



CLINICAL GUIDELINES

Pediatric Abdomen Imaging Guidelines

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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General Guidelines (PEDAB-1.0)

- A pertinent clinical evaluation since the onset or change in symptoms including a detailed history, physical examination, appropriate laboratory studies and basic imaging such as plain radiography or ultrasound should be performed prior to considering advanced imaging (CT, MR, Nuclear Medicine), unless the individual is undergoing guideline-supported scheduled imaging evaluation. A meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) since the onset or change in symptoms can serve as a pertinent clinical evaluation.
- These guidelines are based upon using advanced imaging to answer specific clinical questions that will affect individual management. Imaging is not indicated if the results will not affect individual management decisions. Standard medical practice would dictate continuing conservative therapy prior to advanced imaging in individuals who are improving on current treatment programs.
- Unless otherwise stated in a specific guideline section, the use of advanced imaging to screen asymptomatic individuals for disorders involving the abdomen is not supported. Advanced imaging should only be approved in individuals who have documented active clinical signs or symptoms of disease.
- Unless otherwise stated in a specific guideline section, repeat imaging studies of the same body area are not necessary unless there is evidence for progression of disease, new onset of disease, and/or documentation of how repeat imaging will affect individual management or treatment decisions.
- Ultrasound should be the initial imaging study of choice in most children with abdominal conditions and should be done prior to advanced imaging.
 - ◆ For those individuals who do require advanced imaging after ultrasound, ultrasound can be very beneficial in selecting the proper modality, body area, image sequences, and contrast level that will provide the most definitive information for the individual.
 - ◆ CPT® codes vary by body area and presence or absence of Doppler imaging and are included in the table at the beginning of this guideline.

Red Flags

- Children with abdominal pain AND ANY of the following red flag signs or symptoms require additional investigation. The initial ultrasound is not required. Additional labs may be helpful but are not required.
 - ◆ Pain that wakes the child from sleep
 - ◆ Unexplained fever (T >100.4°F)
 - ◆ History of malignancy with a likelihood or propensity to metastasize to abdomen
 - ◆ Dysphagia
 - ◆ GI bleeding
 - ◆ Significant vomiting
 - ◆ Elevated WBC per the testing laboratory's range
 - ◆ Low WBC (absolute neutrophil count <1000)
 - ◆ Guarding, rebound tenderness, or other peritoneal signs
 - ◆ Severe chronic diarrhea or nocturnal diarrhea in a toilet-trained child
 - ◆ Failure to thrive, involuntary weight loss, or delay in linear growth or pubertal development
 - ◆ Family history of inflammatory bowel disease, familial polyposis syndrome, celiac disease, or peptic ulcer disease
 - ◆ Abdominal mass, hepatomegaly, and/or splenomegaly on exam
 - ◆ Jaundice
 - ◆ Perianal disease
 - ◆ Suspected or confirmed COVID-19 infection with concern for multisystem inflammatory syndrome in children (MIS-C)
 - ◆ Failure to respond to 4 weeks of recent (within 60 days) provider directed conservative care
- See the condition-specific sections for when the above list of exclusionary criteria apply and lead directly to advanced imaging.
- The appropriate advanced imaging for the condition is listed in the condition-specific section.

Pediatric Abdominal Imaging Age Considerations (PEDAB-1.1)

- Many conditions affecting the abdomen in the pediatric population are different diagnoses than those occurring in the adult population. For those diseases that occur in both pediatric and adult populations, differences may exist in management due to individual age, comorbidities, and differences in disease natural history between children and adults.
- Individuals age 18 years old and younger¹³ should be imaged according to the Pediatric Abdomen Imaging Guidelines if discussed. Any conditions not specifically discussed in the Pediatric Abdomen Imaging Guidelines should be imaged according to the General Abdomen Imaging Guidelines. Individuals age >18 years old should be imaged according to the General Abdomen Imaging Guidelines, except where directed otherwise by a specific guideline section.

Pediatric Abdomen Imaging Appropriate Clinical Evaluation and Conservative Treatment (PEDAB-1.2)

- See: **General Guidelines (PEDAB-1.0)**

Pediatric Abdomen Imaging Modality General Considerations (PEDAB-1.3)

➤ Ultrasound

- ◆ See: **General Guidelines (PEDAB-1.0)**

➤ MRI

- ◆ MRI Abdomen is generally performed without and with contrast (CPT® 74183) unless the individual has a documented contraindication to gadolinium or otherwise stated in a specific guideline section.
- ◆ Due to the length of time required for MRI acquisition and the need to minimize individual movement, anesthesia is usually required for almost all infants (except neonates) and young children (age <7 years) as well as older children with delays in development or maturity. This anesthesia may be administered via oral or intravenous routes. In this individual population, MRI sessions should be planned with a goal of minimizing anesthesia exposure by adhering to the following considerations:
 - MRI procedures can be performed without and/or with contrast use as supported by these condition-based guidelines. If intravenous access will already be present for anesthesia administration and there is no contraindication for using contrast, imaging without and with contrast may be appropriate if requested. By doing so, the requesting provider may avoid repetitive anesthesia administration to perform an MRI with contrast if the initial study without contrast is inconclusive.
 - Recent evidence-based literature demonstrates the potential for gadolinium deposition in various organs including the brain, after the use of MRI contrast.
 - The U.S. Food and Drug Administration (FDA) has noted that there is currently no evidence to suggest that gadolinium retention in the brain is harmful and restricting gadolinium-based contrast agents (GBCAs) use is not warranted at this time. It has been recommended that GBCA use should be limited to circumstances in which additional information provided by the contrast agent is necessary and the necessity of repetitive MRIs with GBCAs should be assessed.
 - If multiple body areas are supported by eviCore's guidelines for the clinical condition being evaluated, MRI of all necessary body areas should be obtained concurrently in the same session.
- ◆ The presence of surgical hardware or implanted devices may preclude MRI.
 - The selection of best examination may require coordination between the provider and the imaging service. CT may be the procedure of choice in these cases.

➤ CT

- ◆ CT Abdomen typically extends from the dome of the diaphragm to the upper margin of the sacroiliac joints, and CT Abdomen and Pelvis extends from the dome of the diaphragm through the ischial tuberosities.
 - In general, CT Abdomen is appropriate when evaluating solid abdominal organs.
 - In general, CT Abdomen and Pelvis is appropriate when evaluating inflammatory or infectious processes, hematuria, or conditions that appear to involve both the abdomen and the pelvis.
 - In some cases, especially in follow-up of a known finding, it may be appropriate to limit the exam to the region of concern to reduce radiation exposure.
- ◆ The contrast level in pediatric CT imaging is specific to the clinical indication, as listed in the specific guideline sections.
- ◆ CT Abdomen or Abdomen and Pelvis may be indicated for further evaluation of abnormalities suggested on prior US or MRI studies.
- ◆ CT may be indicated without prior MRI or US as indicated in specific sections of these guidelines.
- ◆ CT should not be used to replace MRI in an attempt to avoid sedation unless listed as a recommended study in a specific guideline section.
- ◆ The selection of the best examination may require coordination between the provider and the imaging service.

➤ Nuclear Medicine

- ◆ Nuclear medicine studies are commonly used in evaluation of the pediatric kidney and gallbladder. Other less common indications exist as well:
 - Esophageal motility study (CPT® 78258) and/or Gastroesophageal reflux study (CPT® 78262) is indicated in the evaluation of gastroesophageal reflux.
- ◆ Nuclear intestinal imaging (preferred code for Meckel's Scan, CPT® 78290) or Gastric mucosa imaging (alternate code for Meckel's scan, CPT® 78261) is indicated for the following:
 - Suspected Meckel's diverticulum
 - Gastric mucosa imaging (CPT® 78261) is also indicated for:
 - Barrett's esophagus
 - Thoracic masses suspected of containing gastric mucosa
- ◆ Gastric emptying study (CPT® 78264) is indicated for evaluation of either suspected delayed or rapid gastric emptying.
- ◆ Gastric emptying study with small bowel transit (CPT® 78265) is indicated for evaluation of suspected abnormalities in both total and regional times for gastrointestinal transit of the small bowel.
- ◆ Gastric emptying study with small bowel and colon transit (CPT® 78266) is indicated for evaluation of suspected abnormalities in both total and regional times for gastrointestinal transit to the colon.
- ◆ Gastrointestinal bleeding scintigraphy (CPT® 78278) is indicated for evaluation of brisk active GI bleeding with indeterminate endoscopy.
- ◆ Gastrointestinal protein loss study (CPT® 78282) is indicated for decreased serum albumin or globulins and no evidence of GI bleeding.

- ◆ Peritoneal-venous shunt patency study (CPT® 78291) is indicated for evaluation of shunt patency and function in a individual with ascites.
- ◆ Nuclear renal imaging (CPT® 78701, CPT® 78707, CPT® 78708, or CPT® 78709) is indicated for evaluation of the following:
 - Renal transplant follow-up
 - Kidney salvage vs. nephrectomy surgical decisions
 - Acute renal failure with no evidence of obstruction on recent ultrasound
 - Chronic renal failure to estimate prognosis for recovery
- 3D Rendering
 - ◆ 3D Rendering indications in pediatric abdomen imaging are identical to those in the general imaging guidelines. See: **3D Rendering (Preface-4.1)** in the Preface Imaging Guidelines.

The guidelines listed in this section for certain specific indications are not intended to be all-inclusive; clinical judgment remains paramount and variance from these guidelines may be appropriate and warranted for specific clinical situations.

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Generalized Abdominal Pain (PEDAB-2)

- Chronic abdominal pain is a common complaint among children and adolescents. Functional abdominal pain disorders, including functional abdominal pain and functional dyspepsia (including symptoms of epigastric pain, burning, postprandial fullness, early satiety), are conditions in which there is no structural or organic disease.
- Children with no red flag signs or symptoms, normal physical examination, and normal laboratory studies (preliminary labs may include CBC, electrolytes, lipase, amylase, urinalysis, ESR, CRP, LFTs, and/or stool for blood and stool culture if diarrhea) should initially be evaluated by ultrasound (CPT® 76700 or CPT® 76705) and treated conservatively.
 - ◆ Gastroenterology (GI) specialist evaluation or consultation is helpful in determining the need for advanced imaging in these cases.
 - ◆ CT Abdomen (CPT® 74160) or Abdomen and Pelvis (CPT® 74177) with contrast are indicated if there are any red flag signs or symptoms (as listed in **General Guidelines (PEDAB-1.0)**)
- Children with abdominal pain that can be localized to a particular area of the abdomen should be imaged according to the relevant guideline section:
 - ◆ **Right Lower Quadrant Pain (PEDAB-3)**
 - ◆ **Flank Pain, Renal Stone (PEDAB-4)**
 - ◆ **Right Upper Quadrant Pain (PEDAB-8)**
 - ◆ **Left Upper Quadrant Pain (PEDAB-25)**
 - ◆ **Left Lower Quadrant Pain (PEDAB-29)**

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Right Lower Quadrant Pain (PEDAB-3)

- The presence of any red flag findings per **General Guidelines (PEDAB-1.0)** precludes adjudication based on any other criteria.
- Ultrasound (CPT® 76700 or CPT® 76705) is indicated as the initial examination. If positive or negative for appendicitis, no further imaging is necessary.
 - ◆ If the appendix is not visualized on ultrasound and the white blood cell count is not elevated, no further imaging is necessary in nearly all cases, although the referring physician should make the final determination of the need for advanced imaging.
- CT Abdomen and Pelvis with contrast (CPT® 74177), CT Abdomen and Pelvis without contrast (CPT® 74176), MRI Abdomen and Pelvis without contrast (CPT® 74181 and CPT® 72195), or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) is indicated for any of the following:
 - ◆ Individuals who are overweight (BMI ≥85th percentile for age)
 - ◆ Insufficient local ultrasound expertise exists
 - ◆ Ultrasound findings are inconclusive¹⁴
- If the appendix is absent, follow guidelines in: **Generalized Abdominal Pain (PEDAB-2)**

Background and Supporting Information

- CDC BMI Calculator for children ([BMI Calculator Child and Teen | Healthy Weight | CDC](#))

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Flank Pain, Renal Stone (PEDAB-4)

- The presence of any red flag findings per **General Guidelines (PEDAB-1.0)** precludes adjudication based on any other criteria.
- Flank Pain imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Flank Pain, Rule Out or Known Renal/Ureteral Stone (AB-4)** in the Abdomen Imaging Guidelines.
 - ◆ Ultrasound (CPT® 76770 or CPT® 76775) is the preferred initial study in children
 - ◆ CT Abdomen and Pelvis without contrast (CPT® 74176) is indicated if ultrasound is inconclusive.
 - ◆ MRI Abdomen (CPT® 74183) and Pelvis (CPT® 72197) without and with contrast is indicated if CT is inconclusive or if significant concern for radiation exposure from frequent CT use for a particular individual.
 - ◆ If hematuria is present, see: **Hematuria (PEDAB-7)** for imaging guidelines.
- Nuclear kidney imaging (CPT® 78707, CPT® 78708, CPT® 78709, or CPT® 78803) is indicated for evaluation of recurrent flank pain when CT and ultrasound are non-diagnostic, or for suspected obstructive uropathy.

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Urinary Tract Infection (UTI) (PEDAB-5)

Upper Urinary Tract (PEDAB-5.1)	18
Lower Urinary Tract (PEDAB-5.2)	19

Upper Urinary Tract (PEDAB-5.1)

- Ultrasound evaluation (CPT® 76770 or CPT® 76775) is initial imaging for all children with first time to diagnose hydronephrosis, pyelonephritis, or congenital renal anomaly.
 - ◆ If hydronephrosis is present, this should be further evaluated with voiding cystourethrography (VCUG), to evaluate for vesicoureteral reflux.
 - In boys, this is generally accomplished using fluoroscopic imaging and iodinated contrast to exclude urethral abnormalities.
 - In girls, Ureteral Reflux Study (Radiopharmaceutical Voiding Cystogram) (CPT® 78740) or fluoroscopic VCUG may be performed.¹⁵
 - Contrast Enhanced Voiding Urosonography (CeVUS) may also be utilized at institutions with expertise in this modality.¹⁵
- Diuretic renography using Tc-99m MAG 3 (CPT® 78707, CPT® 78708, or CPT® 78709) for:¹
 - ◆ Differentiating a dilated non-obstructed urinary system from a true stenosis (e.g., UPJ obstruction; ureteral-vesical junction [UVJ] obstruction).
 - ◆ Quantifying renal parenchymal function.
 - ◆ Ultrasound findings that are compatible with a multicystic dysplastic kidney to evaluate function of the affected kidney or a ureteral-pelvic junction (UPJ) obstruction of the contralateral kidney.
 - ◆ Diagnostic evaluation of upper tract dilatation when VCUG is negative.
 - ◆ Renal function evaluation in individuals with hydronephrosis.
- CT is sensitive in diagnosing pyelonephritis and has a role in evaluation of renal abscess or unusual complications such as xanthogranulomatous pyelonephritis but has no role in the routine evaluation of UTI.
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) is appropriate to evaluate the entire genitourinary tract for congenital abnormalities of distal tracts in complicated pyelonephritis.¹⁵
- Magnetic resonance urography (MRU) (CPT® 74183 and CPT® 72197), is not a first-line test for the routine evaluation of a UTI, but may be appropriate (where available) for investigation of a dilated upper urinary tract.
 - ◆ NOTE: MRU requires sedation in young children.
 - ◆ MRU can also quantitate renal function.
- Technetium-99m-dimercaptosuccinic acid (Tc-99m DMSA) scintigraphy (CPT® 78700, CPT® 78701, or CPT® 78803), is sensitive for evaluation of renal cortical damage.^{11, 13}
 - ◆ DMSA scintigraphy is indicated for:
 - Individuals with atypical or recurrent febrile acute urinary tract infections.¹¹
 - Atypical findings may include poor response to antibiotics, elevated creatinine, poor urine stream, or non E-coli organism.
 - Individuals with febrile urinary tract infections older than 5 years of age with known vesicoureteral reflux.¹⁴
 - For detection of post-pyelonephritic renal scarring at least 6 months after the documented upper tract UTI in high-risk individuals with recurrent UTIs.¹³

- Radiopharmaceutical nuclear medicine imaging (CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, CPT® 78830, CPT® 78831, or CPT® 78832) is indicated for evaluation of suspected pyelonephritis or diffuse interstitial nephritis.
- Nuclear non-imaging renal function study (CPT® 78725) is a quantitative study that can be used to evaluate renal function.
- Children with atypical (poor response to antibiotics within 48 hours, sepsis, poor urine stream, raised creatinine, or non-E. coli UTI) or recurrent febrile UTI may be imaged with US kidneys and bladder (CPT® 76770 or CPT® 76775) (preferred) and/or Voiding cystourethrography (CPT® 78740).

Lower Urinary Tract (PEDAB-5.2)

- Ultrasound evaluation (CPT® 76770 or CPT® 76775) is initial imaging for all children with first time UTI to diagnose hydronephrosis, pyelonephritis, or congenital renal anomaly.
 - ◆ Fluoroscopic Voiding cystourethrography (VCUG) is indicated for detection of possible vesico-ureteral reflux (VUR) in neonates or young children when hydronephrosis is seen on ultrasound.
- The American Academy of Pediatrics clinical practice guidelines no longer recommend routine VCUG for infants and young children from 2 to 24 months of age after the first febrile UTI.
 - ◆ The current recommendation is to postpone the VCUG until the second febrile UTI UNLESS there are:
 - Atypical or complex clinical circumstances.
 - Renal/bladder ultrasound reveals hydronephrosis, scarring, or obstructive uropathy.
- Vesicoureteral Reflux (VUR)
 - ◆ Fluoroscopic VCUG is typically performed for diagnosis and grading of VUR, and should be the first modality used for diagnosis.
 - ◆ Ureteral Reflux Study (Radiopharmaceutical Voiding Cystogram) (CPT® 78740), fluoroscopic VCUG, or CeVUS may be used for follow up imaging of VUR¹⁵
- Male individuals with first UTI should be evaluated with fluoroscopic VCUG studies rather than radionuclide cystography, to visualize the male urethra for possible abnormalities such as posterior urethral valves, strictures, or diverticula.
- For female individuals, radionuclide cystography (CPT® 78740) or fluoroscopic VCUG, may be used as the initial study.
- MR urography is indicated for evaluation of ectopic distal ureteral insertion, or other complex lower urinary tract anatomy.
- Siblings of individuals with known vesicoureteral reflux can undergo Ureteral Reflux Study (Radiopharmaceutical Voiding Cystogram) (CPT® 78740) if they have renal scarring on ultrasound or history of UTI and no prior evaluation for VUR.

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Pediatric Acute Gastroenteritis (PEDAB-6)

- Advanced imaging is not indicated in pediatric acute gastroenteritis, unless there is a concern for diagnosis other than acute gastroenteritis. See specific symptom/diagnosis sections listed below.
- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated if abdominal red flag symptoms are present as listed in **General Guidelines (PEDAB-1.0)**.
- Additional imaging studies will depend on the specific symptoms. See the following sections for additional imaging guidelines:
 - ◆ **Generalized Abdominal Pain (PEDAB-2)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Right Lower Quadrant Pain (PEDAB-3)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Right Upper Quadrant Pain (PEDAB-8)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Inflammatory Bowel Disease, Crohn Disease, or Ulcerative Colitis (PEDAB-9)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Constipation, Diarrhea, and Irritable Bowel Syndrome (PEDAB-12)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Abdominal Mass (PEDAB-13)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Left Upper Quadrant (PEDAB-25)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Intussusception (PEDAB-27)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Bowel Obstruction (PEDAB-28)** in the Pediatric Abdomen Imaging Guidelines
 - ◆ **Left Upper Quadrant Pain (PEDAB-29)** in the Pediatric Abdomen Imaging Guidelines

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Hematuria (PEDAB-7)

Hematuria is a relatively common complaint in pediatric individuals, and the imaging considerations are different from those occurring in adult individuals.

- Ultrasound kidneys (CPT® 76770 or CPT® 76775) and bladder (CPT® 76856 or CPT® 76857) for asymptomatic gross hematuria or microscopic hematuria with proteinuria present.
- No imaging is appropriate for asymptomatic microscopic hematuria without proteinuria.
- For painful hematuria and no recent trauma, ANY of the following studies can be approved:
 - ◆ CT Abdomen and Pelvis without contrast (CPT® 74176)
 - ◆ Ultrasound kidneys (CPT® 76770 or CPT® 76775)
 - ◆ Ultrasound bladder (CPT® 76856 or CPT® 76857)
- For hematuria and recent trauma, the following studies are indicated:
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177)
 - ◆ CT Cystography (CT Pelvis with bladder contrast – CPT® 72193), if gross hematuria is present and pelvic fracture or traumatic bladder injury is suspected.

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Right Upper Quadrant Pain (PEDAB-8)

- The presence of any red flag findings per **General Guidelines (PEDAB-1.0)** precludes adjudication based on any other criteria.
- Right upper quadrant pain imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Abdominal Pain (AB-2)** in the Abdomen Imaging Guidelines.
 - ◆ US abdomen (CPT® 76700) and/or Nuclear medicine imaging of the hepatobiliary system (HIDA scan, CPT® 78226 or CPT® 78227) for initial diagnosis for:
 - Suspicion of acute cholecystitis or acalculous cholecystitis (symptoms may include RUQ pain with fever, elevated white blood cell count, positive Murphy sign).
 - Suspicion of stones and bile duct obstruction (symptoms may include RUQ pain, no fever, normal white blood cell count)
 - Ultrasound results are not needed prior to nuclear medicine imaging of the hepatobiliary system (HIDA scan, CPT® 78226)¹
 - ◆ MRI Abdomen with and without contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160) when either US or NM is equivocal.
 - ◆ In individuals with complaints of RUQ pain with no fever and an ultrasound shows only gallstones, MRI Abdomen without contrast (CPT® 74181), MRI Abdomen without and with contrast (CPT® 74183) or Nuclear medicine imaging of the hepatobiliary system (HIDA scan, CPT® 78226) is indicated to exclude other sources of pain.

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Inflammatory Bowel Disease, Crohn Disease, or Ulcerative Colitis (PEDAB-9)

- Enterography is the most appropriate advanced imaging study for individuals with inflammatory bowel disease (IBD).
 - ◆ MR enterography (CPT® 74183 and CPT® 72197) is generally preferred over CT when possible to avoid radiation exposure for children

Children with Suspected Crohn Disease

Clinical features including weight loss, loose stools, vomiting, and intermittent abdominal pain. Small bowel imaging can provide important information to guide treatment relating to presence, severity, and extent of Crohn's disease and its complications. Initial evaluation typically includes laboratory evaluation and upper and lower endoscopy.

- MR Enterography (CPT® 74183 and CPT® 72197), CT Enterography (CPT® 74177), or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) for ANY of the following:¹
 - ◆ To detect severity and distribution of inflammatory changes
 - ◆ Identify complications (such as fistulizing disease or abscess formation)
- MR Enterography (CPT® 74183 and CPT® 72197) or CT Enterography (CPT® 74177) for evaluation of chronic abdominal pain associated with diarrhea due to concern for inflammatory bowel disease if:
 - ◆ There is a positive family history of inflammatory bowel disease **OR**
 - ◆ There are endoscopy or colonoscopy findings suggestive of inflammatory bowel disease **OR**
 - ◆ Elevated inflammatory markers (fecal lactoferrin $\leq 4.0\mu\text{g/g}$, CRP $>0.5\text{mg/dL}$, or fecal calprotectin $\geq 50\mu\text{g/g}$) **OR**
 - ◆ Diagnosis is still in doubt after colonoscopy and evaluation of inflammatory markers, and Crohn's disease is suspected
- MR Enterography (CPT® 74183 and CPT® 72197) or CT Enterography (CPT® 74177) is indicated prior to endoscopy if requested by or in consultation with the physician who will be performing the endoscopy.⁶
- MRI Pelvis with contrast (CPT® 72196) or MRI Pelvis without and with contrast (CPT® 72197) is indicated for the following:¹
 - ◆ Concern for perianal fistula or abscess
- See: **IBD (Crohn's Disease or Ulcerative Colitis) (AB-23.1)** in the Abdomen Imaging Guidelines for additional information regarding serologic markers

Children with Established IBD

- MR Enterography (CPT® 74183 and CPT® 72197), CT Enterography (CPT® 74177), or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197), is indicated for ANY of the following:¹

- ◆ Monitoring response to disease-modifying treatment on an annual basis or when treatment change is being considered
- ◆ Individuals with new or worsening symptoms or suspected complications including abscess, perforation, fistula, or obstruction
- CT Abdomen and Pelvis with contrast (CPT 74177) is indicated if requested (instead of CTE or MRE) for ANY of the following:¹
 - ◆ New or worsening symptoms
 - ◆ Suspected complications including abscess, perforation, fistula, or obstruction
- MRI Pelvis with contrast (CPT® 72196) or MRI Pelvis without and with contrast (CPT® 72197) is indicated for the following:¹
 - ◆ Concern for perianal fistula or abscess

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Abdominal Sepsis (Suspected Abdominal Abscess) (PEDAB-10)

- Abdominal sepsis imaging indications in pediatric individuals are identical to those for adult individuals.
 - ◆ See: **Abdominal Sepsis (Suspected Abdominal Abscess) (AB-3)** in the Abdomen Imaging Guidelines.

Postoperative Pain within 60 Days Following Abdominal Surgery (PEDAB-11)

- CT Abdomen and Pelvis with contrast (CPT® 74177) is indicated in individuals with suspected postoperative complications (e.g. bowel obstruction, abscess, anastomotic leak, etc.).
 - ◆ Children can also be evaluated with ultrasound (CPT® 76700 or CPT® 76705) initially (especially in small children or in thin older children) or MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197).
 - ◆ Because MRI may not be practical for the timely evaluation of post-operative abscesses, MRI should only replace CT when the study can be completed in a similar time frame as CT.
- Radiopharmaceutical nuclear medicine imaging (CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, CPT® 78830, CPT® 78831, or CPT® 78832) is indicated for evaluation of any of the following:
 - ◆ Peritonitis
 - ◆ Postoperative fever without localizing signs or symptoms
- Beyond 60 days postoperatively, see: **Generalized Abdominal Pain (PEDAB-2)**.

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Constipation, Diarrhea, and Irritable Bowel Syndrome (PEDAB-12)

- Constipation and diarrhea are extremely common complaints in children. The overwhelming majority of individuals do not require advanced imaging for evaluation of constipation or diarrhea.
- Irritable bowel is rare in young children, but more common in adolescents. The overwhelming majority of individuals do not require advanced imaging for evaluation of irritable bowel syndrome.
 - ◆ In most cases, causes of constipation can be excluded based on a careful history and physical examination. Advanced Imaging should be performed if warning signs of other diseases are present.
- Constipation associated with additional signs or symptoms:
 - ◆ CT Abdomen (CPT® 74160) or Abdomen and Pelvis (CPT® 74177) with contrast are indicated if there are any red flag signs or symptoms (as listed in **General Guidelines (PEDAB-1.0)**)
 - ◆ Clinical suspicion of tethered cord based on abnormal physical findings over the spine, abnormal neurological exam, or symptoms refractory to provider-directed treatment for at least 3 months⁶ (See: **Tethered Cord (PEDSP-5)** in the Pediatric Spine Imaging Guidelines).
- Diarrhea associated with additional signs or symptoms:
 - ◆ CT Abdomen (CPT® 74160) or Abdomen and Pelvis (CPT® 74177) with contrast are indicated if there are any red flag signs or symptoms (as listed in **General Guidelines (PEDAB-1.0)**)
- Irritable bowel syndrome associated with additional signs or symptoms:
 - ◆ CT Abdomen (CPT® 74160) or Abdomen and Pelvis (CPT® 74177) with contrast are indicated if there are any red flag signs or symptoms (as listed in **General Guidelines (PEDAB-1.0)**)
- A barium enema and rectal biopsy are indicated for diagnosis of Hirschsprung disease in children with features suggestive of this disorder. MRI Pelvis without and with contrast (CPT® 72197) may be indicated in post-operative patients who have signs of complications related to treatment to assess the position of the pulled-through bowel, the sphincter muscles, and the area of the posterior urethra.

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Abdominal Mass (PEDAB-13)

Abdominal Wall Mass (PEDAB-13.1)	31
Intra-Abdominal Mass (PEDAB-13.2)	31

Abdominal Wall Mass (PEDAB-13.1)

- For initial imaging of a newly discovered abdominal wall mass, ANY of the following studies are indicated:
 - ◆ Ultrasound (CPT® 76700 or CPT® 76705)
 - ◆ MRI Abdomen without contrast (CPT® 74181) or without and with contrast (CPT® 74183)
 - ◆ MRI Pelvis without contrast (CPT® 72195) or without and with contrast (CPT® 72197) may be added to MRI Abdomen if below the umbilicus
- If ultrasound and/or MRI are inconclusive or insufficient for preoperative planning, ANY of the following studies are indicated:
 - ◆ CT Abdomen with contrast (CPT® 74160) or without contrast (CPT® 74150)
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) or without contrast (CPT® 74176) if below the umbilicus

Intra-Abdominal Mass (PEDAB-13.2)

- Ultrasound (CPT® 76700) should be the initial imaging study for children with an intra-abdominal mass.
 - ◆ US with Doppler (CPT® 93975) can also be used to evaluate vascular supply.⁵
- Additional imaging studies will be determined by the results of the ultrasound, and will depend on the location and organ involvement associated with the mass as well as history, physical exam, and laboratory findings. See the following sections for additional imaging guidelines:
 - ◆ **General Guidelines (PEDONC-1)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Pediatric Lymphomas (PEDONC-5)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Neuroblastoma (PEDONC-6)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Pediatric Renal Tumors (PEDONC-7)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Pediatric Germ Cell Tumors (PEDONC-10)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Pediatric Liver Tumors (PEDONC-11)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Pediatric Adrenocortical Carcinoma (PEDONC-14)** in the Pediatric Oncology Imaging Guidelines
 - ◆ **Liver Lesion Characterization (PEDAB-15)**
 - ◆ **Adrenal Lesions (PEDAB-17)**
 - ◆ **Indeterminate Renal Lesion (PEDAB-19)**
 - ◆ **Spleen (PEDAB-26)**

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Renovascular Hypertension and Other Secondary Causes of Hypertension (PEDAB-14)

- Clinical evaluation for suspected hypertension should include repeated blood pressure measurements (generally ≥3 measurements).
 - ◆ Trained health care professionals in the office setting should make a diagnosis of hypertension (HTN) if a child or adolescent has auscultatory-confirmed blood pressure (BP) readings ≥95th percentile at 3 different visits.¹³
 - ◆ Blood pressure may be obtained in-clinic, at home, or by using a wearable ambulatory blood pressure measurement (ABPM) device that records blood pressure at frequent intervals during normal activities and is downloaded later for computer analysis.

For Children Aged 1-<13 years	For Children Aged ≥13 years
Normal BP: <90 th Percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥95th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥95th percentile + 12 mm Hg, or ≥140/90 mm Hg (whichever is lower)	Stage 2 HTN: ≥140/90 mm Hg

Table from [13]

- ANY of the following studies are indicated for initial evaluation of a pediatric individual with suspected secondary hypertension:
 - ◆ Doppler or Duplex Ultrasound (CPT® 93975 or CPT® 93976)
 - ◆ Complete retroperitoneal Ultrasound (CPT® 76770)
 - ◆ Captopril renography (CPT® 78709) has largely been abandoned in clinical practice, replaced by CTA and MRA Abdomen, but may be supported for unusual circumstances.

Other considerations for imaging evaluation:

- CTA Abdomen (CPT® 74175) or MRA Abdomen (CPT® 74185)¹⁴ is indicated for pediatric individuals with hypertension to exclude fibromuscular dysplasia or other blood-flow restricting lesions of the renal arteries and suprarenal aorta.³
- Children with high clinical suspicion for renin-mediated hypertension should undergo additional imaging whether Doppler US findings are positive or negative due to poor sensitivity for detecting distal intrarenal or accessory renal artery stenosis.³ CTA has high sensitivity and specificity.¹⁴
- Echocardiography (CPT® 93306) is indicated at initial evaluation to screen for cardiac abnormalities, coarctation of the aorta, and end-organ damage such as left ventricular hypertrophy.
- Nuclear renal imaging (CPT® 78707, CPT® 78708, or CPT® 78709) is indicated for evaluation of the following:
 - ◆ Severe hypertension with progressive renal insufficiency or failure to respond to three-drug therapy
 - ◆ Malignant or accelerated hypertension
 - ◆ Acute worsening of previously stable hypertension
 - ◆ Diastolic BP >100 in an individual <35 years old
 - ◆ New onset severe hypertension
 - ◆ Hypertension in presence of asymmetric kidneys
 - ◆ Hypertension in presence of acute elevation in creatinine either unexplained or after treatment with ACE inhibitor
 - ◆ Abdominal bruit
 - ◆ Recurrent acute pulmonary edema and hypertension
 - ◆ Hypokalemia with normal or elevated plasma renin level in absence of diuretic therapy
 - ◆ Hypertension with known neurofibromatosis

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Liver Lesion Characterization (PEDAB-15)

- ***High risk individuals⁹:**
 - ◆ Prematurity
 - ◆ Low birth weight
 - ◆ Underlying chronic liver disease
 - ◆ Beckwith Weidman syndrome
 - ◆ Familial adenomatous polyposis
 - ◆ Trisomy 18
 - ◆ Portosystemic shunts
 - ◆ Aicardi syndrome
 - ◆ Hereditary tyrosinemia
 - ◆ Bile salt export pump deficiency
- Pediatric-specific imaging considerations includes:
 - ◆ US Abdomen (CPT® 76700 or CPT® 76705) is the initial study of choice in children. MRI is preferred over CT when possible to reduce radiation exposure
- Liver lesion discovered on US:
 - ◆ Any high risk individual*
 - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160)
 - ◆ Indeterminate liver lesion <3cm
 - Contrast-Enhanced US (CEUS, CPT® 76978, CPT® 76979)
 - If after Contrast-Enhanced US the lesion remains indeterminate or not fully characterized:
 - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160)
 - ◆ Indeterminate liver lesion >3cm
 - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160)
- Liver lesion discovered on CT (non-contrast or single-contrast) or non-contrast MRI
 - ◆ Indeterminate Liver Lesion <3cm
 - Contrast-Enhanced US (CEUS, CPT® 76978, CPT® 76979)
 - If, after Contrast-Enhanced US, the lesion remains indeterminate or not fully characterized
 - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160)
 - ◆ Indeterminate Liver Lesion >3cm
 - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160)
- For the imaging of specific focal liver lesions:
 - ◆ Suspected hepatic adenoma:
 - MRI is considered the best technique for characterization. Follow-up imaging can be CT Abdomen (CPT® 74160 or CPT® 74170) or MRI Abdomen (CPT®

- 74183) every 6 months for 2 years, and then annually, to establish any growth patterns and assess for malignant transformation.
- ◆ Hepatic Hemangioma
 - Limited abdominal US in 6-12 months
 - If stable or decreasing in size: Surveillance 6-12 months until 2 years. After 2 years, no further follow-up is indicated unless it becomes symptomatic
 - If increasing in size: follow-up 3-6 months or biopsy
 - See below for pre-operative considerations
 - ◆ Focal Nodular Hyperplasia (FNH):
 - MRI Abdomen (CPT® 74183) or CT Abdomen (CPT® 74160 or CPT® 74170) to confirm a diagnosis of FNH. The use of Eovist contrast is often diagnostic in differentiating FNH from other lesions seen on MRI or CT.
 - Additional follow-up is limited abdominal US in 6-12 months
 - If stable or decreasing in size: Surveillance 6-12 months until 2 years. After 2 years, no further follow-up is indicated unless it becomes symptomatic.
 - In adolescent females diagnosed with FNH who are continuing to use oral contraceptives: Additional follow-up is annual US for 2 to 3 years. Follow-up with CT or MRI can be done if the lesion is not adequately visualized on US.
 - If increasing in size: follow-up 3-6 months or biopsy
 - ◆ Hepatic cysts:
 - Asymptomatic, simple cysts
 - Limited abdominal US in 6-12 months
 - If stable or decreasing in size: Surveillance 6-12 months until 2 years. After 2 years, no further follow-up is indicated unless it becomes symptomatic
 - If increasing in size: follow-up 3-6 months or biopsy
 - For complicated cysts (US shows internal septations, fenestrations, calcifications, irregular walls, as well as the presence of daughter cysts):
 - MRI Abdomen (CPT® 74183) or CT Abdomen (CPT® 74160 or CPT® 74170) can be performed
 - Additional scenarios and follow-up imaging for an Indeterminate lesion:
 - ◆ Indeterminate lesion <1cm in high-risk individuals* on US, CT, or unenhanced MRI not specifically dealt with in the above guidelines:
 - If **biopsy cannot be performed**, follow-up MRI can be obtained in 3-6 months. Additional imaging in this setting can be considered on an individual basis. This timeframe would also apply if the lesion is indeterminate and an MRI with Eovist is requested for further evaluation in this setting
 - Nuclear medicine liver imaging (ONE of CPT® codes: CPT® 78201, CPT® 78202, CPT® 78803, CPT® 78215, or CPT® 78216) is rarely performed, but can be approved for the following when ultrasound, CT, and MRI are unavailable or contraindicated:
 - ◆ Evaluation of liver mass, trauma, or suspected focal nodular hyperplasia (FNH)

- ◆ Differentiation of hepatic hemangioma from FNH
- ◆ Diffuse hepatic disease or elevated liver function tests
- ◆ Suspected accessory spleen (CPT® 78215 or CPT® 78216 only)

Background and Supporting Information

- For liver lesions in children, it is important to differentiate between benign incidental versus malignant lesions.

TABLE 1. Risk factors for malignant liver tumors in children [7-9]

◆ Hepatoblastoma	◆ Hepatocellular carcinoma
◆ Prematurity	◆ Liver cirrhosis
◆ Low birth weight	◆ Chronic hepatitis B and C
◆ BWS and other overgrowth syndromes	◆ Hereditary tyrosinemia
◆ Familial adenomatous polyposis	◆ Portosystemic shunts
◆ Trisomy 18	◆ Bile salt export pump deficiency
◆ Portosystemic shunts	
◆ Aicardi syndrome	

Data from [7–9]. BWS = Beckwith-Wiedemann syndrome

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Liver Disease (PEDAB-16)

Pediatric Liver Failure and Cirrhosis (PEDAB 16.1)	41
Biliary Disease (PEDAB 16.2)	42

Pediatric Liver Failure and Cirrhosis (PEDAB 16.1)

- Elevated liver function testing imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Abnormal Liver Chemistries (AB-30)** in the Abdomen Imaging Guidelines.
- Causes of liver failure or cirrhosis in pediatric individuals are different from adults, and are frequently idiopathic, but commonly due to ONE of the following:
 - ◆ Biliary dysfunction (biliary atresia, cystic fibrosis, etc.)
 - ◆ Metabolic disease
 - ◆ Post-infectious
- Liver ultrasound (CPT® 76700) with duplex Doppler (CPT® 93975) is indicated as an initial study for individuals prior to approving CT or MRI for pediatric individuals.
 - ◆ MRI Abdomen without and with contrast (CPT® 74183) is indicated for evaluation of ultrasound findings that are inconclusive or technically limited, and is preferred over CT when possible to reduce radiation exposure.
- Repeat liver ultrasound (CPT® 76705) with duplex Doppler (CPT® 93975) is indicated in pediatric individuals in the following circumstances:
 - ◆ Known chronic liver dysfunction or cirrhosis of any cause may be reimaged on an annual basis in the absence of new or worsening findings
 - ◆ New or worsening findings on history, physical exam, or laboratory results that suggest progression of liver disease
 - ◆ Doppler ultrasound liver (CPT® 93975 or CPT® 93976) is indicated when portal venous congestion or portal hypertension is suspected
- Nuclear medicine liver imaging (ONE of CPT® codes: CPT® 78201, CPT® 78202, CPT® 78803, CPT® 78215, or CPT® 78216) is rarely performed, but can be approved for the following when ultrasound, CT, and MRI are unavailable or contraindicated:
 - ◆ Diffuse hepatic disease or elevated liver function tests

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Biliary Disease (PEDAB 16.2)

- The definition of conjugated hyperbilirubinemia is serum conjugated bilirubin >1mg/dL if total bilirubin <5.0 or greater than 20 percent of total bilirubin if total bilirubin >5.0mg/dL. Obstructive causes of liver disease need to be evaluated. Additional labs may include total and fractionated bilirubin, AST, ALT, Alk Phos, GGT, and/or urinalysis.
- Ultrasound Abdomen (CPT® 76700 or CPT® 76705) is initial imaging study of choice
- Advanced imaging such as CT, MRI is rarely indicated unless otherwise indicated below.
- After initial ultrasound:
 - ◆ If Biliary Atresia is suspected:
 - Hepatobiliary System imaging (HIDA scan) can be approved if requested by surgeon before liver biopsy
 - Liver biopsy is diagnostic
 - Advanced imaging such as CT, MRI is rarely indicated
 - ◆ If Choledochal cyst is suspected:
 - CT Abdomen with contrast (CPT® 74160) or MRI/MRCP (CPT® 74183 or CPT® 74181) can be approved.
 - For preoperative assessment: MRI/MRCP (CPT® 74183 or CPT® 74181) can be approved
 - ◆ If primary biliary disease such as Primary sclerosing cholangitis or primary biliary cholangitis is suspected:
 - CT Abdomen with contrast (CPT® 74160) or MRI/MRCP (CPT® 74183 or CPT® 74181) can be approved.

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Adrenal Lesions (PEDAB-17)

- Adrenal masses in infants and young children usually present as palpable abdominal masses or are detected on in utero US. In the neonates, the common masses are adrenal hemorrhage and neuroblastoma. Abdominal US is the initial imaging study of choice.
 - ◆ If an adrenal mass is detected, it can often be adequately evaluated with short interval follow-up retroperitoneal ultrasound (CPT® 76770) in 7 to 10 days.
 - If repeat ultrasound is concerning for neuroblastoma or there is high clinical concern for neuroblastoma, MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen without and with contrast (CPT® 74170) are indicated to confirm the diagnosis. MRI is preferred over CT when possible to reduce radiation exposure. If these studies, confirm neuroblastoma ¹²³I-Metaiodobenzylguanidine (MIBG) scintigraphy is indicated for staging.
 - ◆ Neuroblastoma is the most common primary adrenal tumor in pediatric individuals between day 1 and 5 years of age. See: **Neuroblastoma (PEDONC-6)** in the Pediatric Oncology Imaging Guidelines.
- Additional adrenal imaging considerations include the following:
 - ◆ Adrenal Nuclear Imaging of the cortex and/or medulla (CPT® 78075) is indicated for the following:
 - Distinguishing adrenal adenoma from adrenal hyperplasia.
 - Evaluation of suspected pheochromocytoma or paraganglioma.
 - MIBG preferred (ONE of CPT® codes: CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, or CPT® 78804).
 - For known pheochromocytoma or paraganglioma, see: **Neuroendocrine Cancers and Adrenal Tumors (ONC-15)** in the Oncology Imaging Guidelines.
 - Evaluation of suspected neuroblastoma, ganglioneuroblastoma, or ganglioneuroma.
 - MIBG preferred (ONE of CPT® codes: CPT® 78800, CPT® 78801, CPT® 78802, CPT® 78803, or CPT® 78804 or hybrid SPECT/CT CPT® 78830, CPT® 78831, or CPT® 78832), see: **Neuroblastoma (PEDONC-6)** in the Pediatric Oncology Imaging Guidelines.
 - History of multiple endocrine neoplasia syndromes: See **Multiple Endocrine Neoplasias (MEN) (PEDONC-2.8)** in the Pediatric Oncology Imaging Guidelines.
 - History of neurofibromatosis: See **Neurofibromatosis 1 and 2 (NF1 and NF2) (PEDONC-2.3)** in the Pediatric Oncology Imaging Guidelines
 - History of von Hippel-Lindau disease: See **Von Hippel-Lindau Syndrome (VHL) (PEDONC-2.10)** in the Pediatric Oncology Imaging Guidelines

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Hemochromatosis (PEDAB-18)	
Hereditary (Primary) Hemochromatosis (PEDAB-18.1)	46
Transfusion-Associated (Secondary) Hemochromatosis (PEDAB-18.2)	46

Hereditary (Primary) Hemochromatosis (PEDAB-18.1)

- Hereditary hemochromatosis imaging indications in pediatric individuals are identical to those for adult individuals. See: **Hereditary (Primary) Hemochromatosis (HH) and Other Iron Storage Diseases (AB-11.2)** in the Abdomen Imaging Guidelines.

Transfusion-Associated (Secondary) Hemochromatosis (PEDAB-18.2)

- Transfusion-associated hemochromatosis is a common complication of exposure to repeated red blood cell transfusions. This can occur in any individual with exposure to >20 transfusion episodes, but is most common among sickle cell disease, thalassemia, bone marrow failure (aplastic anemia, Fanconi anemia, etc.), oncology patients, and hematopoietic stem cell transplant patients.
- T2* MRI has been well established in the determination of organ iron burden in transfusion-associated hemochromatosis. Contrast use is not necessary for evaluation of iron burden. The following studies are indicated for evaluation of transfusion-associated hemochromatosis:
 - ◆ MRI Abdomen without contrast (CPT® 74181) for liver iron evaluation.
 - ◆ MRI Cardiac without contrast (CPT® 75557) for cardiac iron evaluation.
 - ◆ MRI Chest without contrast (CPT® 71550) can be approved as a single study to evaluate both heart and liver iron burden.
 - ◆ CPT® 74181 and CPT® 75557 can be approved alone, or together.
 - ◆ If requested, CPT® 71550 will evaluate both heart and liver and should not be approved with any other codes.
- Screening MRI is indicated every 12 months for chronically transfused individuals at risk of hemochromatosis.
- Imaging is indicated every 3 months for treatment response in individuals receiving active treatment (chelation and/or phlebotomy).

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Indeterminate Renal Lesion (PEDAB-19)

- Indeterminate renal lesion characterization imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Indeterminate Renal Lesion (AB-35)** in the Abdomen Imaging Guidelines.
- Indeterminate renal lesion imaging indications in pediatric individuals are uncommon and are usually cysts or congenital anomalies.
- Pediatric-specific imaging considerations include the following:
 - ◆ Pediatric renal cysts have a lower risk of malignant progression than do renal cysts in adults.
 - ◆ CT Abdomen with contrast (CPT® 74160) or MRI Abdomen without and with contrast (CPT® 74183) is indicated for individuals who have simple cysts but are symptomatic and surgical intervention is being considered.
 - ◆ CT Abdomen without and with contrast (CPT® 74170) or MRI Abdomen without and with contrast (CPT® 74183) is indicated for pediatric individuals with complex renal cyst identified on ultrasound.
 - ◆ For individuals with congenital anomalies, nuclear medicine studies with diuretic renography (CPT® 78708 or CPT® 78709) can be performed to determine function and cystography to determine presence of associated reflux.
 - ◆ Individuals with solid renal masses should be imaged according to guidelines in section **Pediatric Renal Tumors (PEDONC-7)** in the Pediatric Oncology Imaging Guidelines.

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Hydronephrosis (PEDAB-20)

Hydronephrosis is a relatively common finding in pediatric individuals, with the following imaging considerations:

- Retroperitoneal ultrasound (CPT® 76770) for:
 - ◆ Prenatal hydronephrosis within the first week of life, and again at 1-6 months of age.
 - ◆ Known hydronephrosis every 3 to 12 months
 - This imaging represents a guideline-supported, scheduled follow-up imaging evaluation, as described in **Clinical Information (PREFACE-3)** in the Preface Imaging Guidelines. A current evaluation (within 60 days) would not be required for authorization.
- Hydronephrosis associated with urinary tract infection or vesicoureteral reflux, see: **Urinary Tract Infection (UTI) (PEDAB-5)** for imaging guidelines.
- Individuals with obstructive uropathy (including ureteropelvic junction obstruction (UPJO), ureterovesical junction obstruction (UVJO), and bladder outlet obstruction) can be evaluated with retroperitoneal ultrasound (CPT® 76770), and diuretic renography (CPT® 78707, CPT® 78708, or CPT® 78709) for preoperative planning and postoperatively at 3 to 12 months.
 - ◆ If hydronephrosis has resolved on postoperative imaging then no further routine imaging is indicated.
- Magnetic resonance urography (MRU) (CPT® 74183 and CPT® 72197) is rarely indicated, but can be approved in individuals with inconclusive ultrasound and diuretic renography.
- CT Abdomen with contrast (CPT® 74160) is rarely indicated, but can be approved in individuals with inconclusive ultrasound and a suspected vascular cause of UPJO.

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Polycystic Kidney Disease (PEDAB-21)

- Abdominal ultrasound (CPT® 76700) or retroperitoneal ultrasound (CPT® 76770) for clinical concern of polycystic kidney disease, or for screening individuals who are at risk for autosomal dominant polycystic kidney disease (ADPKD).

References

1. Devarajan P. Autosomal Recessive polycystic kidney disease. Nelson Textbook of Pediatrics, Chapter 541.2. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, pp 2744-2747.
2. Devarajan P. Autosomal dominant polycystic kidney disease. Nelson Textbook of Pediatrics, Chapter 541.3. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, p 2747-2748.
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Blunt Abdominal Trauma (PEDAB-22)

- Blunt abdominal trauma imaging indications in pediatric individuals are identical to those for adult individuals. See: **Blunt Abdominal Trauma (AB-10.1)** in the Abdomen Imaging Guidelines.

Hernias (PEDAB-23)

- Hernia imaging indications in pediatric individuals are identical to those for adult individuals. See: **Hernias (AB-12)** in the Abdomen Imaging Guidelines.

Abdominal Lymphadenopathy (PEDAB-24)

- Abdominal lymphadenopathy imaging indications in pediatric individuals are identical to those for adult individuals. See: **Abdominal Lymphadenopathy (AB-8)** in the Abdomen Imaging Guidelines.

Left Upper Quadrant Pain (PEDAB-25)

- Left upper quadrant pain imaging indications in pediatric individuals are identical to those for adult individuals. See: Abdominal Pain (AB-2) in the Abdomen Imaging Guidelines.
- Nuclear medicine spleen imaging (CPT® 78185) is rarely performed, but can be approved for left upper quadrant pain when neither ultrasound nor CT is available.

References

1. Royal HD, Brown ML, Drum DE, et al. Society of Nuclear Medicine Procedure guideline for hepatic and splenic imaging 3.0, version 3.0, approved July 20, 2003.

Spleen (PEDAB-26)

- Spleen imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Spleen (AB-34)** in the Abdomen Imaging Guidelines.
- Nuclear medicine spleen imaging (CPT® 78185) is rarely performed, but can be approved for the following indications when CT is unavailable:
 - ◆ Splenic trauma.
 - ◆ Evaluation of splenic function.
 - ◆ Suspected splenic mass, cyst, abscess, infarct, or metastasis.
 - ◆ Radiation treatment planning.
 - ◆ Asplenia.
 - ◆ Suspected functional accessory spleen:
 - Can approve CPT® 78215 or CPT® 78216 instead of CPT® 78185, if requested.
- Pediatric-specific imaging considerations include the following:
 - ◆ MRI is preferred over CT when possible to reduce radiation exposure.

References

1. Brandow AM and Camitta BM. Splenomegaly. Nelson Textbook of Pediatrics, Chapter 513. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp. 2619-2620.
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3. Navarro OM, Siegel MJ. Spleen and Peritoneal Cavity. In: Siegel MJ, editor. Pediatric Sonography, 5th ed. Philadelphia. Wolters Kluwer. 2019. p 304-345.

Intussusception (PEDAB-27)

- Intussusception, telescoping of one bowel loop into another, is a frequent cause of abdominal pain in young children. It may be associated with bloody stool. Plain x-rays (supine and left lateral decubitus views) should be performed initially to exclude mass or bowel obstruction from other causes and to detect possible bowel perforation, which may be an indication for emergent surgical intervention.
 - ◆ Ultrasound (CPT® 76700 or CPT® 76705) is indicated as an initial study if there is a strong suspicion for intussusception, but if negative, plain x-rays of the abdomen should follow.
 - ◆ In some institutions, Ultrasound guidance (CPT® 76942) may be used for reduction of colonic or ileocolic intussusception. Generally, this is an urgent or emergent procedure and may not require prior authorization. See Health Plan specific guidance for prior authorization requirements.

References

1. Maqbool A and Liacouras CA. Intussusception. Nelson Textbook of Pediatrics, Chapter 359.3. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 1965-1967.
2. Edwards EA, Pigg N, Courtier J, Zapala MA, Mackenzie JD, Phelps AS. Intussusception: past, present and future. *Pediatric Radiology*. 2017;47(9):1101-1108. doi:10.1007/s00247-017-3878-x.
3. Coley BDBD. Caffey's Pediatric Diagnostic Imaging. Philadelphia, PA: Elsevier; 2019. Chapter 107, pp1040-1049.
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Bowel Obstruction (PEDAB-28)

Bowel Obstruction (PEDAB-28.1)

- Suspected high-grade obstruction
 - ◆ MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) is preferred to avoid unnecessary radiation exposure
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) can be approved if MRI is not readily available
- Suspected intermittent or low-grade small bowel obstruction
 - ◆ MRI Abdomen and Pelvis without and with contrast (CPT® 74183 and CPT® 72197) is preferred to avoid unnecessary radiation exposure
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) can be approved if MRI is not readily available
 - ◆ If the etiology or level of suspected intermittent or low-grade small bowel obstruction remains undetermined and additional imaging is needed after CT Abdomen and Pelvis:
 - CT Enteroclysis (CPT® 74176 or 74177) or
 - CT Enterography (CPT® 74177) or
 - MR Enteroclysis (CPT® 74183 and CPT® 72197) or
 - MR Enterography (CPT® 74183 and CPT® 72197)
- Small bowel obstruction suspected to be secondary to Crohn's Disease
 - ◆ See: **Inflammatory Bowel Disease, Crohn Disease, or Ulcerative Colitis (PEDAB-9)**

References

1. Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® suspected small-bowel obstruction. *American College of Radiology (ACR)*; 2019
2. Paulson EK, Thompson WM. Review of Small-Bowel Obstruction: The Diagnosis and When to Worry. *Radiology*. 2015;275(2):332-342. doi:10.1148/radiol.15131519.
3. Mullan CP, Siewert B, Eisenberg RL. Small Bowel Obstruction. *American Journal of Roentgenology*. 2012;198(2). doi:10.2214/ajr.10.4998.

Left Lower Quadrant Pain (PEDAB-29)

Diverticulitis is the most common cause of left lower quadrant pain in adults but is extremely rare in children.

- CT Abdomen and Pelvis (CPT® 74177) with contrast is indicated if there are any red flag signs or symptoms (as listed in **General Guidelines (PEDAB-1.0)**)
- In the absence of red flags, advanced imaging is rarely helpful in the initial evaluation of these individuals. Consultation with gastroenterologist can be helpful in determining the appropriate diagnostic pathway.
 - ◆ Pelvic ultrasound (CPT® 76856) is the initial imaging study of choice for children for detecting gynecologic abnormalities that may cause left lower quadrant pain.
 - ◆ For male individuals or if ultrasound is inconclusive, advanced imaging may be appropriate for management as directed by gastroenterological evaluation or consultation

References

1. Maqbool A, and Liacouras CA. Major symptoms and signs of digestive tract disorders. Nelson Textbook of Pediatrics, Chapter 332. eds Nelson Textbook of Pediatrics, Chapter XXX eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, pp 1902-1912.
2. Maqbool A and Liacouras CA, Functional Gastrointestinal Disorders. Nelson Textbook of Pediatrics, Chapter 368. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, pp 2041-2045.

Celiac Disease (Sprue) (PEDAB-30)

- Celiac disease imaging indications in pediatric individuals are identical to those for adult individuals. See: **Celiac Disease (Sprue) (AB-24)** in the Abdomen Imaging Guidelines.

Transplant (PEDAB-31)

- Liver and kidney transplant imaging indications in pediatric individuals are identical to those for adult individuals. See: **Transplant (AB-42)** in the Abdomen Imaging Guidelines.
- For post-transplant lymphoproliferative disorder in pediatric individuals, see: **Pediatric Aggressive Mature B-Cell Non-Hodgkin Lymphomas (NHL)** (**PEDONC-5.3**) in the Pediatric Oncology Imaging Guidelines.

Gaucher Disease (PEDAB-32)

See: **Gaucher Disease (PEDPN-4)** in the Pediatric Peripheral Nerve Disorders Imaging Guidelines.

Vomiting Infant, Malrotation, and Hypertrophic Pyloric Stenosis (PEDAB-33)

- Vomiting in infants is generally classified as either bilious (implying obstruction distal to the Sphincter of Oddi) or non-bilious.
- Bilious vomiting may be a true emergency, as some of the conditions causing this could result in compromise of blood supply to the intestines, a potentially life-threatening situation.
- Nonbilious vomiting in otherwise healthy infants may be imaged with Upper GI series (UGI)
- Suspected malrotation is an indication for emergent imaging. If malrotation with mid-gut volvulus is suspected, acute abdominal series (Chest X-ray and abdominal views, including supine and upright or supine and left lateral decubitus views), followed by UGI series (preferred) and/or Ultrasound abdomen, limited (CPT® 76705) should be performed. If the abdominal X-rays suggest distal bowel obstruction, water soluble contrast enema should be considered.
- Hypertrophic Pyloric Stenosis is an idiopathic condition wherein the circular muscle controlling emptying of the stomach thickens causing a relative obstruction of the gastric outlet. The condition can occur at any age (including occasionally in adults), but the typical child is male, aged 2 to 6 weeks. Projectile non-bilious vomiting is the most common presenting complaint, but the description of projectile vomiting is subjective. The differential diagnosis for non-bilious vomiting includes common conditions such as viral gastroenteritis and gastro-esophageal reflux.
 - ◆ Infants with projectile non-bilious vomiting should be evaluated with Ultrasound abdomen, limited (CPT® 76705). If initial studies are not diagnostic, repeat studies should be performed as frequently as daily until the vomiting resolves or the diagnosis is made. UGI series may be useful as a confirmatory test, may be preferred if ultrasound expertise is not available for this condition, or if the clinical presentation is atypical for Hypertrophic Pyloric Stenosis. Ultrasound is preferred when available, as it involves no contrast or ionizing radiation use.

References

1. Hunter AK and Liacouras CA. Hypertrophic pyloric stenosis. Nelson Textbook of Pediatrics. Chapter 329.1. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 1797-1799.
2. Hunter AK and Liacouras CA, Malrotation. Nelson Textbook of Pediatrics. Chapter 330.3. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 1803-1804.
3. Zhou L-Y, Li S-R, Wang W, et al. Usefulness of Sonography in Evaluating Children Suspected of Malrotation. Journal of Ultrasound in Medicine. 2015;34(10):1825-1832. doi:10.7863/ultra.14.10017.
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Pancreatitis (PEDAB-34)	
Acute Pancreatitis (PEDAB 34.1)	63
Chronic Pancreatitis (PEDAB 34.2)	64

Acute Pancreatitis (PEDAB 34.1)

- The presence of any red flag findings per **General Guidelines (PEDAB-1.0)** precludes adjudication based on any other criteria.
 - ◆ If red flag is present (as per **General Guidelines (PEDAB-1.0)**), then CT Abdomen and Pelvis with contrast (CPT® 74177), CT Abdomen with contrast (CPT® 74160), or MRI/MRCP (CPT® 74183 or CPT® 74181) is indicated²
- Initial imaging
 - ◆ Abdominal US (CPT® 76700 or CPT® 76705) can be approved
 - ◆ If ultrasound performed and is nondiagnostic due to technical limitation (obesity, overlying gas, etc.), or if ultrasound is negative and there is continued clinical suspicion of acute pancreatitis MRI/MRCP (CPT® 74183 or CPT® 74181) can be approved.
 - CT Abdomen and Pelvis with contrast (CPT® 74177) or CT Abdomen with contrast (CPT® 74160) if MRI/MRCP cannot be performed
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) can be approved for management of acute pancreatitis in the following situations:
 - Evaluation of known or suspected complications of acute pancreatitis
 - To characterize degree of organization of collections before intervention
- Abdominal US (CPT® 76700 or CPT® 76705) can be used to follow known fluid collections for resolution or progression
- Acute Recurrent Pancreatitis (ARP)
 - ◆ MRI/MRCP (CPT® 74183 or CPT® 74181) can be approved
 - To identify structural or obstructive causes.
 - To assess for progression to chronic pancreatitis
 - ◆ In a child who requires sedation for imaging, it is reasonable to alternate MRI/MRCP with Abdominal US (CPT® 76700 or CPT® 76705) or CT Abdomen with contrast (CPT® 74160) for serial monitoring of acute recurrent pancreatitis as recommended by or in consultation with a gastroenterologist or pancreatic specialist.

Background and Supporting Information

- The role of imaging is to identify findings at diagnosis, assess for local complications, identify potential etiologies, monitor evolution of local complications, plan and guide interventions.

Chronic Pancreatitis (PEDAB 34.2)

- The role of imaging is to contribute to or establish initial diagnosis, stage/monitor disease, assess for superimposed acute pancreatitis, identify potential etiologies of chronic pancreatitis, characterize secretory function, and/or plan for surgical intervention
- If chronic pancreatitis is suspected:
 - ◆ MRI Abdomen without and with contrast (CPT® 74183) may be approved.
 - CT Abdomen and Pelvis with contrast (CPT® 74177) or CT Abdomen with contrast (CPT® 74160) may be approved if MRI cannot be performed
- Abdominal US (CPT® 76700 or CPT® 76705) may be approved to evaluate suspected or known episode of acute pancreatitis in a child with chronic pancreatitis.
 - ◆ CT Abdomen and Pelvis with contrast (CPT® 74177) or CT Abdomen with contrast (CPT® 74160) or MRI/MRCP (CPT® 74183 or CPT® 74181) may be approved in the following situations:
 - If ultrasound is negative and imaging diagnosis of acute pancreatitis is needed
 - If planning endoscopic or surgical interventions

References

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2. Trout AT, Ayyala RS, Murati MA, et. Al. . Current state of imaging of pediatric pancreatitis: *AJR* expert panel narrative review. *AJR Am J Roentgenol.* 2021;217(2):265-277. doi:10.2214/AJR.21.25508.