]. RBC scintigraphy has been shown to be more sensitive to detect active ongoing bleeding in cases of gastrointestinal location of bleeding that may not be confirmed on CTA, allowing for a localized intervention to occur such as with TAE. However, its utilization in initial suspicion of retroperitoneal bleeding and hematoma is limited and usually not appropriate because of the longer time of examination (from order placement to scan completion) and better sensitivity in the retroperitoneal location provided by other imaging procedures.

Variant 1: Clinically suspected retroperitoneal bleed. Initial imaging.

H. US Abdomen and Pelvis

Ultrasound (US) can be helpful in the overall evaluation of acute patients because of its noninvasiveness and portability [15]. Contrast enhanced US, which utilizes microbubbles of gas in a phospholipid membrane, has been shown to be effective in identifying postsurgical complications, including retroperitoneal hematoma [16]. US performed is 99% sensitive and 98% specific for detecting abdominal aortic aneurysm AAA in the emergency department setting [17]. The speed and accuracy of this approach is therefore useful to detect if abdominal aortic aneurysm is present when a ruptured aneurysm is a differential diagnosis in the emergency or critical care setting. US helps only to detect the presence or absence of abdominal aortic aneurysm, not the presence of rupture, and does not provide significant information regarding alternative etiologies of retroperitoneal bleeding. However, anatomical evaluation of the retroperitoneal structures on US can be difficult in the acute setting because of patient factors (limited positioning in critical care setting and a lack of sufficient acoustic windows to evaluate the entire retroperitoneum). This makes US usually not appropriate in the diagnosis of retroperitoneal bleed. The evaluation of the presence or absence of smaller volumes of retroperitoneal blood products is also limited as is the ability of US to detect if bleeding is active or not and reliably reveal the etiology [16].

Summary of Highlights

ıriant 1: Either CT of the abdomen and pelvis with IV contrast, CT of the abdomen and pelvis without and with IV contrast, or CTA of the abdomen and pelvis with IV contrast are usually appropriate for the initial imaging of clinically suspected retroperitoneal bleed in a patient. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient’s care). The panel did not agree on recommending aortography of the abdomen and pelvis for the initial imaging of clinically suspected retroperitoneal bleed. There is insufficient medical literature to conclude whether or not these patients would benefit from this modality for this clinical scenario. Initial imaging in this patient population is controversial but may be appropriate when there is a need for simultaneous treatment intervention.

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with

		a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

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. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). 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*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

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