New 2025

American College of Radiology
ACR Appropriateness Criteria®
Abdominal Pain-Child

Variant: 1 Child. Acute abdominal pain. Suspected constipation. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
Radiography abdomen and pelvis	May Be Appropriate	☢☢☢
US abdomen	Usually Not Appropriate	O
US duplex Doppler abdomen	Usually Not Appropriate	O
Radiography pelvis	Usually Not Appropriate	☢☢
Fluoroscopy barium enema single-contrast	Usually Not Appropriate	☢☢☢☢
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢☢
MRI abdomen and pelvis with 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
CT abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢

Variant: 2 Child. Acute abdominal pain. Suspected intussusception. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
US abdomen	Usually Appropriate	O
Radiography abdomen and pelvis	May Be Appropriate	☢☢☢
US duplex Doppler abdomen	Usually Not Appropriate	O
Fluoroscopy barium enema single-contrast	Usually Not Appropriate	☢☢☢☢
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢☢
MRI abdomen and pelvis with 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
CT abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢

Variant: 3 Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
Radiography abdomen and pelvis	Usually Appropriate	☢☢☢
US abdomen	May Be Appropriate	O
US duplex Doppler abdomen	May Be Appropriate	O
CT abdomen and pelvis with IV contrast	May Be Appropriate	☢☢☢☢
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢☢
Fluoroscopy small bowel follow-through	Usually Not Appropriate	☢☢☢☢
Fluoroscopy upper GI series	Usually Not Appropriate	☢☢☢

Fluoroscopy upper GI series with small bowel follow-through	Usually Not Appropriate	☢☢☢☢
MRI abdomen and pelvis with 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
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen with IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢

Variant: 4 Child. Acute abdominal pain. Suspected surgical complication. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
Radiography abdomen and pelvis	Usually Appropriate	☢☢☢
CT abdomen and pelvis with IV contrast	Usually Appropriate	☢☢☢☢
US abdomen	May Be Appropriate	O
US duplex Doppler abdomen	Usually Not Appropriate	O
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢☢
Fluoroscopy small bowel follow-through	Usually Not Appropriate	☢☢☢☢
Fluoroscopy upper GI series	Usually Not Appropriate	☢☢☢
Fluoroscopy upper GI series with small bowel follow-through	Usually Not Appropriate	☢☢☢☢
MRI abdomen and pelvis with 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
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen with IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢

Variant: 5 Infant. Suspected necrotizing enterocolitis. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
US abdomen	Usually Appropriate	O
Radiography abdomen and pelvis	Usually Appropriate	☢☢☢
US duplex Doppler abdomen	Usually Not Appropriate	O
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢☢
MRI abdomen and pelvis with 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
CT abdomen and pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢☢

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Summary of Literature Review

Introduction/Background

The range of pathology that can produce abdominal pain in children is not only broad but can vary with age. Because of the wide differential and the inability for a child to clearly identify and describe the nature of their abdominal pain, diagnostic imaging is often needed.

This document will focus on the common causes of acute, nontraumatic abdominal pain in neonates and children that have not been covered in prior Appropriateness Criteria topics, although there will be some overlap with ACR Appropriateness Criteria® topics on "Vomiting in Infants" [1] and "Suspected Small-Bowel Obstruction" [2]. Appendicitis is the most common serious cause of acute, nontraumatic abdominal pain in children and is covered in the ACR Appropriateness Criteria® topic on "Right Lower Quadrant Pain" [3]. Suspected constipation and intussusception are common clinical indications for children presenting with acute, nontraumatic abdominal pain. Bowel obstruction can present with acute abdominal pain and the imaging modality and underlying cause may differ depending on the history of prior surgery. Lastly, in neonates, pain can only be inferred when bowel edema, ischemia, and perforation occur in the setting of necrotizing enterocolitis (NEC).

Special Imaging Considerations

There are many emerging applications for contrast-enhanced ultrasound (US), including bowel applications such as inflammatory bowel disease and NEC [4]. In addition, helpful in assessing bowel perfusion, dual-energy CT (DECT) has been used in the setting of NEC to differentiate between the neonates with and those without bowel ischemia [5]. Oral contrast for CT of the abdomen and pelvis may not be needed for evaluation of acute abdominal pain, although there is still debate for patients with body mass index <25 [6].

The ACR defines practice parameters and technical standards for US examinations. These US examinations are ordered by clinicians and performed in radiology departments with interpretation by radiologists. For the purposes of this document, the examination, listed on the variant tables and described in the variants discussed later, is the US procedure as defined by the ACR practice parameters and technical standards.

Deviations from these examinations include but are not limited to targeted point-of-care US (POCUS), Focused Assessment with Sonography for Trauma (FAST), and extended-FAST (E-FAST). These examinations are often performed at bedside as part of a clinical examination, are fundamentally different from comprehensive diagnostic US examinations, are not performed in the radiology department, and are not interpreted by radiologists.

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: Child. Acute abdominal pain. Suspected constipation. Initial imaging.

Constipation is one of the most common causes of abdominal pain in children [7]. Although functional constipation can typically be diagnosed through a thorough history and physical examination alone [8], the clinical history and physical examination may be unreliable. Some aspects of a thorough physical examination, such as digital rectal examination, may be deemed too invasive [9]. The Rome criteria, developed by the Rome Foundation, serve as the diagnostic standard but are often impractical to use in acute care due to their complexity and length [9]. As a result, imaging is frequently utilized to support the diagnosis.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
A. CT abdomen and pelvis with IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis with intravenous (IV) contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
B. CT abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without and with IV contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
C. CT abdomen and pelvis without IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without IV contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
D. Fluoroscopy barium enema single-contrast

There is no relevant literature to support the use of fluoroscopy barium enema single-contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
E. Fluoroscopy contrast enema

There is no relevant literature to support the use of fluoroscopy contrast enema for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
F. MRI abdomen and pelvis with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis with IV contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
G. MRI abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without and with IV contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
H. MRI abdomen and pelvis without IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without IV contrast for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
I. Radiography abdomen and pelvis

The North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) guidelines recommend against the routine ordering of abdominal radiographs for pediatric functional constipation because multiple studies have shown that abdominal and pelvic radiographs have low sensitivity, specificity, and poor interrater reliability and add minimal to low value in the evaluation of constipation [10-12]. A systematic review in 2005 demonstrated that abdominal radiographs are unreliable for diagnosing constipation because of conflicting evidence and poor interrater reliability [11]. A follow-up systemic review in 2012, which included a total of six studies, four of which were included in the earlier review, showed the sensitivity to range from 60% to 80% and the specificity to range from 43% to 99% [13-19]. More recent studies demonstrate sensitivity range of 63% to 87%, specificity range of 26.8% to 51%, positive predictive value (PPV) range of 18% to 67%, and negative predictive value (NPV) range of 54.3% to 90% [9,20,21].

Colonic transition time using radiography and radiodense markers can also be used to diagnose constipation. A cutoff time of 54 hours demonstrates a sensitivity of 79% and 92%, respectively [18].

Although radiographs of the abdomen and pelvis are not recommended by NASPGHAN and other societies in the setting of known constipation, in the acute abdominal pain setting, the radiograph sensitivity is reasonably high and they may be performed to emergently exclude other pathologies.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
J. Radiography pelvis

There is no relevant literature to support the use of radiography pelvis for initial evaluation with patients suspected of having constipation.

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
K. US abdomen

There is no relevant literature to support the use of US abdomen for initial evaluation with patients suspected of having constipation.

However, POCUS has been used by emergency physicians to measure the transrectal diameter in a prospective, cohort study in children presenting with abdominal pain to a pediatric emergency department. This study found that a cutoff of ≥3.8 cm can diagnose constipation with a sensitivity of 86%, specificity of 71%, NPV of 87%, and PPV of 70% [9].

Variant 1: Child. Acute abdominal pain. Suspected constipation. Initial imaging.
L. US duplex Doppler abdomen

There is no relevant literature to support the use of US duplex Doppler abdomen for initial evaluation with patients suspected of having constipation.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.

Intussusception is common in children, with approximately 35 cases per 100,000 infants since 2000 [22]. The rates vary by age, with a peak of 62 per 100,000 at 6 to 7 months of age [22]. The most common presenting symptom is colicky abdominal pain or crying, followed by vomiting, fever, and blood in the stool [23]. Seventy-five percent of pediatric ileocolic intussusceptions are idiopathic [24]. Ileocolic intussusceptions can also be seen postoperatively or due to a lead point such as Meckel's diverticulum [23,25]. Most small-bowel intussusceptions are usually transient unless there is a lead point such as intussusception related to gastrojejunal tubes [23,26].

Treatment for ileocolic intussusception includes image-guided enema or surgery. Imaging options available for intussusception reduction techniques include fluoroscopic- or US-guided air or water-soluble contrast enema.

Ileocolic intussusception is considered a pediatric emergency because delay in treatment is associated to mortality and morbidity. In a prospective intussusception surveillance of infants from seven hospitals in Tanzania, 55% (114 of 207) had intestinal resection, and the overall case-fatality rate was 30% (62 of 206) [27]. Sixty-eight percent of these infants had abdominal USs prior to surgery, and image-guided enema reduction was not available [27]. Compared with infants who survived, those who died had longer duration of symptoms before admission to a treatment hospital (median 4 versus 3 days, $P < .01$), had higher rate of intestinal resection (81% versus 44%, $P < .001$), and came from families with lower incomes [27]. Delay in diagnosis and treatment can lead to morbidity and mortality; however, the urgency of image-guided reduction remains conflicting because the exact timing of symptom onset can be difficult to accurately elicit due to the patients' age. A study by Lampl et al [28] showed that median time to nonsurgical intervention was higher among patients who ultimately underwent surgery than among those who did not require surgery (17.9 versus 7.0 hours, $P < .0001$). In recent retrospective reviews by Williams et al [29] and Mertiri et al [30], there was no difference in intussusception reduction efficacy or complication rate in patients with increasing time between imaging diagnosis of ileocolic intussusception and reduction attempt, including delay intervals up to 8 hours.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
A. CT abdomen and pelvis with IV contrast

CT can be used to diagnose intussusception, although it is not considered to be a first-line imaging test because of the excellent performance of US. CT abdomen and pelvis with IV contrast can be used as an adjunct to small-bowel intussusceptions to evaluate for underlying pathology [31].

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
B. CT abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without and with IV contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.

C. CT abdomen and pelvis without IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without IV contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
D. Fluoroscopy barium enema single-contrast

There is no relevant literature to support the use of fluoroscopy barium enema single-contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
E. Fluoroscopy contrast enema

US has largely replaced contrast enema as the initial imaging for diagnosing intussusception. Fluoroscopic-guided contrast enema is reserved for secondary imaging for diagnosis when US is nondiagnostic and for treatment when US is positive. Burns et al [32] found that contrast enema fluoroscopic screen time for diagnosis of intussusception is shorter than that previously described, median of 138 seconds for positive cases, 86 seconds for negative cases, and 138 seconds for uncertain cases.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
F. MRI abdomen and pelvis with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis with IV contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
G. MRI abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without and with IV contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
H. MRI abdomen and pelvis without IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without IV contrast for initial evaluation with patients suspected of intussusception.

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
I. Radiography abdomen and pelvis

In a retrospective cohort study of children aged 3 months to 3 years of age, 2-view abdominal radiograph has a sensitivity of 62.3% and a specificity of 86.7% [33], lower than that of US. There is literature that suggests sensitivity and specificity may be increased with a deep learning-based algorithm. In one study, the algorithm's performance was better than that in both residents and faculty, with a sensitivity of 76% (compared with 36% and 56% for residents and faculty, respectively) and a specificity of 96% (compared with 91% and 92% for residents and faculty, respectively) [34]. Another study using deep learning–based algorithm demonstrated a mean area under the curve and Youden Index of 0.94 and 0.74, respectively, with the internal test data set and statistically significantly lower values with the external test data set ($P < .001$) [35]. Therefore, radiographs with artificial intelligence assistance is promising.

When considering abdominal radiograph in conjunction with US, the usefulness remains controversial. A retrospective review of 182 cases by Patel et al [36], showed that patients with bowel obstruction on radiographs had a statistically significant decreased rate of therapeutic enema success (83% versus 21%, P = .0001), increased complicated surgical reductions (47% versus 4%, P = .0012), and increased bowel resection (42% versus 4%, P = .003) compared with those with normal bowel gas pattern. Another retrospective review of 644 cases of intussusception treated with pneumatic reduction at a single institution over a 15-year study period, abdominal radiographs could not differentiate between positive and negative intussusceptions, successful and unsuccessful reduction attempts, or occult pneumoperitoneum [37]. A clinical pathway may include an abdominal radiograph or POCUS for intussusception, followed by confirmation of an ileocolic intussusception via a radiology-performed US prior to reduction attempt [38].

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
J. US abdomen

US is currently the first-line imaging modality, for diagnosing intussusception with high sensitivity and specificity [39]. A systematic review and meta-analysis, which included 14 studies, demonstrated a pooled sensitivity and specificity of 94% and 96%, respectively [40]. Another systematic review and meta-analysis, which included 37 studies, showed a pooled sensitivity and specificity of 96% and 97%, respectively [41]. Please note that these meta-analyses include both diagnostic US and POCUS data and have found the diagnostic performance to be similar between the diagnostic US and POCUS for the diagnosis of intussusception [41].

Variant 2: Child. Acute abdominal pain. Suspected intussusception. Initial imaging.
K. US duplex Doppler abdomen

There is no relevant literature to support the use of US duplex Doppler abdomen for initial evaluation with patients suspected of intussusception.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

Some pediatric bowel obstructions can be a surgical emergency because the obstruction can lead to bowel ischemia, perforation, or sepsis. Hence, prompt and accurate diagnosis of the underlying cause is critical for management. Unfortunately, there are many etiologies for bowel obstruction in children without a prior surgery, and diagnosis will require both clinical assessment and imaging. A common category is inflammation or infection, such as acute appendicitis, which has been covered in the ACR Appropriateness Criteria® topic on "Right Lower Quadrant Pain" [3], or inflammatory bowel disease, which has been covered in the ACR Appropriateness Criteria® topic on "Crohn Disease-Child" [42]. A broad category that commonly affects neonates, infants, or preschool-age children includes congenital abnormalities such as midgut malrotation predisposing to midgut volvulus, Meckel's diverticulum or omphalomesenteric bands leading to segmental volvulus, and bowel-containing hernias, which have been covered in the Appropriateness Criteria® topics on "Vomiting in Infants" [1] and "Hernia" [43]. Acquired or idiopathic obstructions from foreign body ingestion, such as trichobezoars or superabsorbent materials, such as water beads, or intussusception are often encountered in children.

Imaging plays a crucial role in this scenario by identifying the location, severity, and potential etiology of the obstruction to guide the appropriate course of treatment, whether it involves conservative management or surgical intervention [44]. For example, in a study by Chang et al [45] evaluating strangulated small-bowel obstruction (SBO), they found that combined clinicoradiological parameters provided stronger evidence of bowel strangulation than either the clinical or radiological parameters alone.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal

surgery. Initial Imaging.
A. CT abdomen and pelvis with IV contrast

CT abdomen and pelvis with IV contrast is sensitive in diagnosing SBO in children. A recent retrospective review by Halepota et al [46] reported the sensitivity, specificity, PPV, NPV, and accuracy of CT with IV contrast and no oral contrast in children 2 to 16 years of age to be 97.4%, 81.8%, 94.9%, 90.0%, and 93.9%, respectively. Chang et al [45] found that wall thickness and/or reduced wall contrast enhancement in CT and ascites on US combined with the clinical score of 2 increases the likelihood ratio.

Although CT abdomen and pelvis is not recommended as the initial imaging modality for all children with suspected bowel obstruction, it may be useful in scenarios in which the child is very ill-appearing and concurrent cross-sectional imaging is needed for diagnosis, regardless of the presence or absence of bowel obstruction on radiography.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
B. CT abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without and with IV contrast for initial evaluation of patients with suspected SBO. In adults, adding unenhanced CT to contrast-enhanced CT improved the sensitivity, diagnostic confidence, and interobserver agreement of the diagnosis of ischemia from mechanical SBO [47]. The unenhanced CT allowed for detection of transmural hemorrhagic necrosis from ischemia that would be masked on contrast enhanced only CT [47].

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
C. CT abdomen and pelvis without IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
D. CT abdomen with IV contrast

There is no relevant literature to support the use of CT abdomen with IV contrast for initial evaluation of patients with suspected SBO. Please note that the CT abdomen coverage includes the lung bases and upper two-thirds of the abdomen. Therefore, CT abdomen without the pelvis is inadequate for the evaluation of the entire bowel.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
E. CT abdomen without and with IV contrast

There is no relevant literature to support the use of CT abdomen without and with IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
F. CT abdomen without IV contrast

There is no relevant literature to support the use of CT abdomen without IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

G. Fluoroscopy contrast enema

A study by Baad et al [48] evaluated the diagnostic performance and relationship between clinical characteristics, imaging findings, and final diagnosis for the neonatal contrast enema. They found that contrast enema had moderate specificity (87.7%) and low sensitivity (65.5%) for Hirschsprung disease; abnormal rectosigmoid ratio and serrations showed high specificities (90.3%, 97.4%) but low sensitivities (46.6%, 17.2%). Contrast enema showed high specificity (97.4%) and low sensitivity (56.3%) for meconium ileus blinded to cystic fibrosis status; microcolon was specific (96.6%) but not sensitive (68.8%) for meconium ileus; contrast enema showed the highest PPV (73.1%) (specificity 95.6%, sensitivity 82.6%) for small intestinal/colonic atresia; microcolon with an abrupt cutoff was specific (99.1%) but not sensitive (41.3%) for atresias.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

H. Fluoroscopy small bowel follow-through

There is no relevant literature to support the use of fluoroscopy small bowel follow-through for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

I. Fluoroscopy upper GI series

There is no relevant literature to support the use of fluoroscopy upper gastrointestinal (GI) series for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

J. Fluoroscopy upper GI series with small bowel follow-through

There is no relevant literature to support the use of fluoroscopy upper GI series with small bowel follow-through for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

K. MRI abdomen and pelvis with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis with IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

L. MRI abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without and with IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.

M. MRI abdomen and pelvis without IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without IV contrast for initial evaluation of patients with suspected SBO.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal

surgery. Initial Imaging.
N. Radiography abdomen and pelvis

The use of abdominal and pelvic radiography is ubiquitous in the setting of acute abdominal pain to rule out intraabdominal pathologies given the high NPV. In an older study looking at the adult population, the highest sensitivity of abdominal radiography was 90% for intraabdominal foreign body and 49% for bowel obstruction [49]. A more recent study assessing the diagnostic yield of abdominal radiographs in the evaluation of intraabdominal pathology in the pediatric emergency department demonstrated 44% sensitivity, 70% specificity, 17% PPV, and 90% NPV ($P < .05$) [21]. When focusing on just abdominal pain and vomiting as clinical indications, the sensitivity, specificity, PPV, and NPV are 31%, 75%, 11%, and 92% and 51%, 65%, 19%, and 89%, respectively [21]. Oral contrast challenges with serial abdominal and pelvic radiographs can be both diagnostic and therapeutic for SBO, but have only been validated in the setting of adhesive SBO [50].

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
O. US abdomen

There are no recent dedicated publications on the performance of US for SBO in children. However, SBO may be due to underlying etiologies in which US is usually useful as the initial imaging study such as acute appendicitis, intussusception, and midgut malrotation with volvulus.

Variant 3: Child. Acute abdominal pain. Suspected bowel obstruction. No prior abdominal surgery. Initial Imaging.
P. US duplex Doppler abdomen

Along with the discussion in the Appropriateness Criteria® topic on "Vomiting in Infants" [1], Esposito et al [51] evaluated 34 patients with malrotation or malrotation with volvulus as a cause for abdominal pain. Abdominal US with Doppler prior to surgery diagnosed midgut volvulus by identifying the whirlpool sign in 81% of patients (22 of 27). A systematic review and meta-analysis performed in 2020, which included the Esposito article, showed that US with Doppler has a summary sensitivity of 94% and specificity of 100% for the diagnosis of midgut malrotation with or without volvulus [52]. It is important to note that although these studies mention abdominal US with Doppler, it is not the conventional evaluation of the solid organs and the hepatic veins, portal veins, hepatic arteries, splenic veins, and splenic arteries.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging.

In children presenting with acute abdominal pain and a prior history of surgical intervention, imaging plays a critical role in diagnosis and guiding appropriate management. The primary goal of imaging in this scenario is to accurately assess the underlying cause of the abdominal pain while also evaluating for potential surgical complications or recurrences related to the previous procedure. Frequently encountered postsurgical complications include adhesions leading to SBO, abscess formation, and internal hernias [53]. In a study evaluating strangulated SBO in children, 36% of patients had a previous abdominal surgery [45].

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging.
A. CT abdomen and pelvis with IV contrast

The primary benefit of CT in this setting is the potential to identify patients with high-grade obstruction who have bowel ischemia or otherwise require bowel resection [54]. In a study by Chang et al [45], a total of 31 of 69 (44.9%) children with bowel obstruction underwent preoperative abdominal CT scans, and 22.2% of those revealed bowel obstruction with suspected ischemic changes, such as increased bowel wall thickening and/or diminished wall contrast enhancement as assessed by CT. The sensitivity and specificity of CT for bowel strangulation were 50% and 94.1%, respectively. In a mixed pediatric and adult population undergoing laparoscopic Roux-en-Y gastric bypass, 5% (46 of 914) of patients developed internal hernia. CT scan was consistent with the presence of an internal hernia in 26 patients (57.5%), suggestive in 7 patients (15.6%), and demonstrated the presence of SBO without a specific reason in 4 patients (8.9%) [53].

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. B. CT abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without and with IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. C. CT abdomen and pelvis without IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. D. CT abdomen with IV contrast

There is no relevant literature to support the use of CT abdomen with IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery. Please note that the CT abdomen coverage includes the lung bases and upper two-thirds of the abdomen. Therefore, CT abdomen without the pelvis is inadequate for the evaluation of the entire bowel and structures within the pelvis, which may include abscesses.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. E. CT abdomen without and with IV contrast

There is no relevant literature to support the use of CT abdomen without and with IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. F. CT abdomen without IV contrast

There is no relevant literature to support the use of CT abdomen without IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. G. Fluoroscopy contrast enema

There is no relevant literature to support the use of fluoroscopy contrast enema as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. H. Fluoroscopy small bowel follow-through

There is no current literature to support fluoroscopy small bowel follow-through as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery. Fluoroscopy small bowel follow-through is used in clinical practice when adhesive SBO is suspected, usually after an abdominal radiograph. Hypertonic oral contrast can be both diagnostic and therapeutic for identifying which cases can be treated conservatively, as the hyperosmolar agent intraluminally draws water from the bowel wall to reduce edema and promote bowel motility and break through the adhesion [55]. The diagnostic sensitivity as a predictor for adhesive SBO resolution was 100%, with 90% specificity [56].

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. I. Fluoroscopy upper GI series

There is no current literature that supports the use of fluoroscopy upper GI series as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery. Fluoroscopic upper GI series may be performed if there is a concern for leak or obstruction following bariatric surgery or malposition after gastrostomy tube placement in the clinical setting.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. J. Fluoroscopy upper GI series with small bowel follow-through

There is no relevant literature to support the use of fluoroscopy upper GI series with small bowel follow-through as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. K. MRI abdomen and pelvis with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis with IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. L. MRI abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without and with IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. M. MRI abdomen and pelvis without IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without IV contrast as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging. N. Radiography abdomen and pelvis

A recent study assessing the diagnostic yield of abdominal radiographs in the evaluation of intraabdominal pathology in the pediatric emergency department demonstrated 44% sensitivity, 70% specificity, 17% PPV, and 90% NPV ($P < .05$) [21]. When looking at SBO related to adhesions, multiple, dilated, gaseous bowel loops (classic for adhesive SBO) were seen in 59% (123 of 207), and paucity of gas in 41% (84 of 207) [57]. In their cohort, they found that the patients with paucity of bowel gas had a higher association with high-grade or closed-loop obstruction than dilated gaseous loops on abdominal radiography. Chang et al [45], looking at strangulated small bowel in children, had abdominal radiographs in 64 of the 69 children. Of those, 22 (51.2%) showed bowel obstruction. Hypertonic oral contrast challenges serial abdominal and pelvic radiographs can be both diagnostic and therapeutic for adhesive SBO [50]. The appearance of water-soluble contrast in the colon on an abdominal radiograph within 24 hours of its administration, predicts resolution of an adhesive SBO with a pooled sensitivity of 97% and specificity of 96% [50]. Similar to the fluoroscopy small bowel follow-through, the hyperosmolar agent intraluminally draws water from the bowel wall to reduce edema and promote bowel motility and break through the adhesion [55]. The diagnostic sensitivity as a predictor for adhesive SBO resolution was 100%, with a specificity of

90% [56].

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging.
O. US abdomen

Although abdominal US is commonly used clinically to evaluate for fluid collections in the postoperative setting, there are no recent dedicated publications on the performance of US for abdominal pain with prior history of surgery in children. Within a study by Chang et al [45], looking at strangulated small bowel in children, 44 of the 69 children had abdominal US. Of those, 22 (50%) showed bowel obstruction and ascites. Postoperative intussusceptions have been published following various abdominal surgeries and hence abdominal US may be useful similarly to Variant 2. However, there are no pediatric studies looking at the diagnostic usefulness or performance of US in this setting.

Variant 4: Child. Acute abdominal pain. Suspected surgical complication. Initial imaging.
P. US duplex Doppler abdomen

There is no relevant literature to support the use of US duplex Doppler abdomen as the initial evaluation of children with acute abdominal pain and known prior abdominal surgery.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.

NEC is an intestinal disease primarily affecting premature infants and is one of the main causes of neonatal death in the neonatal intensive care unit [58]. The estimated mortality rate associated with NEC ranges between 20% and 30%, with the highest rate among infants requiring surgery [59]. Imaging plays a vital role in staging and management of NEC, as abdominal radiograph is incorporated into the Bell Staging diagnostic criteria [60]. Although US has not been included in any iterations of the Bell Staging system, many recent studies have investigated its use for diagnosing and managing NEC.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
A. CT abdomen and pelvis with IV contrast

An observational study involved 21 patients with NEC stages 2-A, 2-B, and 3-A who underwent DECT. Twelve patients (57.1%) without ischemia were followed up without surgery, whereas 9 patients (42.9%) with ischemia detected on DECT underwent surgical intervention, including resection and anastomosis or ileostomy and colostomy [5]. DECT was found to have 100% sensitivity, 100% specificity, and 100% PPV for detecting bowel ischemia [5].

Although the data are promising, the small number of patients limits its generalizability. Additionally, CT abdomen and pelvis with IV contrast looking for bowel ischemia should be reserved for secondary imaging, after confirmation of NEC by clinical signs and symptoms and radiographs and/or US of the abdomen and pelvis.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
B. CT abdomen and pelvis without and with IV contrast

An observational study involved 21 patients with NEC stages 2-A, 2-B, and 3-A who underwent DECT. Twelve patients (57.1%) without ischemia were followed up without surgery, whereas 9 patients (42.9%) with ischemia detected on DECT underwent surgical intervention, including resection and anastomosis or ileostomy and colostomy [5]. DECT was found to have 100% sensitivity, 100% specificity, and 100% PPV for detecting bowel ischemia [5].

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
C. CT abdomen and pelvis without IV contrast

There is no relevant literature to support the use of CT abdomen and pelvis without IV contrast for initial evaluation of patients with suspected NEC.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
D. Fluoroscopy contrast enema

There is no relevant literature to support the use of fluoroscopic contrast enema for the initial evaluation of patients with suspected NEC. Contrast enemas are reserved for evaluating strictures after NEC. In a retrospective study, contrast enema had a sensitivity of 66.7% and a specificity of 95.1% for evaluating post-NEC strictures [61]. Contrast enemas had a higher sensitivity than distal loopograms for detecting post-NEC colonic strictures (93% versus 50%, respectively) in a retrospective study of 68 neonates who underwent imaging prior to stoma closure [62]. However, contrast enemas are more likely to yield false-positive results and therefore have lower specificity (88% versus 95%, respectively) [62]. Another retrospective review performed over 10 years at a single center found a low yield of strictures identified by contrast enema prior to stoma closure (9 of 133), although most of those identified (8 of 9) were in patients with a diagnosis of NEC [63].

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
E. MRI abdomen and pelvis with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis with IV contrast for initial evaluation of patients with suspected NEC.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
F. MRI abdomen and pelvis without and with IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without and with IV contrast for initial evaluation of patients with suspected NEC.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
G. MRI abdomen and pelvis without IV contrast

There is no relevant literature to support the use of MRI abdomen and pelvis without IV contrast for initial evaluation of patients with suspected NEC.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
H. Radiography abdomen and pelvis

An abdominal and pelvis radiograph is the most common first-line imaging modality for NEC, as it is part of the Bell Staging diagnostic criteria [60]. A retrospective review of 80 infants demonstrated low sensitivity and high specificity for the following radiographic features of NEC: portal venous gas, pneumatosis intestinalis, and free air. The sensitivities were 13%, 42%, and 52%, respectively, and the specificities were 100%, 100%, and 92%, respectively [64]. A 10-point scale of abnormal findings (the Duke Abdominal Assessment Scale) was designed to standardized reporting of abdominal and pelvic radiographs in neonates with suspected NEC. However, the scale has high variability and is not routinely used in clinical practice [65,66].

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
I. US abdomen

The role of abdominal US for NEC is currently complementary to radiography of the abdomen, often used when radiography is inconclusive. However, there is an argument for US as the initial imaging study, as the area under the receiver operating curve for the radiography logistic model was 0.745 (95% confidence interval [CI], 0.629–0.812), which was statistically lower than the US logistic model, 0.857 (95% CI, 0.802–0.946) ($P = .014$) for predicting surgical NEC [67]. The same study found that a thick bowel wall (>2.5 mm), intramural gas (pneumatosis intestinalis), portal venous gas, and reduced peristalsis were independent diagnostic factors associated with surgical NEC, with peristalsis not seen on radiography [67]. In a prospective study of 26 infants with Bell Stage 2 or 3, the sensitivity, specificity, PPV, and NPV of US for the detection of bowel necrosis using color imaging were calculated as 100%, 95.4%, 80.0%, and 100%, respectively [68]. Thus, US can be used to identify surgical NEC before it becomes apparent on radiography.

Regarding the previously published sonographic findings, a systematic review and meta-analysis demonstrated all to have sensitivities below 70% and specificities largely above 80% for diagnosing definite NEC [69]. Another systematic review and meta-analysis showed the following US findings associated with surgery or death: pneumatosis, pneumoperitoneum, bowel wall echogenicity, bowel wall thickening/thinning, absent perfusion, absent peristalsis, complex ascites, focal fluid collection, and dilated bowel. Of those sonographic features, the ones with highest odd ratios include pneumoperitoneum (9.63, 95% CI, 1.65–56.32), absent peristalsis (10.68, 95% CI, 1.65–69.02), complex ascites (11.28, 95% CI, 4.23–30.04), and focal fluid collection (17.92, 95% CI, 3.11–103.31) [70]. Recently described sonographic features that include mesenteric thickening, hyperechogenicity of intestinal contents, abnormalities of the abdominal wall, and poor definition of the intestinal wall with odd ratios of 5.45, 4.64, 4.92, and 4.13, respectively [71].

A retrospective review of 54 infants with equivocal abdominal radiographs showed the presence of pneumatosis in 22 patients (41%), absence of pneumatosis in 31 patients (57%), and was equivocal in 1 patient. Of the 31 patients without pneumatosis on abdominal US, 25 patients (78%) were not treated for NEC and did not require treatment within 1 week following the negative US [72]. Hence, US may help detect early NEC and guide management for those who may not need antibiotics or a shorter course.

Variant 5: Infant. Suspected necrotizing enterocolitis. Initial imaging.
J. US duplex Doppler abdomen

A prospective clinical study with 62 newborns (29 in the NEC group and 33 in the control group) evaluated the superior mesenteric artery and portal vein. The authors found that a superior mesenteric artery resistive index of >0.75 has a sensitivity of 96.3% and a specificity of 90.9%, and a pulsatility index of >1.85 had a sensitivity of 88.9% and a specificity of 78.8% in predicting NEC [73]. Portal volumetric blood flow (Vflow) <37 mL/min was present in 89.7% of patients with NEC (odds ratio 11.7) [73]. Although the data are promising, the applicability of Doppler as a first imaging study is limited to technical challenges in accurately sampling small mesenteric vessels in premature infants. Therefore, this examination should be reserved for follow-up or problem-solving.

A case series has been published demonstrating the potential uses of contrast enhanced US in the setting of bowel disease in prematurity [74]. However, no performance data are currently available.

Summary of Highlights

This is a summary of the key recommendations from the variant tables. Refer to the complete narrative document for more information.

- **Variant 1**: For initial imaging of a child presenting with acute abdominal pain from suspected constipation, no imaging is recommended. However, in the acute setting, radiographs of the abdomen and pelvis may be appropriate to exclude other pathology and not necessarily to diagnose constipation given the reported low sensitivity, specificity, and interrater reliability.

- **Variant 2**: For initial imaging of a child presenting with acute abdominal pain from suspected intussusception, US of the abdomen is the recommended study. Radiographs of the abdomen and pelvis may be appropriate during the initial evaluation for diagnosis, although the sensitivity and specificity is lower than that of US. However, radiographs may exclude complications associated with intussusception, such as bowel obstruction or perforation.
- **Variant 3**: For initial imaging of a child presenting with acute abdominal pain from suspected bowel obstruction without prior abdominal surgery, radiography of the abdomen and pelvis is usually appropriate. Concurrent US of the abdomen without or with Doppler may be appropriate for evaluating congenital malformations (eg, midgut malrotation with volvulus, bowel atresia, or duplication cyst) or acquired abnormalities (eg, pyloric stenosis, intussusception, or complicated Meckel's diverticulum or appendicitis) that can cause bowel obstruction in children. CT abdomen and pelvis with IV contrast may be appropriate as part of the initial workup when radiographs are unrevealing, but clinical suspicion remains high.
- **Variant 4**: For initial imaging of a child presenting with acute abdominal pain from suspected surgical complications, both radiography and CT of the abdomen and pelvis are usually appropriate and equivalent alternatives. US of the abdomen may be appropriate to evaluate for complicated free fluid or complex fluid collections related to postoperative complications.
- **Variant 5**: For initial imaging of a child presenting with suspected NEC, both radiography of the abdomen and pelvis and US of the abdomen are usually appropriate and complementary.

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.

Gender Equality and Inclusivity Clause

The ACR acknowledges the limitations in applying inclusive language when citing research studies that predates the use of the current understanding of language inclusive of diversity in sex, intersex, gender, and gender-diverse people. The data variables regarding sex and gender used in the cited literature will not be changed. However, this guideline will use the terminology and definitions as proposed by the National Institutes of Health.

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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Disclaimer

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

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