

# Cigna Medical Coverage Policies – Radiology Pediatric Abdomen Imaging Guidelines

Effective April 1, 2023



---

## Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by eviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures eviCore does not review for Cigna. Please refer to the [Cigna CPT code list](#) for the current list of high-tech imaging procedures that eviCore reviews for Cigna.

CPT® (Current Procedural Terminology) is a registered trademark of the American Medical Association (AMA). CPT® five digit codes, nomenclature and other data are copyright 2022 American Medical Association. All Rights Reserved. No fee schedules, basic units, relative values or related listings are included in the CPT® book. AMA does not directly or indirectly practice medicine or dispense medical services. AMA assumes no liability for the data contained herein or not contained herein.

| <b>Pediatric Abdomen Imaging Guidelines</b>  |           |
|--|-----------|
| <b>Pediatric Abdomen Imaging Guidelines</b>  | <b>2</b>  |
| <b>Procedure Codes Associated with Abdomen Imaging</b>                                 | <b>4</b>  |
| <b>General Guidelines (PEDAB-1)</b>  | <b>5</b>  |
| <b>Generalized Abdominal Pain (PEDAB-2)</b>  | <b>11</b> |
| <b>Right Lower Quadrant Pain (PEDAB-3)</b>   | <b>12</b> |
| <b>Flank Pain, Renal Stone (PEDAB-4)</b>   | <b>14</b> |
| <b>Urinary Tract Infection (UTI) (PEDAB-5)</b>   | <b>15</b> |
| <b>Pediatric Acute Gastroenteritis (PEDAB-6)</b>                                       | <b>19</b> |
| <b>Hematuria (PEDAB-7)</b>   | <b>20</b> |
| <b>Right Upper Quadrant Pain (PEDAB-8)</b>   | <b>21</b> |
| <b>Inflammatory Bowel Disease, Crohn Disease, or Ulcerative Colitis (PEDAB-9)</b>      | <b>22</b> |
| <b>Abdominal Sepsis (Suspected Abdominal Abscess) (PEDAB-10)</b>                       | <b>24</b> |
| <b>Postoperative Pain within 60 Days Following Abdominal Surgery (PEDAB-11)</b>        | <b>25</b> |
| <b>Constipation, Diarrhea, and Irritable Bowel Syndrome (PEDAB-12)</b>                 | <b>26</b> |
| <b>Abdominal Mass (PEDAB-13)</b>   | <b>27</b> |
| <b>Renovascular Hypertension and Other Secondary Causes of Hypertension (PEDAB-14)</b> | <b>30</b> |
| <b>Liver Lesion Characterization (PEDAB-15)</b>  | <b>32</b> |
| <b>Liver Disease (PEDAB-16)</b>  | <b>33</b> |
| <b>Adrenal Lesions (PEDAB-17)</b>  | <b>36</b> |
| <b>Hemochromatosis (PEDAB-18)</b>  | <b>37</b> |
| <b>Indeterminate Renal Lesion (PEDAB-19)</b>   | <b>39</b> |
| <b>Hydronephrosis (PEDAB-20)</b>   | <b>40</b> |
| <b>Polycystic Kidney Disease (PEDAB-21)</b>  | <b>41</b> |
| <b>Blunt Abdominal Trauma (PEDAB-22)</b>   | <b>42</b> |
| <b>Hernias (PEDAB-23)</b>  | <b>43</b> |
| <b>Abdominal Lymphadenopathy (PEDAB-24)</b>  | <b>44</b> |
| <b>Left Upper Quadrant Pain (PEDAB-25)</b>   | <b>45</b> |
| <b>Spleen (PEDAB-26)</b>   | <b>46</b> |
| <b>Intussusception (PEDAB-27)</b>  | <b>47</b> |
| <b>Bowel Obstruction (PEDAB-28)</b>  | <b>48</b> |
| <b>Left Lower Quadrant Pain (PEDAB-29)</b>   | <b>49</b> |
| <b>Celiac Disease (Sprue) (PEDAB-30)</b>   | <b>50</b> |
| <b>Transplant (PEDAB-31)</b>   | <b>51</b> |
| <b>Gaucher Disease (PEDAB-32)</b>  | <b>52</b> |

|   |           |
|---|-----------|
| <b>Vomiting Infant, Malrotation, and Hypertrophic Pyloric Stenosis (PEDAB-33)</b> | <b>53</b> |
| <b>Pancreatitis (PEDAB-34)</b>  | <b>54</b> |

| <b>Procedure Codes Associated with Abdomen Imaging</b>   |             |
|--|-------------|
| <b>MRI</b>   | <b>CPT®</b> |
| MRI Abdomen without contrast   | 74181       |
| MRI Abdomen with contrast (rarely used)  | 74182       |
| MRI Abdomen without and with contrast  | 74183       |
| Unlisted MRI procedure (for radiation planning or surgical software)   | 76498       |
| <b>MRA</b>   | <b>CPT®</b> |
| MRA Abdomen  | 74185       |
| <b>CT</b>  | <b>CPT®</b> |
| CT Abdomen without contrast  | 74150       |
| CT Abdomen with contrast   | 74160       |
| CT Abdomen without and with contrast   | 74170       |
| CT Abdomen and Pelvis without contrast   | 74176       |
| CT Abdomen and Pelvis with contrast  | 74177       |
| CT Abdomen and Pelvis without and with contrast  | 74178       |
| CT Guidance for Needle Placement (Biopsy, Aspiration, Injection, etc.)   | 77012       |
| CT Guidance for and monitoring of Visceral Tissue Ablation   | 77013       |
| CT Guidance for Placement of Radiation Therapy Fields  | 77014       |
| Unlisted CT procedure (for radiation planning or surgical software)  | 76497       |
| <b>CTA</b>   | <b>CPT®</b> |
| CTA Abdomen  | 74175       |
| CTA Abdomen and Pelvis   | 74174       |
| <b>Ultrasound</b>  | <b>CPT®</b> |
| Ultrasound, abdomen; complete  | 76700       |
| Ultrasound, abdomen; limited   | 76705       |
| Ultrasound, abdominal wall   | 76705       |
| Ultrasound, retroperitoneal; complete  | 76770       |
| Ultrasound, retroperitoneal; limited   | 76775       |
| Ultrasound, transplanted kidney (with duplex Doppler)  | 76776       |
| Duplex scan of arterial inflow and venous outflow of abdominal, pelvic, scrotal contents and/or retroperitoneal organs; complete study | 93975       |
| Duplex scan of arterial inflow and venous outflow of abdominal, pelvic, scrotal contents and/or retroperitoneal organs; limited study  | 93976       |
| Duplex scan of aorta, inferior vena cava, iliac vasculature, or bypass grafts; complete  | 93978       |
| Duplex scan of aorta, inferior vena cava, iliac vasculature, or bypass grafts; limited   | 93979       |

| <b>General Guidelines (PEDAB-1)</b>   |          |
|---|----------|
| <b>General Guidelines (PEDAB-1.0)</b>   | <b>6</b> |
| <b>Pediatric Abdominal Imaging Age Considerations (PEDAB-1.1)</b>                                       | <b>8</b> |
| <b>Pediatric Abdomen Imaging Appropriate Clinical Evaluation and Conservative Treatment (PEDAB-1.2)</b> | <b>8</b> |
| <b>Pediatric Abdomen Imaging Modality General Considerations (PEDAB-1.3)</b>                            | <b>8</b> |

## **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
  - ◆ 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
  - ◆ 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 younger<sup>13</sup> 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 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.

### ➤ 3D Rendering

- ◆ 3D Rendering indications in pediatric abdomen imaging are identical to those for 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.

## References

1. Bridges MD. ACR–SPR Practice parameter for the performance and interpretation of magnetic resonance imaging (MRI). Revised 2017 (Resolution 10).
2. Karmazyn BK, John SD, Siegel MJ, et al. ACR–ASER–SCBT–MR–SPR Practice parameter for the performance of pediatric computed tomography (CT). Last review date: 2019 (Resolution 6).
3. Ing C, Dimaggio C, Whitehouse A, et al. Long-term Differences in Language and Cognitive Function After Childhood Exposure to Anesthesia. *Pediatrics*. 2012;130(3). doi:10.1542/peds.2011-3822.
4. Monteleone M, Khandji A, Cappell J, Lai WW, Biagas K, Schleien C. Anesthesia in Children. *Journal of Neurosurgical Anesthesiology*. 2014;26(4):396-398. doi:10.1097/ana.000000000000124.
5. DiMaggio C, Sun LS, Li G. Early Childhood Exposure to Anesthesia and Risk of Developmental and Behavioral Disorders in a Sibling Birth Cohort. *Anesthesia & Analgesia*. 2011;113(5):1143-1151. doi:10.1213/ane.0b013e3182147f42.
6. Abell TL, Camilleri M, Donohoe K, et al. Consensus Recommendations for Gastric Emptying Scintigraphy: A Joint Report of the American Neurogastroenterology and Motility Society and the Society of Nuclear Medicine. *The American Journal of Gastroenterology*. 2008;103(3):753-763. doi:10.1111/j.1572-0241.2007.01636.x.
7. Raju GS, Gerson L, Das A, Lewis B. American Gastroenterological Association (AGA) Institute Medical Position Statement on Obscure Gastrointestinal Bleeding. *Gastroenterology*. 2007;133(5):1694-1696. doi:10.1053/j.gastro.2007.06.008.
8. Zuckerman GR, Prakash C, Askin MP, Lewis BS. AGA technical review on the evaluation and management of occult and obscure gastrointestinal bleeding. *Gastroenterology*. 2000;118(1):201-221. doi:10.1016/s0016-5085(00)70430-6.
9. Morton KA, Clark PB, Christensen CR, et al. Diagnostic nuclear medicine. Amirsys. 2000 1st Ed. Chapter 8, pp 122-125.
10. Fraum TJ, Ludwig DR, Bashir MR, Fowler KJ. Gadolinium-based contrast agents: A comprehensive risk assessment. *Journal of Magnetic Resonance Imaging*. 2017;46(2):338-353. doi:10.1002/jmri.25625.
11. Update on FDA approach to safety issue of gadolinium retention after administration of gadolinium-based contrast agents available at <https://www.fda.gov/media/116492/download>.
12. Blumfield E, Swenson DW, Iyer RS, Stanescu AL. Gadolinium-based contrast agents — review of recent literature on magnetic resonance imaging signal intensity changes and tissue deposits, with emphasis on pediatric patients. *Pediatric Radiology*. 2019;49(4):448-457. doi:10.1007/s00247-018-4304-8.
13. Implementation Guide: Medicaid State Plan Eligibility Eligibility Groups Mandatory Coverage Infants and Children under Age 19 Guidance Portal. <https://www.hhs.gov/guidance/document/implementation-guide-medicaid-state-plan-eligibility-eligibility-groups-aeu-mandatory-2>.

## Generalized Abdominal Pain (PEDAB-2)

- Ultrasound (CPT® 76700 or CPT® 76705) and conservative treatment are indicated for the initial evaluation of children with no red flags 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).
  - ◆ Gastroenterology (GI) specialist evaluation or consultation is helpful in determining the need for advanced imaging in these cases.
- 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)**
- CT Abdomen (CPT® 74160) or 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)**)

### Background and Supporting Information

- 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.

### References

1. Magbool A and Liacouras CA. Major symptoms and signs of digestive tract disorders. *Nelson Textbook of Pediatrics, Chapter 322*. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 1902-1912.
2. Magbool 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.
3. Reust CE, Williams A. Acute abdominal pain in children. *Am Fam Physician*. 2016 May 15;93(10):830-6.
4. Cogley JR, O'Connor SC, Houshyar R, Dulaimy KA. Emergent Pediatric US: What Every Radiologist Should Know. *RadioGraphics*. 2012;32(3):651-665. doi:10.1148/rg.323115111.
5. Sanchez TR, Corwin MT, Davoodian A, Stein-Wexler R. Sonography of Abdominal Pain in Children. *Journal of Ultrasound in Medicine*. 2016;35(3):627-635. doi:10.7863/ultra.15.04047.
6. Harwood R, Partridge R, Minford J, Almond S. Paediatric abdominal pain in the time of COVID-19: a new diagnostic dilemma. *J Surg Case Rep*. 2020;2020(9):rjaa337. doi:10.1093/jscr/rjaa337.
7. Noda S, Ma J, Romberg EK, Hernandez RE, Ferguson MR. Severe COVID-19 initially presenting as mesenteric adenopathy. *Pediatr Radiol*. 2021;51(1):140-143. doi:10.1007/s00247-020-04789-9.
8. Caro-Dominguez P, Navallas M, Rianza-Martin L, Ghadimi Mahani M, et. al. Imaging findings of multisystem inflammatory syndrome in children associated with COVID-19. *Pediatr Radiol*. 2021;51(1):140-143. doi:10.1007/s00247-021-05065-0.
9. Koppen IJ, Nurko S, Saps M, Di Lorenzo C, Benninga MA. The pediatric Rome IV criteria: what's new? *Expert Rev Gastroenterol Hepatol*. 2017;11(3):193-201. doi:10.1080/17474124.2017.1282820.
10. Sahn B, Eze OP, Edelman MC, Chougar CE, Thomas RM, Schleien CL, Weinstein T. Features of Intestinal Disease Associated With COVID-Related Multisystem Inflammatory Syndrome in Children. *J Pediatr Gastroenterol Nutr*. 2021 Mar 1;72(3):384-387.

## 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 diagnostic 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.
- CT Abdomen and Pelvis with contrast (CPT® 74177), CT Abdomen and Pelvis without contrast (CPT® 74176), MRI Pelvis without contrast (CPT® 72195), or MRI Pelvis without and with contrast (CPT® 72197) is indicated for any of the following:
  - ◆ Individuals who are overweight (BMI ≥85<sup>th</sup> percentile for age)
  - ◆ Insufficient local ultrasound expertise exists
  - ◆ Ultrasound findings are inconclusive
- 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)

## References

1. Aiken JJ and Oldham KT. Acute Appendicitis. *Nelson Textbook of Pediatrics, Chapter 343*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition 2016. pp 1887-1894.
2. Aspelund G, Fingeret A, Gross E, et al. Ultrasonography/MRI Versus CT for Diagnosing Appendicitis. *Pediatrics*. 2014;133(4):586-593. doi:10.1542/peds.2013-2128.
3. Moore MM, Gustas CN, Choudhary AK, et al. MRI for clinically suspected pediatric appendicitis: an implemented program. *Pediatric Radiology*. 2012;42(9):1056-1063. doi:10.1007/s00247-012-2412-4.
4. Kotagal M, Richards MK, Chapman T, et al. Improving ultrasound quality to reduce computed tomography use in pediatric appendicitis: the Safe and Sound campaign. *The American Journal of Surgery*. 2015;209(5):896-900. doi:10.1016/j.amjsurg.2014.12.029.
5. Kotagal M, Richards MK, Flum DR, Acierno SP, Weinsheimer RL, Goldin AB. Use and accuracy of diagnostic imaging in the evaluation of pediatric appendicitis. *Journal of Pediatric Surgery*. 2015;50(4):642-646. doi:10.1016/j.jpedsurg.2014.09.080.
6. Cohen B, Bowling J, Midulla P, et al. The non-diagnostic ultrasound in appendicitis: is a non-visualized appendix the same as a negative study? *Journal of Pediatric Surgery*. 2015;50(6):923-927. doi:10.1016/j.jpedsurg.2015.03.012.
7. Bachur RG, Levy JA, Callahan MJ, Rangel SJ, Monuteaux MC. Effect of Reduction in the Use of Computed Tomography on Clinical Outcomes of Appendicitis. *JAMA Pediatrics*. 2015;169(8):755. doi:10.1001/jamapediatrics.2015.0479.
8. Dibble EH, Swenson DW, Cartagena C, Baird GL, Herliczek TW. Effectiveness of a Staged US and Unenhanced MR Imaging Algorithm in the Diagnosis of Pediatric Appendicitis. *Radiology*. 2018;286(3):1022-1029. doi:10.1148/radiol.2017162755.
9. Koberlein GC, Trout AT, Rigsby CK, et al. ACR Appropriateness Criteria® Suspected Appendicitis-Child. *Journal of the American College of Radiology*. 2019;16(5). doi:10.1016/j.jacr.2019.02.022.
10. Repplinger MD, Pickhardt PJ, Robbins JB, et al. Prospective Comparison of the Diagnostic Accuracy of MR Imaging versus CT for Acute Appendicitis. *Radiology*. 2018;288(2):467-475. doi:10.1148/radiol.2018171838.
11. Harwood R, Partridge R, Minford J, Almond S. Paediatric abdominal pain in the time of COVID-19: a new diagnostic dilemma. *J Surg Case Rep*. 2020;2020(9):rjaa337. doi:10.1093/jscr/rjaa337.
12. Imler D, Keller C, Sivasankar S, et al. Magnetic resonance imaging versus ultrasound as the initial imaging modality for pediatric and young adult patients with suspected appendicitis. *Acad Emerg Med*. 2017;24(5):569-577. doi:10.1111/acem.13180.
13. Jennings R, Guo H, Goldin A, Wright DR. Cost-effectiveness of imaging protocols for suspected appendicitis. *Pediatrics*. 2020;145(2):e20191352. doi:10.1542/peds.2019-1352.
14. AlFraih Y, Robinson T, Stein N, Kam A, Flageole H. Quality assurance and performance improvement project for suspected appendicitis. *Pediatr Qual Saf*. 2020 ;5(3):e290. doi:10.1097/pq9.0000000000000290.

## 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 without and with contrast (CPT® 74183) and MRI Pelvis without and with contrast (CPT® 72197) 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.

### References

1. American College of Radiology ACR Appropriateness Criteria® Acute onset of flank pain-Suspicion of stone disease (Urolithiasis) Revised 2015. <https://acsearch.acr.org/docs/69362/Narrative/>.
2. Kim CK, Biyyam DR, Becker MD, et al. ACR–SPR Practice parameter for the performance of renal scintigraphy. Revised 2017 (Resolution 29).
3. Tekgül S, Dogan HS, Kočvara R, et al. European Association of Urology. European Society for Paediatric Urology. Guidelines on Paediatric Urology 2015 with limited text update March 2017.
4. Mendichovszky I, Solar BT, Smeulders N, Easty M, Biassoni L. Nuclear Medicine in Pediatric Nephro-Urology: An Overview. *Seminars in Nuclear Medicine*. 2017;47(3):204-228. doi:10.1053/j.semnuclmed.2016.12.002.
5. Dillman JR, Rigsby CK, Iyer RS, Alazraki AL, Anupindi SA, Brown BP, Chan SS, Dorfman SR, Falcone RA, Garber MD, Nguyen JC. ACR Appropriateness Criteria® Hematuria-Child. *Journal of the American College of Radiology*. 2018 May 31;15(5):S91-103.
6. Bowen DK, Tasian GE. Pediatric Stone Disease. *Urologic Clinics of North America*. 2018;45(4):539-550. doi:10.1016/j.ucl.2018.06.002.

## Urinary Tract Infection (UTI) (PEDAB-5)

|                                 |    |
|---------------------------------|----|
| Upper Urinary Tract (PEDAB-5.1) | 16 |
| Lower Urinary Tract (PEDAB-5.2) | 17 |

## Upper Urinary Tract (PEDAB-5.1)

- 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.
  - ◆ 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.<sup>15</sup>
    - Contrast Enhanced Voiding Urosonography (CeVUS) may also be utilized at institutions with expertise in this modality<sup>15</sup>.
- Diuretic renography using Tc-99m MAG 3 (CPT® 78707, CPT® 78708, or CPT® 78709) for:
  - ◆ 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.
- Post-contrast CT Abdomen (CPT® 74160) has a role in the evaluation of renal abscess or unusual complications such as xanthogranulomatous pyelonephritis, but has no role in the routine evaluation of UTI.
- 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 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<sup>11, 13</sup>.
  - ◆ DSMA scintigraphy is indicated for:
    - Individuals with atypical or recurrent febrile acute urinary tract infections<sup>11</sup>.
      - Atypical findings may include poor response to antibiotics, elevated creatinine, or non-E coli organism.
    - Individuals with febrile urinary tract infections older than 5 years of age with known vesicoureteral reflux.<sup>14</sup>
    - For detection of post-pyelonephrotic renal scarring at least 6 months after the documented upper tract UTI in high-risk individuals with recurrent UTIs<sup>13</sup>.
- 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 VUR<sup>15</sup>
- 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.

## References

1. Mandell GA, Eggli DF, Gilday DL, et al. Society of Nuclear Medicine Procedure guideline for renal cortical scintigraphy in children. *Society Nuclear of Medicine Procedure Guidelines Manual*. Version 3.0, Approved June 20, 2003. pp.195-198.
2. Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months. *Pediatrics*. 2011;128(3):595-610. doi:10.1542/peds.2011-1330.
3. Elder JS. Urinary tract infections. *Nelson Textbook of Pediatrics, Chapter 538*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 2556-2562.
4. Jackson EC. Urinary Tract Infections in Children: Knowledge Updates and a Salute to the Future. *Pediatrics in Review*. 2015;36(4):153-166. doi:10.1542/pir.36-4-153.
5. Peters CA, Skoog SJ, Arant BS, et al. Management and screening of primary vesicoureteral reflux in children. American Urological Association. Published 2010. Reviewed and Validity Confirmed 2017.
6. Fettich J, Colarinha P, Fischer S, et al. Guidelines for direct radionuclide cystography in children. *European Journal of Nuclear Medicine and Molecular Imaging*. 2003;30(5). doi:10.1007/s00259-003-1137-x.
7. Palestro CJ, Brown ML, Forstrom LA et al. Society of Nuclear Medicine Procedure guideline for 111In-Leukocyte scintigraphy for suspected infection/inflammation, Version 3.0, approved June 2, 2004.
8. Vries EFJD, Roca M, Jamar F, Israel O, Signore A. Guidelines for the labelling of leucocytes with 99mTc-HMPAO. *European Journal of Nuclear Medicine and Molecular Imaging*. 2010;37(4):842-848. doi:10.1007/s00259-010-1394-4.
9. Mendichovszky I, Solar BT, Smeulders N, Easty M, Biassoni L. Nuclear Medicine in Pediatric Nephro-Urology: An Overview. *Seminars in Nuclear Medicine*. 2017;47(3):204-228. doi:10.1053/j.semnuclmed.2016.12.002.
10. Riccabona M. Imaging in childhood urinary tract infection. *La radiologia medica*. 2015;121(5):391-401. doi:10.1007/s11547-015-0594-1.
11. American College of Radiology ACR Appropriateness Criteria® Urinary Tract Infection—Child. Revised 2016. <https://acsearch.acr.org/docs/69444/Narrative/>.
12. Buettcher M, Trueck J, Niederer-Loher A, et. al. Swiss consensus recommendations on urinary tract infections in children. *European journal of pediatrics*. 2021;180(3):663-74
13. Vali R, Armstrong IS, Bar-Sever Z, et. al. SNMMI procedure standard/EANM practice guideline on pediatric [99mTc] Tc-DMSA renal cortical scintigraphy: an update. *Clinical and Translational Imaging*. 2022;4:1-2.
14. Ergun R, Sekerci CA, Tanidir Y, et. al. Abnormal DMSA renal scan findings and associated factors in older children with vesicoureteral reflux. *International Urology and Nephrology*. 2021;53(10):1963-8.
15. ACR–SPR practice parameter for the performance of fluoroscopic and sonographic voiding cystourethrography in children. Revised 2019 (Resolution 10). Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/voidingcysto.pdf?la=en>.

## 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 Lower Quadrant Pain (PEDAB-29)** in the Pediatric Abdomen Imaging Guidelines

### Reference

1. Kotloff KL. Acute gastroenteritis in children. *Nelson Textbook of Pediatrics. Chapter 366.* eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 2012-2032.

## Hematuria (PEDAB-7)

- 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.

### *Background and Supporting Information*

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

### *References*

1. Dillman JR, Rigsby CK, Iyer RS, Alazraki AL, Anupindi SA, Brown BP, Chan SS, Dorfman SR, Falcone RA, Garber MD, Nguyen JC. ACR Appropriateness Criteria® Hematuria-Child. Journal of the American College of Radiology. 2018 May 31;15(5):S91-103. Accessed 7/17/2018.
2. Flores FX. Clinical evaluation of the child with hematuria. Nelson Textbook of Pediatrics. Chapter 536. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, pp 2718-2720.
3. ACR Appropriateness Criteria® Hematuria-Child. Revised 2018.

## 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)<sup>1</sup>
  - ◆ MRI Abdomen with and without contrast (CPT® 74183) or CT Abdomen with contrast (CPT® 74160) when either US or NM is equivocal.
  - ◆ MRI Abdomen without contrast (CPT® 74181), MRI Abdomen without and with contrast (CPT® 74183) in individuals with complaints of RUQ pain with no fever and an ultrasound shows only gallstones.

### References

1. Garcia EM, Camacho MA, Karolyi DR, et al. ACR Appropriateness Criteria® Right Lower Quadrant Pain—Suspected Appendicitis. Revised 2018.
2. Gerard PS, Biyyam DR, Brown RKJ, et al. ACR-SPR practice parameter for the performance of hepatobiliary scintigraphy. ACR Practice Parameters. Revised 2017 (Resolution 30).

## 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).

### **Children with Suspected Crohn Disease**

- Clinical features including weight loss, loose stools, vomiting, and intermittent abdominal pain
  - ◆ 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 (after laboratory evaluation, and colonoscopy or upper endoscopy [as appropriate] with biopsy are performed initially) for ANY of the following<sup>1</sup>:
    - To detect severity and distribution of inflammatory changes
    - Identify complications (such as fistulizing disease or abscess formation)
- MRI Pelvis with contrast (CPT® 72196) or MRI Pelvis without and with contrast (CPT® 72197) is indicated for the following<sup>1</sup>:
  - ◆ Concern for perianal fistula or abscess

### **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<sup>1</sup>:
  - ◆ 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<sup>1</sup>:
  - ◆ 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<sup>1</sup>:
  - ◆ Concern for perianal fistula or abscess

### ***Background and Supporting Information***

- MR enterography (CPT® 74183 and CPT® 72197) is generally preferred over CT when possible to avoid radiation exposure for children

### References

1. Moore MM, Gee MS, Iyer RS, et. al. ACR Appropriateness Criteria® Crohn Disease-Child. *J Am Coll Radiol*. 2022;19(5S):S19-S36.
2. .
3. Duigenan S Gee MS. Imaging of Pediatric Patients With Inflammatory Bowel Disease. *American Journal of Roentgenology*. 2012;199(4):907-915. doi:10.2214/ajr.11.7966.
4. Grossman AB and Baldassano RN. Inflammatory bowel disease. *Nelson Textbook of Pediatrics, Chapter 336*. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition. 2016, pp 1819-1831.
5. Maltz R, Podberesky DJ, Saeed SA. Imaging modalities in pediatric inflammatory bowel disease. *Current Opinion in Pediatrics*. 2014;26(5):590-596. doi:10.1097/mop.000000000000131.
6. Schooler GR, Hull NC, Mavis A, Lee EY. MR Imaging Evaluation of Inflammatory Bowel Disease in Children: Magnetic Resonance Imaging Clinics of North America. 2019;27(2):291-300. doi:10.1016/j.mric.2019.01.007.

## 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.
- Beyond 60 days postoperatively, see: **Generalized Abdominal Pain (PEDAB-2)**.

### References

1. Chang KJ, Marin DM, Kim DH, et al. Suspected small bowel obstruction. ACR Appropriateness Criteria®. Date of origin: 1996. Last review date: 2019.
2. Yagmhai V, Rosen MP, Lalani T, et al. Acute (nonlocalized) abdominal pain and fever or suspected abdominal abscess. ACR Appropriateness Criteria®. Date of origin: 1996. Last review date: 2012.
3. Palestro CJ, Brown ML, Forstrom LA et al. Society of Nuclear Medicine Procedure guideline for 111In-Leukocyte scintigraphy for suspected infection/inflammation, Version 3.0, approved June 2, 2004.
4. Vries EFJD, Roca M, Jamar F, Israel O, Signore A. Guidelines for the labelling of leucocytes with 99mTc-HMPAO. European Journal of Nuclear Medicine and Molecular Imaging. 2010;37(4):842-848. doi:10.1007/s00259-010-1394-4.

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

- 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.
- 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 months<sup>6</sup> (See: **Tethered Cord (PEDSP-5)** for 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)**)
- MRI Pelvis without and with contrast (CPT® 72197) if ALL of the following:
  - ◆ Hirschsprung disease
  - ◆ Post-operative individuals who have signs of complication

### Background and Supporting Information

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.

### 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.
3. Maqbool A and Liacouras CA. Encopresis and functional constipation. *Nelson Textbook of Pediatrics*, Chapter 335.3 eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020. pp 1958-1961.
4. Kotloff KL Acute Gastroenteritis in Children. *Nelson Textbook of Pediatrics*, Chapter 366. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, p 2033-2041.
5. Zella GC, Israel EJ. Chronic Diarrhea in Children. *Pediatrics in Review*. 2012;33(5):207-218. doi:10.1542/pir.33-5-207.
6. Hasosah M. Chronic refractory constipation in children: Think beyond stools. *Glob Pediatr Health*. 2021;8. doi:10.1177/2333794X211048739.

## **Abdominal Mass (PEDAB-13)**

|  |           |
|--|-----------|
| <b>Abdominal Wall Mass (PEDAB-13.1)</b>  | <b>28</b> |
| <b>Intra-Abdominal Mass (PEDAB-13.2)</b> | <b>28</b> |

### **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<sup>5</sup>.
- 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 (ACC) (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)**

## References

1. Allen-Rhoades W and Steuber CP. Clinical assessment and differential diagnosis of the child with suspected cancer. *Principles and Practice of Pediatric Oncology*. eds Pizzo PA and Poplack DG. 7th edition 2016. pp. 101-111.
2. Malkan AD, Loh A, Bahrami A, et al. An Approach to Renal Masses in Pediatrics. *Pediatrics*. 2014;135(1):142-158. doi:10.1542/peds.2014-1011.
3. Crane GL, Hernanz-Schulman M. Current Imaging Assessment of Congenital Abdominal Masses in Pediatric Patients. *Seminars in Roentgenology*. 2012;47(1):32-44. doi:10.1053/j.ro.2011.07.004.
4. Chung EM, Graeber AR, Conran RM. Renal Tumors of Childhood: Radiologic-Pathologic Correlation Part 1. The 1st Decade: From the Radiologic Pathology Archives. *RadioGraphics*. 2016;36(2):499-522. doi:10.1148/rg.2016150230.
5. Chung EM, Lattin GE, Fagen KE, et al. Renal Tumors of Childhood: Radiologic-Pathologic Correlation Part 2. The 2nd Decade: From the Radiologic Pathology Archives. *RadioGraphics*. 2017;37(5):1538-1558. doi:10.1148/rg.2017160189.
6. Kim HHR, Hull NC, Lee EY, Phillips GS. Pediatric abdominal masses: Imaging guidelines and recommendations. *Radiol Clin North Am*. 2022;60(1):113-129. doi:10.1016/j.rcl.2021.08.008

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

- Clinical evaluation for suspected hypertension should include repeated blood pressure measurements (generally  $\geq 3$  measurements). If these measurements are at or above the age-dependent systolic or diastolic blood pressures requiring further evaluation, as listed in the following table, further evaluation is warranted. 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.

| Age-Dependent Systolic or Diastolic Blood Pressures Requiring Further Evaluation <sup>16</sup> |          |           |          |           |
|--|----------|-----------|----------|-----------|
|  | Boys     |           | Girls    |           |
| Age  | Systolic | Diastolic | Systolic | Diastolic |
| 1  | 98       | 52        | 98       | 54        |
| 2  | 100      | 55        | 101      | 58        |
| 3  | 101      | 58        | 102      | 60        |
| 4  | 102      | 60        | 103      | 62        |
| 5  | 103      | 63        | 104      | 64        |
| 6  | 105      | 66        | 105      | 67        |
| 7  | 106      | 68        | 106      | 68        |
| 8  | 107      | 69        | 107      | 69        |
| 9  | 107      | 70        | 108      | 71        |
| 10   | 108      | 72        | 109      | 72        |
| 11   | 110      | 74        | 111      | 74        |
| 12   | 113      | 75        | 114      | 75        |
| $\geq 13$  | 120      | 80        | 120      | 80        |

- ANY of the following studies are indicated for initial evaluation of a pediatric individual with suspected secondary hypertension:
  - ◆ Doppler or Duplex Ultrasound (CPT<sup>®</sup> 93975 or CPT<sup>®</sup> 93976).
  - ◆ Complete retroperitoneal ultrasound (CPT<sup>®</sup> 76770).
  - ◆ Captopril renography (CPT<sup>®</sup> 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:**

- MRA Abdomen (CPT<sup>®</sup> 74185) or CTA Abdomen (CPT<sup>®</sup> 74175) may be indicated for pediatric individuals with hypertension to exclude fibromuscular dysplasia or other blood-flow restricting lesions of the renal arteries.
- Echocardiography (CPT<sup>®</sup> 93306) is indicated at initial evaluation to screen for cardiac abnormalities, coarctation of the aorta, and end-organ damage such as left ventricular hypertrophy.

## References

1. Castelli PK, Dillman JR, Smith EA, Vellody R, Cho K, Stanley JC. Imaging of Renin-Mediated Hypertension in Children. *American Journal of Roentgenology*. 2013;200(6). doi:10.2214/ajr.12.9427.
2. Chhadia S, Cohn RA, Vural G, Donaldson JS. Renal Doppler evaluation in the child with hypertension: a reasonable screening discriminator? *Pediatric Radiology*. 2013;43(12):1549-1556. doi:10.1007/s00247-013-2741-y.
3. Castelli PK, Dillman JR, Kershaw DB, Khalatbari S, Stanley JC, Smith EA. Renal sonography with Doppler for detecting suspected pediatric renin-mediated hypertension – is it adequate? *Pediatric Radiology*. 2013;44(1):42-49. doi:10.1007/s00247-013-2785-z.
4. Harvin HJ, Verma N, Nikolaidis P, et al. Renovascular hypertension. *ACR Appropriateness Criteria®*. Revised 2017.
5. Trautmann A, Roebuck DJ, McLaren CA, Brennan E, Marks SD, Tullus K. Non-invasive imaging cannot replace formal angiography in the diagnosis of renovascular hypertension. *Pediatric Nephrology*. 2016;32(3):495-502. doi:10.1007/s00467-016-3501-7.
6. Lande MB. Systemic hypertension. *Nelson Textbook of Pediatrics*, Chapter 445. eds Kliegman RM, Stanton BF, St. Geme JW III, et al. 20th edition 2016, pp 2294-2303.
7. Brady TM. Hypertension. *Pediatrics in Review*. 2012;33(12):541-552. doi:10.1542/pir.33-12-541.
8. Ilivitzki A, Glozman L, Alfonso RL, Ofer A, Razi NB, Shapira MR. Sonographic evaluation of renovascular hypertension in the pediatric population: State-of-the-art. *Journal of Clinical Ultrasound*. 2017;45(5):282-292. doi:10.1002/jcu.22467.
9. Mendichovszky I, Solar BT, Smeulders N, Easty M, Biassoni L. Nuclear Medicine in Pediatric Nephro-Urology: An Overview. *Seminars in Nuclear Medicine*. 2017;47(3):204-228. doi:10.1053/j.semnuclmed.2016.12.002.
10. Ingelfinger JR. The Child or Adolescent with Elevated Blood Pressure. *New England Journal of Medicine*. 2014;370(24):2316-2325. doi:10.1056/nejmcp1001120.
11. Kim CK, Biyyam DR, Becker MD, et al. *ACR–SPR Practice Guideline for the Performance of Renal Scintigraphy*. Revised 2017 (Resolution 29).
12. Tekgöl S, Dogan HS, Kočvara R, et al. European Association of Urology. European Society for Paediatric Urology. *Guidelines on Paediatric Urology 2015 with limited text update March 2017*.
13. Flynn JT, Kaelber DC, Baker-Smith CM, et al; SUBCOMMITTEE ON SCREENING AND MANAGEMENT OF HIGH BLOOD PRESSURE IN CHILDREN. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*. 2017; 140(3):e20171904. *Pediatrics*. 2017;140(6). doi:10.1542/peds.2017-3035.

## Liver Lesion Characterization (PEDAB-15)

- Liver lesion characterization imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Liver Lesion Characterization (AB-29)** in the Abdomen Imaging Guidelines.
- 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.

### References

1. Hegde SV, Dillman JR, Lopez MJ, Strouse PJ. Imaging of multifocal liver lesions in children and adolescents. *Cancer Imaging*. 2012;12(3):516-529. doi:10.1102/1470-7330.2012.0045.
2. Fernandez-Pineda I. Differential diagnosis and management of liver tumors in infants. *World Journal of Hepatology*. 2014;6(7):486. doi:10.4254/wjh.v6.i7.486.
3. Siegel MJ, Masand PM. Liver. In: Siegel MJ, editor. *Pediatric Sonography*. 5th ed, Philadelphia, Wolters Kluwer, 2019. p 211-272.
4. Squires JE and Balistreri WF. Evaluation of patients with possible liver dysfunction. *Nelson Textbook of Pediatrics*, Chapter 382.1. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 2089-2092.
5. Chung EM, Cube R, Lewis RB, Conran RM. Pediatric Liver Masses: Radiologic-Pathologic Correlation Part 1. Benign Tumors. *RadioGraphics*. 2010;30(3):801-826. doi:10.1148/rg.303095173.
6. Shamir SB, Kurian J, Kogan-Liberman D, Taragin BH. Hepatic Imaging in Neonates and Young Infants: State of the Art. *Radiology*. 2017;285(3):763-777. doi:10.1148/radiol.2017170305.



| <b>Liver Disease (PEDAB-16)</b>                           |           |
|---|-----------|
| <b>Pediatric Liver Failure and Cirrhosis (PEDAB-16.1)</b> | <b>34</b> |
| <b>Biliary Disease (PEDAB-16.2)</b>                       | <b>34</b> |

## **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.
- 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.

### ***Background and Supporting Information***

- 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.
  - ◆ Idiopathic causes

## **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.

### References

1. Squires JE and Balistreri WF. Evaluation of patients with possible liver dysfunction. *Nelson Textbook of Pediatrics, Chapter 382.1*. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition 2020, pp 2089-2092.
2. Fusillo S, Rudolph B. Nonalcoholic Fatty Liver Disease. *Pediatrics in Review*. 2015;36(5):198-206. doi:10.1542/pir.36-5-198.
3. Rijn RV, Nievelstein R. Paediatric ultrasonography of the liver, hepatobiliary tract and pancreas. *European Journal of Radiology*. 2014;83(9):1570-1581. doi:10.1016/j.ejrad.2014.03.025.
4. Paranjape SM, Mogayzel PJ. Cystic Fibrosis. *Pediatrics in Review*. 2014;35(5):194-205. doi:10.1542/pir.35-5-194.
5. 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.
6. Soares KC, Goldstein SD, Ghaseb MA, Kamel I, Hackam DJ, Pawlik TM. Pediatric choledochal cysts: diagnosis and current management. *Pediatr Surg Int*. 2017 Jun;33(6):637-650. doi: 10.1007/s00383-017-4083-6. Epub 2017 Mar 31. PMID: 28364277.
7. Abbey P, Kandasamy D, Naranje P. Neonatal Jaundice. *Indian J Pediatr*. 2019 Sep;86(9):830-841. doi: 10.1007/s12098-019-02856-0. Epub 2019 Feb 21. PMID: 30790186.

## Adrenal Lesions (PEDAB-17)

- 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.
    - MRI Abdomen without and with contrast (CPT® 74183) or CT Abdomen without and with contrast (CPT® 74170) are indicated to confirm the diagnosis if repeat ultrasound is concerning for neuroblastoma or there is high clinical concern for neuroblastoma. MRI is preferred over CT when possible to reduce radiation exposure. If these studies, confirm neuroblastoma <sup>123</sup>I-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.

### Background and Supporting Information

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.

### References

1. Gawande, R, Castenaeda, R and Daldrup-Link, H. Adrenal hemorrhage in pearls and pitfalls. Pediatric imaging: variants and other difficult diagnoses. eds. Heike E, Daldrup-Link, and Newman B. Cambridge University Press, Apr 24, 2014.
2. Moreira SG, Pow-Sang JM. Evaluation and Management of Adrenal Masses. Cancer Control. 2002;9(4):326-334. doi:10.1177/107327480200900407.
3. Sharp SE, Gelfand MJ, Shulkin BL. Pediatrics: Diagnosis of Neuroblastoma. Seminars in Nuclear Medicine. 2011;41(5):345-353. doi:10.1053/j.semnuclmed.2011.05.001.
4. Bombardieri E, Giannarile F, Aktolun C, et al. <sup>131</sup>I/<sup>123</sup>I-Metaiodobenzylguanidine (mIBG) scintigraphy: procedure guidelines for tumour imaging. European Journal of Nuclear Medicine and Molecular Imaging. 2010;37(12):2436-2446. doi:10.1007/s00259-010-1545-7.
5. Chrisoulidou A, Kaltsas G, Ilias I, Grossman AB. The diagnosis and management of malignant pheochromocytoma and paraganglioma. Endocrine-Related Cancer. 2007;14(3):569-585. doi:10.1677/erc-07-0074.
6. Ganguly A. Primary Aldosteronism. New England Journal of Medicine. 1998;339(25):1828-1834. doi:10.1056/nejm199812173392507.
7. Orth DN. Cushing's Syndrome. New England Journal of Medicine. 1995;332(12):791-803. doi:10.1056/nejm199503233321207.
8. Siegel MJ, Chung EM. Adrenal gland, pancreas, and other retroperitoneal structures. In Siegel MJ, editor. Pediatric sonography. 5th ed. Philadelphia, Wolters Kluwer, 2019. p 467-512.
9. White PC. Congenital adrenal hyperplasia and related disorders. Nelson Textbook of Pediatrics, Chapter 594. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 2970-2979.
10. Sargar KM, Khanna G, Bowling RH. Imaging of Nonmalignant Adrenal Lesions in Children. RadioGraphics. 2017;37(6):1648-1664. doi:10.1148/rg.2017170043.

| <b>Hemochromatosis (PEDAB-18)</b>                                      |           |
|--|-----------|
| <b>Hereditary (Primary) Hemochromatosis (PEDAB-18.1)</b>               | <b>38</b> |
| <b>Transfusion-Associated (Secondary) Hemochromatosis (PEDAB-18.2)</b> | <b>38</b> |

### **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)**

- 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).

#### ***Background and Supporting Information***

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 individuals, and hematopoietic stem cell transplant individuals.

#### ***References***

1. Evidence-Based Management of Sickle Cell Disease: Expert Panel Report, 2014. *Pediatrics*. 2014;134(6). doi:10.1542/peds.2014-2986.
2. Chavhan GB, Babyn PS, Thomas B, Shroff MM, Haacke EM. Principles, Techniques, and Applications of T2\*-based MR Imaging and Its Special Applications. *RadioGraphics*. 2009;29(5):1433-1449. doi:10.1148/rg.295095034.
3. Children's Oncology Group. Long-term follow-up guidelines for survivors of childhood, adolescent, and young adult cancers. Version 4.0 – October 2013, Monrovia, CA.

## Indeterminate Renal Lesion (PEDAB-19)

- Indeterminate renal lesion characterization imaging indications in pediatric individuals are very similar to those for adult individuals. See: **Renal Failure (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:
  - ◆ 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.

### *Background and Supporting Information*

Pediatric renal cysts have a lower risk of malignant progression than do renal cysts in adults

### *References*

1. Karmazyn B, Tawadros A, Delaney L, et al. Ultrasound classification of solitary renal cysts in children. *Journal of Pediatric Urology*. 2015;11(3). doi:10.1016/j.jpuro.2015.03.001.
2. Kim CK, Biyyam DR, Becker MD, et al. ACR–SPR Practice parameter for the performance of renal scintigraphy. Revised 2017 (Resolution 29).
3. Mandell GA, Egli DF, Gilday DL, et al. Society of Nuclear Medicine, Procedure guideline for renal cortical scintigraphy in children, Version 3.0, approved June 20, 2003.

## Hydronephrosis (PEDAB-20)

- 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.
- Retroperitoneal ultrasound (CPT® 76770) and diuretic renography (CPT® 78707, CPT® 78708, or CPT® 78709) for evaluation obstructive uropathy (including ureteropelvic junction obstruction (UPJO) ), ureterovesical junction obstruction (UVJO), and bladder outlet obstruction) preoperatively 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.

### Background and Supporting Information

Hydronephrosis is a relatively common finding in pediatric individuals.

### References

1. Darge K, Siegel MJ. Kidney. In: Seigel MJ, editor Pediatric Sonography, 5<sup>th</sup> ed, Philadelphia, Wolters Kluwer, 2019. p 396-466.
2. Sinha A, Bagga A, Krishna A, et al. Revised guidelines on management of antenatal hydronephrosis. Indian Journal of Nephrology. 2013;23(2):83. doi:10.4103/0971-4065.109403.
3. Dervoort KV, Lasky S, Sethna C, et al. Hydronephrosis in Infants and Children: Natural History and Risk Factors for Persistence in Children Followed by a Medical Service. Clinical medicine Pediatrics. 2009;3. doi:10.4137/cmped.s3584.
4. Hsi RS, Holt SK, Gore JL, Lendvay TS, Harper JD. National Trends in Followup Imaging after Pyeloplasty in Children in the United States. Journal of Urology. 2015;194(3):777-782. doi:10.1016/j.juro.2015.03.123.
5. Elder JS. Obstruction of the urinary tract. Nelson Textbook of Pediatrics, Chapter 555. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp 2800-2810.
6. Nguyen HT, Benson CB, Bromley B, et al. Multidisciplinary consensus on the classification of prenatal and postnatal urinary tract dilation (UTD classification system). Journal of Pediatric Urology. 2014;10(6):982-998. doi:10.1016/j.jpuro.2014.10.002.
7. Chow JS, Koning JL, Back SJ, Nguyen HT, Phelps A, Darge K. Classification of pediatric urinary tract dilation: the new language. Pediatric Radiology. 2017;47(9):1109-1115. doi:10.1007/s00247-017-3883-0.
8. Brown BP, Simoneaux SF, Dillman JR, Rigsby CK, Iyer RS, Alazraki AL, Bardo DM, Chan SS, Chandra T, Dorfman SR, Garber MD. ACR Appropriateness Criteria® Antenatal Hydronephrosis—Infant. Journal of the American College of Radiology. 2020 Nov 1;17(11):S367-79.



## 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.
3. Gimpel C, Avni EF, Breyssem L, et al. Imaging of Kidney Cysts and Cystic Kidney Diseases in Children: An International Working Group Consensus Statement. Radiology. 2019;290(3):769-782. doi:10.1148/radiol.2018181243.

## 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.

## 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.
- 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.
2. Brandow AM and Camitta BM. Hyposplenism, splenic trauma, and splenectomy. Nelson Textbook of Pediatrics, Chapter 514. eds Kliegman RM, St. Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM. 21st edition. 2020, pp. 2621-2622.
3. Navarro OM, Siegel MJ. Spleen and Peritoneal Cavity. In: Siegel MJ, editor. Pediatric Sonography, 5<sup>th</sup> ed. Philadelphia. Wolters Kluwer. 2019. p 304-345.

## Intussusception (PEDAB-27)

- 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.

### *Background and Supporting Information*

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.

### *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.
4. Atweh LA, Naffaa L, Barakat A, Baassiri A. Imaging Acute Non-Traumatic Abdominal Pathologies in Pediatric Patients: A Pictorial Review. *Journal of Radiology Case Reports*. 2019;13(7). doi:10.3941/jrcr.v13i7.3443.

## 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)

- 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)**)
- 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.

### *Background and Supporting Information*

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

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

### *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)

- 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 (CXR 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.
- Infants with projectile non-bilious vomiting should be evaluated with US 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 US expertise is not available for this condition, or if the clinical presentation is atypical for Hypertrophic Pyloric Stenosis. US is preferred when available, as it involves no contrast or ionizing radiation use.

### Background and Supporting Information

- 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.
- 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.

### 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.
4. Hwang J-Y. Emergency ultrasonography of the gastrointestinal tract of children. Ultrasonography. 2017;36(3):204-221. doi:10.14366/usg.16052.
5. Atweh LA, Naffaa L, Barakat A, Baassiri A. Imaging Acute Non-Traumatic Abdominal Pathologies in Pediatric Patients: A Pictorial Review. Journal of Radiology Case Reports. 2019;13(7). doi:10.3941/jrcr.v13i7.3443.
6. Coley BDBD. Caffey's Pediatric Diagnostic Imaging. Philadelphia, PA: Elsevier; 2019. Chapters 100 and 102.
7. American College of Radiology ACR Appropriateness Criteria® Vomiting in Infants. Revised 2020. <https://acsearch.acr.org/docs/69445/Narrative/>.

| <b>Pancreatitis (PEDAB-34)</b>           |           |
|--|-----------|
| <b>Acute Pancreatitis (PEDAB-34.1)</b>   | <b>55</b> |
| <b>Chronic Pancreatitis (PEDAB-34.2)</b> | <b>55</b> |

## **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 indicated<sup>2</sup>
- 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)**

- 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



### **Background and Supporting Information**

- 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

### **References**

1. Trout AT, Anupindi SA, Freeman AJ, et. al. North American Society for Pediatric Gastroenterology, Hepatology and Nutrition and the Society for Pediatric Radiology joint position paper on noninvasive imaging of pediatric pancreatitis: literature summary and recommendations. *J Pediatr Gastroenterol Nutr.* 2021;72(1):151-167. doi:10.1097/MPG.0000000000002964.
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.