2011 Imaging Criteria

Computed Tomography (CT), Abdomen and Pelvis (Pediatric)[1*RIN, 2]

ICD-9-CM: 87.71, 88.01
CPT: 74176, 74177, 74178
I/O Setting: Outpatient

INDICATION(S)

100 Abdominal mass by PE/KUB/US
200 Suspected intra-abdominal hemorrhage ♦
300 Acute abdominal pain, unknown etiology ♦
400 Suspected appendicitis ♦
500 Suspected intra-abdominal/pelvic abscess ♦
600 Follow-up of known abdominal/pelvic abscess after Rx
700 Fever of unknown origin (FUO)
800 Abdominal/pelvic evaluation with known cancer
900 Suspected bowel obstruction
1000 Abdominal/pelvic trauma
1100 Cryptorchidism
1200 Genitourinary tract tumor by imaging/testing
1300 Nephrolithiasis
1400 Unilateral flank/abdominal pain by Hx
1500 Cystitis/pyelonephritis by culture
1600 Noncystic/indeterminate renal parenchymal mass by US
1700 Hematuria (nontraumatic)

100 Abdominal mass by PE/KUB/US[3, 4]

200 Suspected intra-abdominal hemorrhage **[All]** ♦
- 210 Abdominal pain/tenderness/distention
- 220 Risk factor for bleeding **[One]**
  - 221 Recent intra-abdominal surgery/instrumentation[5]
  - 222 Coagulopathy
  - 223 Abdominal/pelvic trauma
- 230 Findings **[One]**
  - 231 Hct decrease ≥ 6% w/in 4 hrs
  - 232 Hemodynamic instability **[One]**[6]
    - -1 Systolic BP < normal
    - -2 Decrease in systolic BP ≥ 20 mmHg from baseline
    - -3 Shock by PE[7]

-4 Tachycardia
-5 Urine output < 1 cc/kg/hr

300 Acute abdominal pain, unknown etiology **[All]** ♦
- 310 Abdominal tenderness
- 320 CBC normal
- 330 Serum/urine HCG **[One]**[8]
  - 331 Negative
  - 332 Not indicated[9]
- 340 U/A or urine culture normal
- 350 Cervical cultures **[One]**
  - 351 Gonorrhea test negative and no chlamydia by DNA/antibody testing
  - 352 Not indicated

400 Suspected appendicitis **[All]** ♦[10, 11]
- 410 Periumbilical/suprapubic/RLQ pain[12]
- 420 Findings **[One]**
  - 421 Involuntary guarding with localization of pain
  - 422 Persistent direct tenderness to palpation
  - 423 Abdominal rigidity
  - 424 WBC > 12,000/cu.mm($12x10^9$/L)
  - 425 Temperature > 100.4 F(38.0 C)
- 430 Pelvic examination **[One]**[13]
  - 431 Nondiagnostic for etiology of pain
  - 432 Not indicated[14]
- 440 Pregnancy excluded **[One]**[15]
  - 441 HCG negative[16]
  - 442 Patient not sexually active by Hx[17]
  - 443 Not indicated[9]

500 Suspected intra-abdominal/pelvic abscess **[Both]** ♦[18]
- 510 Abdominal/pelvic pain > 24 hrs by Hx
- 520 Findings **[Two]**[19]
  - 521 Localized abdominal tenderness
  - 522 Temperature > 100.4 F(38.0 C)
  - 523 WBC > 10,000/cu.mm($10x10^9$/L)

600 Follow-up of known abdominal/pelvic abscess after Rx **[One]**[18]
- 610 Sx/findings unimproved **after** Rx **[Both]**[20]
  - 611 IV Abx ≥ 2 days
  - 612 Drainage

620 Sx/findings unimproved after IV Abx Rx ≥ 1 wk[20]
630 New/worsening Sx/findings **[One]**
631 Abdominal pain
632 Abdominal mass
633 Temperature > 100.4 F(38.0 C)
634 WBC increasing
640 Single follow-up study

700 Fever of unknown origin (FUO) **[All]**[21]
710 Temperature > 101 F(38.3 C) > 2 wks
720 No fever source by Hx & PE
730 CXR normal
740 Blood cultures negative/nondiagnostic for etiology of fever
750 Urine culture negative/nondiagnostic for etiology of fever

800 Abdominal/pelvic evaluation with known cancer **[One]**
810 Initial staging[22]
820 Follow-up after Rx **[One]**
821 After surgery and before adjuvant chemotherapy/radiation
822 After Rx for metastatic/unresectable disease[23]
830 New/worsening Sx/findings **[One]**
831 Anorexia
832 Weight loss by Hx/PE
833 Jaundice
834 Abdominal/pelvic pain
835 Abdominal/pelvic mass
836 Hepatomegaly
837 Ascites
838 Bowel obstruction by KUB
839 LFTs elevated/increasing

900 Suspected bowel obstruction **[Both]**[24]
910 Sx/findings **[Two]**
911 Crampy abdominal pain
912 Nausea/vomiting
913 Constipation
914 Abdominal distention
915 High-pitched, tinkling bowel sounds
916 Diffuse abdominal tenderness
920 KUB abnormal but nonspecific[25]

1000 Abdominal/pelvic trauma **[One]**
- 1010 Initial evaluation ♦[26]
- 1020 Follow-up for known/suspected intra-abdominal injury **[One]**[27]
  - 1021 Periodic assessment[28, 29]
  - 1022 New/worsening Sx/findings **[One]** ♦[26]
    - -1 Abdominal/pelvic pain
    - -2 Abdominal/pelvic tenderness
    - -3 Hct decrease ≥ 6% w/in 4 hrs
    - -4 Hemodynamic instability **[One]**
      - A) Systolic BP < normal
      - B) Decrease in systolic BP ≥ 20 mmHg from baseline
      - C) Shock by PE[7]
      - D) Tachycardia
      - E) Urine output < 1 cc/kg/hr

1100 Cryptorchidism **[Both]**[30]
- 1110 Testicle not palpable in scrotum/inguinal canal
- 1120 Abdominal/pelvic US nondiagnostic for undescended testicle

1200 Genitourinary tract tumor by imaging/testing[31]

1300 Nephrolithiasis **[One]**[32]
- 1310 Suspected renal/ureteral stone and US nondiagnostic/not indicated **[One]**[33, 34]
  - 1311 Unilateral flank pain[35]
  - 1312 Sx/findings **[Both]**[36]
    - -1 Symptoms **[One]**[37]
      - A) Unilateral abdominal/pelvic pain
      - B) Unilateral groin/genitalia pain
    - -2 Findings **[One]**
      - A) Hematuria
      - B) Multiple stones by KUB[38]
- 1320 Known renal/ureteral stone **[One]**[39]
  - 1321 Pain/nausea/vomiting uncontrolled by medication
  - 1322 Continued flank/abdominal pain ≥ 3 days
  - 1323 Continued microscopic hematuria ≥ 4 wks
  - 1324 Continued hematuria ≥ 2 wks after passing stone
  - 1325 Stone present by KUB ≥ 8 wks

1400 Unilateral flank/abdominal pain by Hx **[One]**
- 1410 Solitary kidney
- 1420 Known pelvic tumor

1430 Prior kidney/ureteral/bladder procedure/instrumentation
1440 Stone by KUB
1450 Hematuria

1500 Cystitis/pyelonephritis by culture **[One]**[40, 41, 42, 43, 44]
1510 Cystitis **and [One]**
1511 Age ≤ 2
1512 Male patient[45]
1513 Temperature > 100.4 F(38.0 C)
1514 Episodes ≥ 2x
1520 Pyelonephritis

1600 Noncystic/indeterminate renal parenchymal mass by US[46]

1700 Hematuria (nontraumatic) **[One]**[47*RIN, 48]
1710 Gross hematuria **[Both]**[49]
1711 Blood by urine dipstick
1712 Urine culture negative
1720 Microscopic hematuria **[All]**[50, 51]
1721 RBCs ≥ 3/HPF
1722 No RBC casts by U/A[52, 53]
1723 UTI excluded **[One]**
-1 Urine dipstick negative for nitrite/leukocyte esterase
-2 Urine culture negative

Notes

(1)-RIN:

These criteria cover those indications for which both a CT of the abdomen and the pelvis are warranted.

(2)

The risks of radiation exposure, contrast toxicity, and sedation or anesthesia versus the potential benefits of obtaining precise diagnostic information should always be considerations before electing any imaging procedure in children.

(3)

The finding of a mass in a child requires further examination to assess for malignancy, compression of organs, and internal hemorrhage. US can usually define the primary site of the mass, determine the types of tissue components (e.g., cysts, hemorrhage, calcification), and identify vascular involvement (Nazemi and Malempati, Emerg Med Clin North Am 2009, 27: 477-95). US offers the advantage of being noninvasive, free of radiation, and painless; however, when gaseous distention is present, the exam is less beneficial. CT provides better resolution than US and in the case of a suspected malignant tumor, can determine involvement of vessels and vital organs (Raab and Gartner, Prim Care 2009, 36: 671-84).

(4)

CT is preferred to MRI to evaluate patients with an abdominal mass. CT is superior to MRI in evaluating solid organs, the bowel, and the presence of pathology in this region. Results of FOBT, urinalysis, or other simple tests may direct the provider to more organ-specific tests.

(5)

Bleeding postoperatively or after instrumentation is most likely to occur immediately or within the first 24 hours after the procedure. Delayed bleeding may also occur. When to obtain an imaging study is a matter of clinical judgment.

(6)

These criteria apply to hemodynamic instability at initial presentation or any time during hospitalization. While this may be due simply to volume depletion, it is a matter of clinical judgment whether it represents severe disease with sepsis, volume loss, or retroperitoneal bleeding.

(7)

PE findings in shock include clouded sensorium, hypotension, decreased urine output, tachycardia, and cool, mottled extremities with diminished or absent peripheral pulses.

(8)

A positive HCG with abdominal pain should raise the question of an ectopic pregnancy.

(9)

Pregnancy testing is not indicated in male patients or in premenarchal female patients.

(10)

The diagnosis of appendicitis usually rests upon history and PE. The teaching has traditionally been that imaging studies are helpful only with atypical presentations (e.g., in the very young or very old, in adolescent girls and women of reproductive age, when the patient has had symptoms for several days) and that imaging can delay diagnosis and treatment. Others, however, advocate routine use of imaging for any patient with suspected appendicitis (Hawkins and Thirlby, Adv Surg 2009; 43: 13-22). Imaging can confirm the diagnosis, exclude appendicitis, or suggest an alternative diagnosis.

CT has better test performance than compression US, with a sensitivity, specificity, and positive predictive value of nearly 94% (van Randen et al., Radiology 2008; 249(1): 97-106; Al-Khayal and Al-Omran, Saudi Med J 2007; 28(2): 173-180). CT without the use of contrast is adequate for making the diagnosis (Hlibczuk et al., Ann Emerg Med 2010, 55: 51-9 e1). CT has been shown to be cost-effective by eliminating unnecessary surgery (Doria et al., Radiology 2006; 241(1): 83-94; Terasawa et al., Ann Intern Med 2004; 141(7): 537-546).

(11)

Although CT has a significantly higher sensitivity than US for detecting appendicitis and is useful for obese patients, US is commonly recommended for children because of its lack of radiation exposure (Holscher and Heij, Pediatr Radiol 2009; 39(5): 497-499; Morrow and Newman, Semin Pediatr Surg 2007; 16(1): 34-40).

(12)

The pain associated with appendicitis varies according to the anatomic location of the appendix; a pelvic appendix can cause tenderness in the suprapubic area or the RLQ, while a retrocecal appendix may manifest as periumbilical or flank discomfort.

(13)
Pelvic examination is performed to exclude diagnoses such as PID, ovarian cyst, or ectopic pregnancy.

(14)
Pelvic examination is not indicated in male patients or premenarchal females.

(15)
Pregnancy and related complications (e.g., ectopic pregnancy, incomplete abortion, inevitable abortion) must be excluded before performing this procedure.

(16)
Pregnancy testing can be by measurement of either a serum or urine HCG and may be documented in either the PCP's, gynecologist's, or surgeon's records.

(17)
Patients have varying definitions of sexual activity (e.g., number of partners, timing of most recent episode, frequency of sexual activity). Unless the provider can confirm on exam that the patient has never had sexual intercourse, whether a patient is sexually active or not is a matter of clinical judgment.

(18)
Whether to perform CT or US in this situation is a matter of clinical judgment. US is excellent for imaging pelvic, liver, and appendiceal abscesses. US is not as useful deeper within the abdomen and is more technique dependent than CT. CT is better able to image the retroperitoneum and between bowel loops. If the patient is unstable and needs to undergo surgery, imaging may not be necessary.

(19)
These findings, when accompanied by abdominal pain, are suggestive of peritoneal irritation.

(20)
Evaluation is indicated for unimproved or worsening symptoms or findings (e.g., fever, elevated WBC, ileus, pain, tenderness, abdominal or pelvic mass).

(21)
FUO may be caused by infection, inflammation, or malignancy (e.g., lymphoma). CT is ordered to look for enlarged nodes or other findings consistent with a tumor.

(22)
Staging studies assess local disease extension, the presence of intra-abdominal tumor spread (most notably liver metastases), and tumor resectability.

(23)
The timing of follow-up is determined by specific oncology protocols.

(24)
CT is increasingly being used in the evaluation of bowel obstruction. Although in most instances the presence of obstruction is established by history, PE, and plain films, the speed and ability of CT to reveal the precise site, severity, and cause of obstruction makes it particularly valuable in aiding management decisions in the acute setting. CT has a high degree of accuracy in confirming the cause of bowel obstruction and can help in differentiating between adhesions, malignancy, or internal hernias as the cause of the obstruction (Scaglione et al., Eur J Radiol 2004; 50(1): 15-22; Zissin et al., Abdom Imaging 2004; 29: 320-325). CT has a reported sensitivity of 78% to 100% and an accuracy of 90% to 95% for detection of high-grade or complete small bowel obstruction (Mallo et al., J Gastrointest Surg 2005; 9(5): 690-694; Torreggiani et al., Can Assoc Radiol J 2003; 54(2): 93-99; Frager, Gastroenterol Clin North Am 2002; 31(3): 777-799; Boudiaf et al., Radiographics 2001; 21(3): 613-624). MRI may be as accurate as CT but is limited by poor anatomic definition and its inability to detect colonic obstructions (Beall et al., Clin Radiol 2002; 57(8): 719-724).

(25)
Plain abdominal radiography remains the starting point for imaging bowel obstruction, as it is widely available and inexpensive. X-ray has a sensitivity of 69% with a 57% specificity in detecting obstruction (Boudiaf et al., Radiographics 2001; 21(3): 613-624). Normal KUB findings are associated with a low incidence of bowel obstruction and none that are high-grade.

(26)

In most cases, the imaging modality utilized to assess the abdomen in a pediatric trauma patient is based on the clinical status of the child (Vane, Surg Clin North Am 2002; 82(2): 315-323). CT is capable of delineating injury to the spleen, liver, kidney, pancreas, adrenals, and retroperitoneum and is therefore extremely useful in diagnosing suspected intra-abdominal injury in a hemodynamically stable patient. For patients presenting with hemodynamic instability, FAST (focused abdominal sonography for trauma) performed in the ED may be useful in identifying intraperitoneal fluid and hemorrhage (Holmes et al., Ann Emerg Med 2004; 43(3): 354-361; Gaines and Ford, Crit Care Med 2002; 30(11 Suppl): S416-423; Vane, Surg Clin North Am 2002; 82(2): 315-323). However, unstable patients may require urgent surgery without imaging examinations.

(27)

CT scan can identify specific traumatic injuries to almost any intra-abdominal structure, including that of solid organ (liver, spleen, pancreas, kidney), vascular, and hollow viscus (gallbladder, small bowel, colon, and bladder). It can also often define injury severity, from mild contusion to rupture, allowing conservative management based on defined radiologic and clinical criteria. In some instances, initial CT scan has identified findings consistent with a possible injury (hemoperitoneum, pneumoperitoneum, peritoneal fluid), without identifying a specific source. One option in these instances, depending on the patient's condition, may be conservative management with repeat CT scan in 12 to 24 hours to show more specific signs not present on the initial scan (Novelline et al., Radiol Clin North Am 1999; 37(3): 591-612, vi-vii).

(28)

Follow-up imaging of splenic injury, the most common injury in blunt abdominal trauma, is controversial. The majority of clinicians choose to perform imaging, most using CT. Follow-up CT at 48 to 72 hours and at 1 week in patients with a minimal isolated splenic injury to exclude delayed rupture is advocated by some. US may provide the information necessary for management in a more cost-effective way than CT. Full physical activity is generally not allowed until complete healing has been demonstrated by imaging. Severe injuries may require months to heal. Since the late complications of pseudocyst formation, delayed splenic rupture, and pseudoaneurysm formation are rare, the question remains whether periodic imaging assessment is necessary. Until further studies are conclusive, periodic assessment with imaging is reasonable. The interval between studies is a matter of clinical judgment.

(29)

Injuries to the kidney should be assessed by CT or retrograde studies (e.g., retrograde pyelogram) and graded according to their severity. Because operative repair of many renal injuries can result in nephrectomy, observation should be the first line of therapy when the patient is clinically stable.

(30)-DEF:

Cryptorchidism is failure of the testicle to descend into the scrotum. This diagnosis is usually established in childhood but may not become apparent until later in life.

(31)

Several diagnostic methods are used in evaluating genitourinary tract tumors including MRI, US, cystoscopy, retrograde pyelogram, and nephroureteroscopy.

(32)

Helical CT scanning without contrast is the most sensitive imaging test for the detecting renal and ureteral calculi; IVP is rarely used in children (Dogan and Tekgul, Curr Urol Rep 2007, 8: 163-73).

(33)

US is recommended for the evaluation of suspected renal or ureteral stones in infants; helical CT should be used for older children and adolescents. In older patients, the increased fat content around the kidney obscures echogenic stones on US but not on CT (Hoppe and Kemper, Pediatr Nephrol 2010, 25: 403-13).

(34)

The pain from nephrolithiasis, often called renal colic, may be localized to the flank, abdomen, or pelvis, and may radiate to the groin and genitalia.

(35)

Although hematuria is a common finding, nephrolithiasis may be present without hematuria and cases with a high suspicion of stone disease warrant further diagnostic testing (American College of Radiology (ACR), ACR Appropriateness Criteria: acute onset flank pain, suspicious of stone disease. 2008).

(36)

Although unilateral flank pain is a classic presentation of nephrolithiasis, hematuria or stones seen on a KUB would only make one suspect kidney stones if there was accompanying pain. CT is appropriate for confirming the diagnosis of nephrolithiasis.

(37)
The most common symptoms of nephrolithiasis in infants and young children are nonspecific abdominal pain, irritability, and vomiting (Hoppe and Kemper, Pediatr Nephrol 2010, 25: 403-13).

(38)
Imaging is performed in this instance to identify the culprit stone causing symptoms and to determine the presence of any obstruction.

(39)
Imaging is not always needed in patients with a prior history of renal or ureteral stones but is indicated if treatment is planned (e.g., lithotripsy) or symptoms suggest obstruction. KUB may be sufficient to visualize the stone and follow its course in nonacute cases.

(40)-DEF:
Cystitis is an inflammation of the bladder caused by a bacterial infection.

(41)-DEF:
Pyelonephritis is a kidney infection, confirmed by positive urine culture and is usually accompanied by fever, flank pain, and pyuria.

(42)
Cystitis or pyelonephritis in children should be well documented. Urine cultures can be retrieved through urethral catheterization or a bagged or midstream specimen. In the event of a positive urine culture from a bagged specimen, transurethral catheterization is recommended to determine whether UTI or contamination is the cause (Gilljam and Svensson, Pediatr Nurs 2008; 34(3): 241-245).

(43)
Whether to perform US or CT to exclude an underlying anatomic abnormality (e.g., stone, obstruction) or a complication (e.g., abscess) is a matter of clinical judgment.

(44)
The imaging evaluation of UTI should include a study to detect reflux; reflux can cause recurrent UTI and may be reversible (Cincinnati Children's Hospital Medical Center, Evidence-based care guideline for medical management of first urinary tract infection in children 12 years of age or less. 2006). There are several studies available to investigate UTI, including US, VCUG, and radionuclide cystography. Each has its relative advantages; which study to perform is a matter of clinical judgment. VCUG is the best study for characterizing reflux and showing bladder diverticula and urethral abnormalities in boys.

(45)
Cystitis and pyelonephritis are more common in female patients. These conditions should prompt earlier evaluation in male patients.

(46)
In children, noncystic or indeterminate masses most frequently represent Wilms' tumors. Findings by CT which suggest Wilms' tumor include a spherical mass with smooth margins and a "pseudocapsule" of compressed renal tissue. Extension beyond the renal capsule may be seen.

(47)-RIN:
These criteria address CT of the abdomen and pelvis for nontraumatic hematuria only. For work-up of a traumatic hematuria, see indication 1000 in this criteria subset.

(48)
Although there are many causes of hematuria (e.g., stones, cysts, congenital anomalies), the primary concern with nontraumatic hematuria in children is infection. Rarely, children will present with painless hematuria secondary to a renal or urinary tract tumor (gross hematuria with rhabdomyosarcoma and microscopic hematuria with Wilms' tumor).

(49)
Although asymptomatic gross hematuria in children is uncommon, it could be due to structural abnormalities or IgA nephropathy; therefore, further evaluation is justified (Greenfield et al., Urology 2007; 69(1): 166-169; Pan, Pediatr Clin North Am 2006; 53(3): 401-412, vi).

(50)-DEF:
Definitions of microscopic hematuria vary from 1 to more than 10 RBCs per HPF; commonly for males it is ≥ 3 RBCs per HPF and for females it is ≥ 5 RBCs per HPF.

(51)

Causes of microscopic hematuria in children and adolescents include IgA nephropathy, UTI, or glomerulonephritis.

(52)-DEF:

Red cell casts are red cells that have collected in the renal tubules and are bound together in a protein matrix which are then excreted as cylindrical casts. The finding of RBC casts is diagnostic for renal parenchymal disease.

(53)

If red cell casts are present, CT is preferred to US to exclude structural disease.