

MedSolutions, Inc.
Clinical Decision Support Tool
Diagnostic Strategies

This tool addresses common symptoms and symptom complexes. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or patient's Primary Care Physician (PCP) may provide additional insight.

PEDIATRIC AND CONGENITAL IMAGING GUIDELINES
ABDOMEN and PELVIS
© 2009 MedSolutions, Inc

MedSolutions, Inc. Clinical Decision Support Tool
for Advanced Diagnostic Imaging

Common symptoms and symptom complexes are addressed by this tool. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician may provide additional insight.

This version incorporates MSI accepted revisions prior to 11/30/08

TABLE OF CONTENTS

2009 PEDIATRIC and CONGENITAL ABDOMEN GUIDELINES		PAGE
PACAB-1	GENERAL GUIDELINES	4
PACAB-2	ABDOMINAL PAIN, NONSPECIFIC	4
PACAB-3	ABDOMINAL SEPSIS (SUSPECTED ABDOMINAL ABSCESS)	6
PACAB-4	FLANK PAIN, RULE OUT RENAL STONE	6
PACAB-5	ACUTE GASTROENTERITIS (Pediatric)	6
PACAB-6	LEFT LOWER QUADRANT PAIN	7
PACAB-7	LEFT UPPER QUADRANT PAIN	7
PACAB-8	POSTOPERATIVE PAIN within 60 DAYS FOLLOWING ABDOMINAL SURGERY	8
PACAB-9	RIGHT LOWER QUADRANT PAIN, RULE OUT APPENDICITIS	8
PACAB-10	RIGHT UPPER QUADRANT PAIN, RULE OUT CHOLECYSTITIS	9
PACAB-11	ABDOMINAL LYMPHADENOPATHY	9
PACAB-12	BLUNT ABDOMINAL TRAUMA	9
PACAB-13	GAUCHER'S DISEASE	10
PACAB-14	HERNIAS	10
PACAB-15	LIPOMA	11
PACAB-16	ADRENAL CORTICAL LESIONS	11
PACAB-17	BOWEL OBSTRUCTION	14
PACAB-18	DIARRHEA/CONSTIPATION and BLOATING/IRRITABLE BOWEL	14
PACAB-19	INFLAMMATORY BOWEL DISEASE, RULE OUT CROHN'S or ULCERATIVE COLITIS	15
PACAB-20	LIVER LESION CHARACTERIZATION	16
PACAB-21	ELEVATED LIVER FUNCTION TEST (LFT'S) LEVELS	18
PACAB-22	SPLEEN	19
PACAB-23	INDETERMINATE RENAL LESION	19
PACAB-24	RENOVASCULAR HYPERTENSION	20
PACAB-25	URINARY TRACT INFECTION	21
PACAB-26	PATENT URACHUS	22
PEDIATRIC and CONGENITAL ABDOMEN GUIDELINE REFERENCES		23

TABLE OF CONTENTS

2009 PEDIATRIC and CONGENITAL PELVIS GUIDELINES		PAGE
PACPV-1	GENERAL GUIDELINES	28
PACPV-2	ABNORMAL UTERINE BLEEDING	28
PACPV-3	AMENORRHEA	29
PACPV-4	ADENOMYOSIS	30
PACPV-5	SUSPECTED ADNEXAL MASS	30
PACPV-6	ENDOMETRIOSIS	32
PACPV-7	PELVIC INFLAMMATORY DISEASE (PID)	32
PACPV-8	PELVIC PAIN/DYSPAREUNIA, FEMALE	33
PACPV-9	LEIOMYOMATA	33
PACPV-10	PERIURETHRAL CYSTS and URETHRAL DIVERTICULA	34
PACPV-11	FETAL MRI	34
PACPV-12	PENIS-SOFT TISSUE MASS	35
PACPV-13	SCROTAL PATHOLOGY	35
PACPV-14	UNDESCENDED TESTIS	35
PEDIATRIC and CONGENITAL PELVIS GUIDELINE REFERENCES		36

PEDIATRIC AND CONGENITAL ABDOMINAL IMAGING GUIDELINES

PACAB-1~GENERAL GUIDELINES

- The Abdominal Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Abdominal Imaging Guidelines.
- Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray and ultrasound.
- Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crest.
- To avoid radiation exposure, pediatric imaging should consider the use of ultrasound or MRI where it is a clinical option.
 - MRI of the abdomen with contrast only is essentially never performed. If contrast is indicated, MRI abdomen without and with contrast (CPT 74183) should be performed.
- CT imaging:
 - Abdominal CT is usually performed with contrast (CPT 74160). Exceptions are noted in the individual guidelines.
 - Abdominal CT performed for evaluation of renal stones is performed without intravenous contrast (CPT 74150).
 - Abdominal CT for the evaluation of a pediatric abdominal mass can be performed without and with intravenous contrast (CPT 74170), to detect calcification in the mass.
- Abdominal CT or MRI can be considered to further evaluate abnormalities seen on other imaging modalities such as plain x-ray, ultrasound, etc.
- **Fever of Unknown Origin:** Refer to ONC-28~Medical Conditions with Cancer in the Differential Diagnosis in the Adult Oncology guidelines.
- Suspected ascites should be initially evaluated by ultrasound. Ultrasound results can then determine the need for peritoneal fluid analysis or further imaging specific to the findings.*

**Shah R and Fields JM. Ascites: eMedicine, updated February 21, 2007. <http://www.emedicine.com/med/topic173.htm>. Accessed November 11, 2008*

GENERAL ABDOMINAL SIGNS/SYMPTOMS (ALPHABETICAL ORDER)

PACAB-2~ABDOMINAL PAIN, NONSPECIFIC

- Ultrasound should be the initial imaging study in patients who present with right upper quadrant pain, left upper quadrant pain or epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an ultrasound is nondiagnostic or an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.).*

*ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, revised 2007

- Ultrasound should be the initial imaging study in females with ovaries or uterus intact who present with generalized abdominal or lower abdominal pain, in order to rule out gynecological pathology.
- Children with generalized abdominal pain and normal physical examination and laboratory studies, including stool for blood (and stool culture if diarrhea), should initially be evaluated by ultrasound and treated conservatively.
 - Gastroenterology (GI) specialist evaluation is helpful in determining the need for advanced imaging.
- Children with abdominal pain and signs of failure to thrive, anemia, bleeding, and/or abnormal laboratory studies should be initially evaluated with ultrasound to determine the need for further imaging.*
 - **Pediatr Nurs* 2007; 33(3):247-259
- Children presenting with abdominal pain may have an intussusception.
 - Plain x-rays (supine and left lateral decubitus views) should be performed initially to exclude mass or bowel obstruction from other causes.
 - Ultrasound is appropriate as the initial study if there is a strong suspicion for intussusception, but if negative, plain x-rays of the abdomen should follow.
- CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed for any of the following:
 - Abnormal lab such as WBC greater than 10,000 or abnormal stool analysis
 - Persistent fever
 - Failure of conservative treatment for 3-4 weeks
 - Documented rebound tenderness or guarding on a recent physical exam
 - Persistent abdominal pain (greater than 4 weeks with no improvement) with unremarkable endoscopy and/or barium enema results
 - Nondiagnostic recent endoscopy and/or barium study
- In all other patients who present with persistent abdominal pain (greater than 4 weeks with no improvement) with unremarkable endoscopy and/or barium enema results, CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed.
 - GI specialist evaluation can be helpful in determining the appropriate imaging pathway.
 - Repeat imaging in patients with unchanged or improving symptoms is not appropriate.
- CT of abdomen and/or pelvis may be performed to evaluate abnormalities detected on plain abdominal x-rays that require further clarification.

PACAB-3~ABDOMINAL SEPSIS (SUSPECTED ABDOMINAL ABSCESS)

- CT abdomen and/or pelvis with contrast (CPT 74160 and/or 72193) is indicated when the patient has a palpable mass or suspicious abdominal symptoms with fever and/or elevated white blood cell count.*
**ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess, 2006*
- Ultrasound may be useful in follow-up of known fluid collections, especially with catheter drainage, provided the patient is stable or improving. Serial CT scans with contrast (CPT 74160 and/or 72193) are also appropriate.

PACAB-4~FLANK PAIN, RULE OUT RENAL STONE

- In pregnant patients and children, ultrasound or MR urography (MRI abdomen and pelvis, contrast as requested) is the best initial study to avoid radiation exposure.*
**ACR Appropriateness Criteria, Acute onset flank pain, 2007*
- CT of the abdomen and pelvis without contrast (CPT 74150 and 72192) are the best imaging studies in the non-pregnant patient to rule out kidney stone.
- Serial CT scans to determine the passage or dissolution (of uric acid stones) of kidney stones are acceptable if they do not exceed three scans in a six week period.
 - If the stone has been seen on the pelvic CT portion of the CT scan, the subsequent CT scan(s) should only include the pelvis.
 - Urology evaluation can be helpful in determining the need for serial CT scans.
- Post-procedure follow-up should be performed with x-rays of the abdomen every 6 to 12 months in asymptomatic patients unless the patient had uric acid stones.¹
- CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) can be performed if there were surgical complications or the patient develops unusual symptoms.¹

¹Wolf, J. *Nephrolithiasis*. eMedicine, February 15, 2006,
<http://www.emedicine.com>. Accessed September 18, 2007

PACAB-5~ACUTE GASTROENTERITIS (PEDIATRIC)

- Imaging is not indicated in pediatric acute gastroenteritis unless there is a concern for other causes of symptoms.
- Pediatric imaging in suspected gastroenteritis should begin with plain x-rays of the abdomen, including supine and left lateral decubitus views. The left lateral decubitus view is useful for the detection of air-fluid levels and for detection of gas in the rectum —to exclude obstruction.
- Ultrasound should be performed if there is suspicion for intussusception or organomegaly.
- Ultrasound may detect findings of gastroenteritis, but is not indicated for the diagnosis of gastroenteritis.
- Gastroenterology (GI) specialist evaluation is helpful, especially in evaluating patients with persistent symptoms or with gross bleeding.

- **References:**

- Levine A. *Pediatrics, Gastroenteritis*. eMedicine, June 14, 2006, <http://www.emedicine.com>. Accessed September 28, 2007
- CDC, *Managing Acute Gastroenteritis Among Children*, November 21, 2003, Vol.52, No. RR-16

PACAB-6~LEFT LOWER QUADRANT PAIN

- Pelvic ultrasound is the initial imaging study of choice for children and for females <45 years old who still have ovaries or uterus intact, for detecting gynecologic abnormalities that may cause left lower quadrant pain.
- A 5 to 7 day trial of conservative therapy and close observation should be performed prior to considering advanced imaging in patients who present with mild localized abdominal pain, but without significant clinical or laboratory findings.
- **CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed if pain persists or if any one of the following significant clinical findings is present:**
 - severe abdominal pain
 - palpable mass on examination
 - nausea/vomiting
 - fever
 - significant abdominal tenderness to palpation
 - elevated white blood cell count
- Gastroenterology (GI) specialist evaluation is helpful in determining the appropriate diagnostic pathway in patients with mild pain and heme positive stools or rectal bleeding, since advanced imaging with CT is rarely helpful in the initial evaluation of these patients.
 - **References:**
 - *Society for Surgery of the Alimentary Tract. *Surgical Treatment of Diverticulitis* Revised 5/2003. <http://www.ssat.com>. Accessed November 20, 2006*
 - *Am Fam Physician* 2005;72:1229-1234 and 1241-1242
 - *ACR Appropriateness Criteria, Left Lower Quadrant Pain, 2008*
 - Cooperman A and Sherif A. *Diverticulitis*. eMedicine, July 7, 2006, <http://www.emedicine.com>. Accessed November 20, 2006

PACAB-7~LEFT UPPER QUADRANT PAIN

- Ultrasound should be the initial imaging study in patients who present with left upper quadrant pain or epigastric pain, since ultrasound is useful in detecting gallbladder and other hepatobiliary pathology, renal lesions, ascites, splenic pathology, and sometimes adrenal lesions. If an ultrasound is nondiagnostic or an abnormality is found that warrants further imaging, the information provided by ultrasound can help determine the most appropriate advanced imaging modality (CT vs MRI vs MRCP, etc.)*

**ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen and retroperitoneum, revised 2007*

PACAB-8~POSTOPERATIVE PAIN WITHIN 60 DAYS FOLLOWING ABDOMINAL SURGERY

- CT abdomen and pelvis with contrast (CPT 74160 and 72193) can be performed in patients with suspected postoperative complications (e.g. bowel obstruction, abscess, anastomotic leak, etc.)*
- Children should be evaluated with ultrasound initially (especially in small children or in thin older children) or with MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197).*
 - Although MRI theoretically would be desirable to reduce radiation exposure, MRI is not practical for the timely evaluation of post-operative abscesses.
 - MRI often requires sedation, is a lengthy study, and may take several days to be performed, thus causing a significant time delay in diagnosis.
- Beyond 60 days postoperatively, see PACAB-2 Abdominal Pain, Nonspecific.
 - *ACR Appropriateness Criteria, Suspected small bowel obstruction, 2005
 - *ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess, 2006

PACAB-9~RIGHT LOWER QUADRANT PAIN, RULE OUT APPENDICITIS

- Children, females of childbearing age, and pregnant patients may be evaluated first with ultrasound if local expertise exists. If positive, no further diagnostic imaging is necessary. If negative or equivocal, CT abdomen and pelvis with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) can be performed.
 - MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) or without contrast (CPT 74181 and 72195) can be performed for pregnant patients or if ultrasound or CT is equivocal.
 - **References:**
 - AJR 2004 Sept;183:671-675
 - Radiology 2006 March;238(3):891-899
- If appendicitis is strongly suspected, CT of the abdomen and pelvis either with contrast (CPT 74160 and 72193) or without contrast (CPT 74150 and 72192) should be performed in all patients except pregnant patients (see above).*
 - * ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess, 2006
- If appendicitis is not at the top of the differential diagnosis, then females less than 45 years old who have ovaries or uterus intact and present with right lower quadrant pain should have ultrasound of the pelvis performed initially to rule out gynecological pathology.
- If the appendix is absent, follow guidelines in PACAB-2 Abdominal Pain, Nonspecific.

PACAB-10~RIGHT UPPER QUADRANT PAIN, RULE OUT CHOLECYSTITIS

- Right upper quadrant ultrasound is generally the imaging study of choice in the patient with acute right upper quadrant pain, with or without fever, if the gallbladder has not been removed.*
 - **ACR Appropriateness Criteria, Right upper quadrant pain, 2007*
 - **Barnes DS. Gallbladder and Biliary Tract Disease. The Cleveland Clinic Disease Management Project. July 9, 2002.*
<http://www.clevelandclinicmeded.com/diseasemanagement>
Accessed November 20, 2006
- In patients who have had cholecystectomy, or in patients with normal ultrasound, CT of the abdomen with contrast (CPT 74160) can be performed.

MISCELLANEOUS ABDOMINAL ENTITIES (ALPHABETICAL ORDER)

PACAB-11~ABDOMINAL LYMPHADENOPATHY

- Patients with lymphadenopathy localized to the abdomen and found incidentally on previous imaging without associated fever, weight loss, pain, GI bleeding, or other intraabdominal findings to raise the suspicion of malignancy, can have one follow-up CT abdomen with contrast (CPT 74160) or CT abdomen and pelvis with contrast (CPT 74160 and 72193) two months following the original imaging study.
 - If enlarged lymph node(s) persist, biopsy should be considered to establish a histological diagnosis.*
 - PET scan is not generally appropriate prior to biopsy.
 - **Am Fam Physician 2002 Dec;66(11):2103-2110*
 - **Kanwar V. Lymphadenopathy. eMedicine, June 28, 2006.*
<http://www.emedicine.com>. Accessed September 20, 2007
 - **Gow K. Lymph Node Disorders. eMedicine, May 15, 2006.*
<http://www.emedicine.com>. Accessed September 20, 2007

PACAB-12~BLUNT ABDOMINAL TRAUMA

- Significant trauma should be evaluated in the Emergency Department.
- Trauma with low probability of intra-abdominal injury should have ultrasound initially and any positive findings can be further evaluated with CT abdomen and/or pelvis without and with contrast (CPT 74170 and/or 72194).
- For more significant trauma or blunt renal trauma associated with hematuria^{1,2} CT abdomen and pelvis without and with contrast (CPT 74170 and 72194) may be used initially to determine patients who need hospitalization for observation.³
 - ¹ *Geehan DM and Santucci RA. Renal Trauma. eMedicine, June 12, 2006.*
<http://www.emedicine.com>. Accessed September 11, 2007
 - ² *Smith J. Kidney, Trauma. eMedicine, Feb 21, 2007.*
<http://www.emedicine.com>. Accessed September 11, 2007
 - ³ *ACR Appropriateness Criteria, Blunt abdominal trauma, 2005*

PACAB-13~GAUCHER'S DISEASE

- See also PACPN-3 Gaucher's Disease in the Pediatric and Congenital Peripheral Nerve Disorders guidelines
- **Imaging for follow-up:**
 - **Patients not on enzyme therapy:** MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
 - **Patients on enzyme therapy:**
 - Not achieved therapeutic goals: MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 months
 - Achieved therapeutic goals: MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718) every 12 to 24 months
 - Change in dose of medication or clinical complication: MRI abdomen without contrast (CPT 74181) and MRI lower extremity without contrast (CPT 73718)
 - **Patients with active bone disease** may require more frequent monitoring than once a year.
- **References:**
 - Current Medical Research and Opinion 2006;22(6):1045-1064
 - Semin Hematol 2004 Oct;41(4 Suppl 5):15-22

PACAB-14~HERNIAS

- Patients without prior inguinal hernia surgery who present with lower abdominal or groin pain and suspected inguinal hernia may benefit from evaluation by a surgeon.
 - Imaging (ultrasound, CT, MRI) can be helpful when physical exam is inconclusive.
 - Ultrasound has a very high sensitivity and specificity (88%-100%) for evaluating inguinal and femoral hernias.* Ultrasound identified the pathology in a groin (either hernia or lipoma) without a palpable bulge at an accuracy of 75%.*
 - *Ann R Coll Surg Eng 2003 May;85(3)L174-177
 - *Ann Ital Chir. 2002 Jan-Feb;73(1):65-68
 - *Surg Endosc 2002 Apr;16(4):659-662
- Patients with known or suspected Spigelian hernia (anterior abdominal wall hernia through the semilunar line) or ventral hernia can be evaluated by ultrasound initially, but CT of the abdomen (and pelvis if below the umbilicus) either with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) may be necessary for definitive evaluation.
- Patients with known or suspected incisional hernia can be evaluated with CT abdomen (and pelvis where applicable) either with contrast (CPT 74160 ± 72193) or without contrast (CPT 74150 ± CPT 72192) (whichever the physician prefers).
- Patients with suspected recurrent inguinal hernia after inguinal hernia surgery can have CT of the pelvis with contrast (CPT 72193) or without contrast (CPT 72192)

(whichever the physician prefers).

- **Sportsman's Hernia**
 - A controversial clinical entity thought to account for up to 5% of all groin injuries, especially among athletes involved in kicking sports.
 - Probably a chronic overuse injury involving posterior inguinal wall weakness, tearing of the transversus abdominis aponeurosis, and neuralgia.
 - Conservative management is performed initially. Some elite athletes require surgical intervention.
 - Ultrasound may show posterior inguinal wall bulging, but this is also seen in asymptomatic athletes.
 - Advanced imaging is not indicated.
 - The microtears described at surgery cannot be reliably diagnosed on imaging and therefore, this condition remains a clinical diagnosis.
- **References:**
 - Robinson P. *Imaging of Athletic Pubalgia*. Presented at: 33rd Annual Radiology Refresher Course of the International Skeletal Society; September 13-16, 2006; Vancouver, British Columbia, Canada.
 - Manthey D and Nicks BA. *Hernias*. eMedicine, January 3, 2007. <http://www.emedicine.com>. Accessed September 11, 2007

PACAB-15~LIPOMA

- **Subcutaneous lipoma** does not require imaging for diagnosis
 - Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
 - If the clinical exam is equivocal, ultrasound should be performed initially.
 - Noncontrast MRI can be performed if surgery is planned.
- Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.
 - Lesions with Hounsfield units (HU) less than -50 HU do not require additional imaging except for surgical planning.*
 - *Scott-Conner CEH and Radebold K. *Lipomas*. eMedicine, April 17, 2006. <http://www.emedicine.com>. Accessed September 11, 2007
- Noncontrast MRI can be considered if ultrasound and/or CT are equivocal, or for preoperative planning.
 - MRI shows a discrete, homogenous fatty mass with few or no thin septa and minimal or no areas of high T2 signal.*
 - *AJR 2004;182:733-739

SPECIFIC ABDOMINAL ORGANS

PACAB-16~ADRENAL CORTICAL LESIONS

- **PACAB-16.1 Adrenal Cortical Lesions**
 - CT abdomen without contrast (CPT 74150) is the imaging study of choice in patients with no history of malignancy, no symptoms, and a lesion less than 3 cm.
 - If the Hounsfield number is less than 10 HU, malignancy is unlikely and no

follow-up imaging is required.*

*J Clin Endocrinol Metab 2005 Feb;90(2):871-877

- If CT with washout or MRI defines the lesion as a benign lesion- adenoma, myelolipoma, hematoma or cyst, follow-up imaging is not indicated.*

*AJR 2007;189:1119-1123

AJR 2008 May;190:1163-1168

- Mass lesions larger than 6 cm or hormone-secreting tumors should be resected.*

*ACR Appropriateness Criteria, Incidentally discovered adrenal mass, 2007

*AJR 2005;185:684-688

- If the lesion cannot definitely be characterized as a benign adenoma on noncontrast CT, CT abdomen with contrast (CPT 74160) with washout calculated can be performed to help distinguish benign adenoma from other lesions such as metastases.

- Over 50% washout of contrast material on a 10-minute delayed CT scan is diagnostic of an adenoma. This is the most sensitive and specific study because it can detect both lipid rich (70% of adenomas) and lipid poor (30% of adenomas) adenomas.

- If CT is contraindicated, chemical shift MRI (CPT 74181) can be performed.

- Noncontrast CT (CPT 74150) and chemical shift MRI (CPT 74181) have comparable performances in the evaluation of lipid content.

- **INDETERMINATE LESION:** CT of the abdomen with washout (74160) can be performed. MRI will not add significant information and MRI is not indicated unless there is a history of malignancy of a cell type that would reasonably spread to the adrenals or there is evidence of a hormone secreting adrenal tumor.

- Follow-up at 3 to 6 months, at 12 months, and at 24 months from the initial finding of the lesion can be performed.

- Endocrine re-evaluation should be performed at one year.^{1,2}

- There is no good evidence supporting continued radiologic surveillance if the follow-up at 24 months shows no change in adrenal tumor size.²

¹J Clin Endocrinol Metab 2005 Feb;90(2):871-877

²Ann Intern Med 2003;138:424-429

- If CT is contraindicated and MRI is indeterminate, follow-up noncontrast abdominal MRI (CPT 74181) at 3 to 6 months, at 12 months, and at 24 months from the initial finding of the lesion can be performed.*

*Ann Intern Med 2003;138:424-429

- **In the oncology patient,** CT abdomen without and with contrast (CPT 74170) (malignant lesions show slow enhancement with delayed washout after intravenous contrast) or MRI abdomen (contrast as requested; default CPT code 74183) is appropriate for evaluation of an adrenal lesion.

- Biopsy may be considered if pheochromocytoma is excluded.

- **PACAB-16.2 Adrenal Endocrine Tumors**

- In patients with signs/symptoms of an adrenal cortical endocrine syndrome (e.g. Cushing's syndrome, Conn's syndrome), evaluation may include dexamethasone suppression, serum ACTH level, serum aldosterone/renin, and/or virulizing hormone levels, and 24 hour urine for adrenal hormones.*

- **Normal Values:**
 - Aldosterone: 3-10 ng/dl (supine); 5-30 ng/dl (upright)
 - Cortisol: at 8am: 250-850 nmol/L
at 4pm: 110-390 nmol/L
at 10pm: 50% of 8 am value

*Uwaifo GI and Fojo AT. *Adrenal Carcinoma*. eMedicine, May 26, 2006, <http://www.emedicine.com>. Accessed September 11, 2007

- CT with bolus arterial phase (CPT 74160) can be performed if lab studies confirm adrenal cortical endocrine syndrome.*

* *J Clin Endocrinol Metab* 2008 Sept;93(9):3266-3281

- **Pheochromocytoma**

- Signs/symptoms include flushing spells and/or poorly controlled hypertension.
- Elevated plasma metanephrines support the diagnosis of pheochromocytoma.
- If plasma metanephrines are not elevated, a 24-hour urine for catecholamine and metanephrine levels should be obtained prior to considering advanced imaging.
- If catecholamine and metanephrine levels are not elevated in a 24-hour urine, then no advanced imaging is indicated unless unexplained symptoms suggestive of pheochromocytoma persist.^{1,2}
- If possible, 24-hour urine for catecholamines and metanephrines should be obtained after an episode of signs/symptoms (e.g. following a hypertensive crisis).
 - Sensitivity for diagnosing pheochromocytoma is 99.7% with this approach.^{1,2}

¹ Vuquin P. *Pheochromocytoma*. eMedicine, June 5, 2006, <http://www.emedicine.com>. Accessed September 18, 2007

² Sweeney A. *Pheochromocytoma*. eMedicine, Sept 11, 2007, <http://www.emedicine.com>. Accessed September 18, 2007

- Chemical shift MRI (CPT 74181) is the preferred imaging study for possible pheochromocytoma, since the tumor lights up brightly on T2 weighted images; however MRI abdomen, contrast as requested, can be performed.
- In patients with elevated catecholamines/metanephrines, great care should be exercised when considering intravenous contrast administration. These patients are known to have hypertensive crises with the bolus injection of intravenous contrast.

BOWEL (ALPHABETICAL ORDER)

PACAB-17~BOWEL OBSTRUCTION

- Plain x-rays of the abdomen (obstructive series) should be obtained as the initial study in patients with suspected bowel obstruction.
- CT of the abdomen and pelvis with contrast (CPT 74160 and 72193) may be used to confirm the presence and site of an obstruction if plain x-rays are abnormal or equivocal.
- CT with contrast (CPT 74160 and 72193) may also be indicated if there is a high index of suspicion for bowel obstruction (abdominal pain, vomiting, constipation, abdominal distention, failure to pass flatus), especially in patients with prior history of abdominal surgery, history of malignancy, or patients with current hernias.*
**ACR Appropriateness Criteria, Suspected small bowel obstruction, 2005*

PACAB-18~DIARRHEA/CONSTIPATION and BLOATING/IRRITABLE BOWEL

- **Diarrhea** in the absence of fever, weight loss, abnormal physical examination findings, fecal incontinence, gastrointestinal (GI) bleeding, or abnormal labs including stool analysis, should be treated conservatively initially or endoscopy should be performed.
 - Diarrhea associated with any of the above signs/symptoms may require imaging depending on the highest probable concern.
 - GI specialist consultation is helpful in determining the appropriate imaging pathway.
 - If advanced imaging is indicated, CT scans of abdomen and pelvis with contrast (CPT 74160 and 72193) are appropriate.
 - References:
 - *Gastroenterol* 1999;116:1461-1463
 - *Gastroenterol* 2004;127:287-293
- **Constipation** in the absence of family history of inflammatory bowel disease or cancer, onset of constipation after age 50, acute onset of constipation in the elderly, GI bleeding, fever, substantial pain, vomiting, weight loss, rectal pain, abnormal lab studies, or abnormal physical examination findings should be treated conservatively and advanced imaging is not indicated.
 - Patients who fail to respond to treatment or have any of the above abnormal findings should undergo barium enema or endoscopy.
 - GI specialist consultation is helpful in determining the appropriate imaging pathway.
 - **Reference:**
 - *Am Fam Physician* 2002 June;65(11):2283-2290
 - *J Fam Practice* 2007 June;56(6 Suppl):S13-S20
 - *Gastrointest Endosc* 2005 Aug;62(2):199-201
 - MRI Defecography for constipation should be considered investigational. It may be appropriate if ordered for preoperative evaluation for the planning of complex pelvic reconstruction.*

*Obstet & Gynecol 2004;103:41-46

*Radiographics 2002;22:817-832

- **Constipation in children** that is not associated with abnormal physical examination including rectal exam, abnormal laboratory studies, GI bleeding, and/or failure to thrive does not require imaging.
 - With any of the above mentioned findings, the child should be evaluated with plain x-rays, ultrasound, or barium enema.
 - GI specialist consultation is helpful in determining the appropriate imaging pathway.*

*Am Fam Physician 2002 June;65(11):2283-2290

- **Bloating and/or Irritable bowel syndrome**
 - Irritable bowel syndrome is frequently a diagnosis of exclusion and is often associated with bloating or abdominal fullness.
 - The criteria for making the clinical diagnosis include the following:
 - Abdominal pain
 - Onset of symptoms associated with a change in frequency of stool (diarrhea, constipation, or both)
 - Onset of symptoms with an associated change in the form of stool.
 - Relief of symptoms with defecation
 - If the above symptoms occur in a patient under age 50 and are associated with alarm symptoms such as fever, anemia, weight loss, GI bleeding, frequent nocturnal symptoms, or failure of a 6-8 week trial of conservative therapy, work-up should include laboratory studies and flexible sigmoidoscopy prior to considering advanced imaging.
 - Children should be evaluated with plain x-rays, ultrasound, or barium enema prior to considering advanced imaging.
 - GI specialist consultation is helpful in determining the appropriate imaging pathway, since advanced imaging is often not indicated in these patients.
 - References:
 - Am Fam Physician 2003 May;67(10):2157-2162
 - Serper M. Irritable bowel syndrome: evidence-based evaluation and management. Patient Care Online, July 16, 2007, <http://www.patientcareonline.com>. Accessed September 20, 2007
 - EI-Baba M. Irritable Bowel Syndrome. eMedicine, July 31, 2007, <http://www.emedicine.com>. Accessed September 20, 2007
 - Gastroenterol 2000;119:1761-1778

PACAB-19~INFLAMMATORY BOWEL DISEASE, RULE OUT CROHN'S DISEASE or ULCERATIVE COLITIS

- Colonoscopy or barium studies are the preferred imaging studies for the initial evaluation of suspected early Crohn's disease or ulcerative colitis when pathology is limited to the mucosa.
- CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for assessing mesenteric and extra-intestinal extent of disease.
- CT scans of the abdomen and pelvis with contrast (CPT 74160 and 72193) are the best studies for evaluation of possible abscess, bowel perforation, fistula formation,

or acute inflammation in the patient with known Crohn's disease or ulcerative colitis and an acute exacerbation (abdominal pain).

- Children <age14 should be initially evaluated with ultrasound or MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197).
 - Endoscopic ultrasound, rectal ultrasound or pelvic MRI (CPT 72197) may be considered in the setting of rectal pathology (either inflammatory or neoplastic) to evaluate for peri-rectal involvement.
 - Suspected small bowel Crohn's should be initially evaluated with small bowel follow through (SBFT), barium study, and/or ileoscopy. If these are inconclusive or if obstructive disease is expected, CT enteroclysis may be considered (CPT 74160 and 76377).¹
 - Capsule Endoscopy (CPT 91110) may be considered if SBFT and/or ileoscopy are inconclusive, and NON-obstructive small bowel Crohn's is present. Capsule endoscopy is particularly effective for detecting proximal and early mucosal disease.²
- ¹*Radiology* 2006 Jan;238(1):128-134
- ²*Cigna HealthCare Coverage Positron, Subject: Capsule Endoscopy, Revised Feb. 15, 2007*
- If advanced imaging is indicated, MRI Enterography (CPT 74181) may be performed, especially in young patients to avoid radiation, to monitor response to immunomodulatory agents, and to differentiate acute phase disease from remission.*
- *Curr Opin Gastroenterol* 2008 March;24(2):135-140
- SPECT and PET are considered investigational.*
- *ACR Appropriateness Criteria, Crohn's Disease, 2005*

LIVER

PACAB-20~LIVER LESION CHARACTERIZATION

- Suspected hepatomegaly should be evaluated by ultrasound initially.
 - A suspected liver lesion should be evaluated by ultrasound initially.
 - A liver lesion with typical ultrasound and/or contrast enhanced CT features of a simple cyst or hemangioma may be classified as benign and does not require follow-up imaging.*
- *Radiology* 2000 Jan;214(1):167-172
- A liver lesion with typical CT features of a malignant mass does not require additional imaging. Confirmation with biopsy under ultrasound or CT guidance is indicated.
 - PET scan is not indicated to evaluate a liver lesion in a patient with no prior history of confirmed malignancy.
 - **PACAB-20.1 Hemangioma**
 - If a lesion >1cm is found as an incidental finding on ultrasound or other imaging, triple phase CT (CPT 74170) is preferred to confirm a suspected hepatic hemangioma.*
- *Hepatology* 2005 Nov;42(5):1208-1236

- Most hemangiomas are easily diagnosed with CT scan.
- MRI of the abdomen without and with contrast (CPT 74183) should be reserved for equivocal lesions.
 - In one study, the diagnosis of hemangioma was established by ultrasound in 57% of patients, by CT scan in 73%, and by MRI in 84%.*
*J Am Coll Surg 2003 Sep;197(3):392-402
- CT angiography of the abdomen (CPT 74175) is useful as a preoperative study in patients with large hemangiomas considered for resection.
- **PACAB-20.2 Hepatic Adenoma or Focal Nodular Hyperplasia**
 - MRI of the abdomen without and with contrast (CPT 74183) is the imaging study of choice to evaluate a possible hepatic adenoma or focal nodular hyperplasia (FNH).
 - For FNH lesions being followed by serial imaging, MRI of the abdomen without and with contrast (CPT 74183) can be performed annually for 3 years. If no changes occur, imaging is discontinued.
 - Lesions greater than 3 cm should be biopsied for definitive diagnosis.*
*AJR 2004;182:1227-1231
- **PACAB-20.3 Cirrhotic Liver**
 - An indeterminate liver lesion in a cirrhotic liver is best evaluated with MRI of the abdomen without and with contrast (CPT 74183).
- **PACAB-20.4 Nonalcoholic fatty liver disease (NAFLD):**
 - Ultrasound is the preferred imaging study to evaluate for biliary disease or isolated liver lesion.
 - Distinguishing between fatty liver and steatohepatitis is made via biopsy rather than advanced imaging. Imaging (US, CT, or MRI) is not useful to differentiate benign steatosis from steatohepatitis*
*Gastroenterology 2002 Nov;123(5):1705-1725
*Internal Medicine Journal 2004;34:187-191
*CMAJ 2005 March;172(7):899-905
*Am Fam Physician 2006 June;73(11):1961-1968
- **PACAB-20.5 Liver Lesion <1 cm**
 - Any liver lesion less than 1 cm should be followed with ultrasound every 3 to 6 months for 2 years and, if stable, ultrasound should be performed every 6 to 12 months.
- **PACAB-20.6 Liver Lesion ≥1cm**
 - Liver lesions ≥1cm may be evaluated by CT abdomen without and with contrast (CPT 74170) or MRI abdomen without and with contrast (CPT 74183).
 - If the lesion appearance is typical of hepatocellular carcinoma (HCC), the lesion should be treated as HCC.
 - If further characterization of a one centimeter or larger liver lesion found on CT is needed, MRI of the abdomen without and with contrast (CPT 74183) can be performed.
 - Lesions that are unable to be characterized as either benign or typical of malignancy on CT or MRI should be biopsied.
 - Lesions ≥1cm with a negative biopsy can have repeat ultrasound or CT abdomen without and with contrast (CPT 74170) every 3 to 6 months until the lesion resolves, displays diagnostic characteristics of HCC, or repeat biopsy is positive.

- **Reference:**
 - *Hepatology* 2005 Nov;42(5):1208-1236

PACAB-21~ELEVATED LIVER FUNCTION TEST (LFT) LEVELS

- The enzymes included in this category are AST, ALT, alkaline phosphatase, GGT, and bilirubin.
- Patients with elevation of AST and/or ALT less than two times normal should have repeat levels performed in three to four weeks prior to considering advanced imaging.
- Patients on lipid lowering medications (statins) or other medications known to cause elevated LFT's should have those medications stopped for at least 4 weeks and the LFT levels repeated prior to considering advanced imaging.
- Patients with persistently elevated LFT's or LFT's less than three times normal should have ultrasound as the initial imaging study.
 - If a liver or pancreatic mass is seen, CT of the abdomen without and with contrast (CPT 74170) is appropriate.
 - If biliary dilatation or other nonspecific abnormality is seen, CT of the abdomen with contrast (CPT 74160) is appropriate.
- MRCP (CPT 74181) is appropriate in patients who are status post cholecystectomy and have a possible common bile duct stone.
- If biliary dilatation is seen on ultrasound or CT, MRCP (CPT 74181) may be appropriate.
 - Specialist evaluation can be helpful in determining the need for MRCP because ERCP is both diagnostic and therapeutic if biliary stone is a high probability.
- Patients with known cancer and suspected liver metastases should have CT of the abdomen without and with contrast (CPT 74170) or CT of the abdomen with contrast (CPT 74160) (whichever the physician prefers). Default CPT code should be 74170.
- Patients with elevated alpha-fetoprotein (AFP) levels should have MRI of the abdomen without and with contrast (CPT 74183).
- CT of the abdomen with contrast (CPT 74160) is appropriate in patients who present with painless jaundice. MRI/MRCP are accurate but should be reserved for patients with contraindications to CT.*
 - **ACR Appropriateness Criteria, Jaundice, 2008*
- **Hemochromatosis:**
 - The diagnosis is made by biopsy.
 - Specialist (GI or Hematologist) evaluation is helpful.
 - MRI abdomen without contrast (CPT 74181) is used to confirm liver iron stores and for following treatment.*
 - **Hepatology* 2001;33(5):1321-1328
 - *Joffe S. *Hemochromatosis*. eMedicine, March 11, 2005. <http://www.emedicine.com>. Accessed November 20, 2006

SPLEEN

PACAB-22~SPLEEN

- **Splenomegaly** is usually the result of systemic disease, and diagnostic studies are directed toward identifying the causative disease.
 - Complete blood count with differential, LFT's, and peripheral blood smear examination should be performed prior to considering advanced imaging.
 - Suspected splenomegaly should be evaluated by ultrasound initially.*
 - * ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, revised 2007
 - If ultrasound is indeterminate or shows an abnormality, CT abdomen without and with contrast (CPT 74170) can be performed.*
 - *Kaplan U and Coffman D. Splenomegaly. eMedicine, October 5, 2004, <http://www.emedicine.com>. Accessed November 21, 2006
 - In children, if ultrasound is indeterminate, MRI abdomen without and with contrast (CPT 74183) can be performed.
 - If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.
- **Incidental Finding of Splenic Lesion(s):**
 - If an incidental splenic lesion is seen on a non-abdominal imaging study (e.g. chest CT, thoracic MRI, etc.), abdominal ultrasound should be performed if the lesion has cystic qualities.
 - CT abdomen (either with contrast [CPT 74160] or without and with contrast [CPT 74170]) can be performed if ultrasound is non-diagnostic or the lesion does not have cystic qualities.
 - If CT is indeterminate or contraindicated, MRI abdomen without and with contrast (CPT 74183) can be performed.
 - There is no evidence-based data to support performing serial CT or MRI scans to follow patients with incidental splenic lesions.
- **Trauma:**
 - CT scans of the abdomen and pelvis without and with contrast (CPT 74170 and 72194) are indicated in patients with blunt abdominal trauma with suspected splenic rupture or in patients with penetrating trauma to the left upper quadrant.

RENAL (FLANK PAIN, RULE OUT RENAL STONE- SEE PACAB- 4)

PACAB-23~INDETERMINATE RENAL LESION

- Newly discovered renal mass >1 cm (indeterminate by the initial test)
 - Ultrasound should be performed initially
 - If the lesion is consistent with a simple cyst on ultrasound (spherical or ovoid shape, absence of internal echoes, presence of a thin smooth wall, enhancement of the posterior wall), no further imaging is indicated.*
 - *Am Fam Physician 2001;63:288-294 and 299

- Lesions >1 cm that are not characterized as a simple cyst by ultrasound can be evaluated by CT Abdomen without and with contrast (CPT 74170).
 - If the patient cannot tolerate intravenous contrast, then MRI of the abdomen without and with contrast (CPT 74183) is appropriate
- If CT or MRI characterizes the lesion as benign, no further imaging is necessary.
- If the initial follow-up CT or MRI is still indeterminate, follow-up imaging should be performed in 3 to 6 months, then annually for 5 years in older patients. In younger patients, longer annual follow-up is needed.*
 - *Radiographics 2004;24:5101-5115
- If the patient cannot tolerate intravenous contrast, then MRI of the abdomen without and with contrast (CPT 74183) is appropriate.
- If a lesion has been characterized as a hyperdense renal cyst, follow-up CT scan should be performed in 3 to 6 months.
- Newly discovered renal mass < 1 cm
 - CT abdomen without and with contrast (CPT 74170) with ultra-thin cuts should be performed
 - If CT demonstrates a simple cyst or other benign lesion, no further imaging is necessary
 - If CT is indeterminate, MRI abdomen without and with contrast (CPT 74183) can be performed.
 - If MRI demonstrates a benign lesion, no further imaging is necessary
- If the initial follow-up CT or MRI is still indeterminate, follow-up imaging should be performed in 3 to 6 months, then annually for 5 years in older patients. In younger patients, longer annual follow-up is needed.*
 - *Radiographics 2004; 24:5101-5115
- If a lesion has been characterized as a hyperdense renal cyst, follow-up CT scan should be performed in 3 to 6 months.

PACAB-24~RENOVASCULAR HYPERTENSION

- Doppler ultrasound is the most cost-effective exam for screening renovascular hypertension and can be used as the initial screening tool for medically controlled patients with clinical suspicion of renovascular disease. However, ultrasound results are highly dependant on the expertise of the local facility/radiologist.*
 - *AJR 2005;184:931-937
- Other considerations for imaging evaluation:*
 - Abdominal MRA (CPT 74185) or CTA (CPT 74175) may be indicated for the following:
 - Patients under 40 years old with hypertension, controlled or uncontrolled, to exclude fibromuscular dysplasia of the renal arteries.

PACAB-25~URINARY TRACT INFECTION (UTI)

- Urology evaluation is helpful in determining the need for advanced imaging in patients with recurrent urinary tract infections.
- Thorough diagnostic work-up includes ultrasound, voiding cystourethrography (VCUG), diuretic renography, and MR urography (MRI abdomen and pelvis, contrast as requested).
- Males with first time urinary tract infection may benefit from Urology evaluation and CT urogram (CPT 74170 and 72194).
- Children should be evaluated initially by ultrasound and if further imaging is indicated, MRI abdomen and pelvis (contrast as requested) can be performed.
- **PACAB-25.1 Upper Urinary Tract**
- Males with first time UTI (and females with first or second UTI) should undergo ultrasound evaluation as the initial imaging modality to diagnose hydronephrosis, pyonephrosis or congenital renal anomaly.
 - If hydronephrosis is present, this should be further evaluated with voiding cystourethrography (VCUG), to evaluate for vesicoureteral reflux.
 - If the ultrasound findings are compatible with a multicystic dysplastic kidney, diuretic renography should be confirmed to evaluate function of the affected kidney or a ureteral-pelvic junction (UPJ) obstruction of the contralateral kidney.
 - If VCUG is negative, diuretic renography (using Tc-99m MAG 3) should be performed for diagnostic evaluation of upper tract dilatation.
 - Diuretic renography is also appropriate for follow-up of some children with hydronephrosis.
 - Diuretic renography is the study of choice for differentiating a dilated non-obstructed urinary system from a true stenosis (e.g., UPJ obstruction; ureteral-vesical junction [UVJ] obstruction), and for quantifying renal parenchymal function.
 - Magnetic resonance urography (MRU) is appropriate (where available) for investigation of a dilated upper urinary tract.
 - **NOTE:** MRU requires sedation in young children
 - Where available, MRU can also quantitate renal function.
- Children aged 5 years or younger with febrile UTI may undergo nuclear medicine DMSA imaging (Technetium-99m-dimercaptosuccinic acid [DMSA] scintigraphy) for the diagnosis of acute pyelonephritis.
 - Sensitivity of DMSA scintigraphy is much higher than ultrasound and is equivalent to CT, but at a lower radiation dose.
 - Tc-99m DMSA scintigraphy is highly sensitive for detection of acute pyelonephritis and is the reference standard for detection of post-pyelonephritic renal scarring.
 - For detection of renal scarring, DMSA scintigraphy should be performed at least 6 months after the documented upper tract UTI.
- Power Doppler ultrasound is significantly less accurate than Tc-99m DMSA or CT for the diagnosis of acute pyelonephritis.

- MRI is very sensitive for the detection of acute pyelonephritis, and where available, should be used in place of CT
 - **NOTE:** MRI requires sedation in young children
- **PACAB-25.2 Lower Urinary Tract**
 - Ultrasound studies in neonates or young children revealing hydronephrosis should undergo voiding cystourethrography (VCUG) for detection of possible vesico-ureteral reflux (VUR).
 - Fluoroscopic VCUG is typically performed for diagnosis and grading of VUR, and should be the first modality used for diagnosis.
- Radionuclide cystography, because of its lower radiation burden and higher sensitivity for reflux > Grade I, is recommended for follow-up imaging of VU reflux, and investigation of VU reflux in siblings of refluxing children.
 - First time male UTI's should be evaluated with fluoroscopic VCUG studies rather than radionuclide cystography, to visualize the male urethra for possible posterior urethral valves.
 - Radionuclide cystography may replace fluoroscopic VCUG in girls as the first time study, since urethral anatomy is rarely abnormal except in complex malformations.
- MR urography may be used for evaluation of ectopic distal ureteral insertion, or other complex lower urinary tract anatomy.
 - **NOTE:** MR urography requires sedation in young children
- **References:**
 - *Radiology* 1998;207:377-384
 - *J Urol* 2003;169:2308-2311
 - Mandell GA, Egli DF, Gilday DL, et al. Society of Nuclear Medicine Procedure Guideline for Renal Cortical Scintigraphy in Children. Society Nuclear of Medicine Procedure Guidelines Manual.1997, pp.135 -139
 - *AJR* 1991;157:539-543
 - *Radiology* 2001;218: 101-108

PACAB-26~PATENT URACHUS

- **Patent urachus** which is suspected due to umbilical discharge should initially be evaluated by ultrasound.
 - The urachus is a “tube” connecting the fetal bladder to the umbilical cord. It is usually obliterated during fetal growth, but if it remains patent, there can be a connection between the bladder and the umbilicus.
- CT pelvis with contrast (CPT 72193) can be performed if ultrasound is equivocal or if needed for surgical planning.

PEDIATRIC AND CONGENITAL ABDOMINAL IMAGING GUIDELINE REFERENCES

PACAB-1~General Guidelines

- Shah R and Fields JM. *Ascites*. eMedicine, updated February 21, 2007; <http://www.emedicine.com/med/topic173.htm>. Accessed November 11, 2008.

PACAB-2~Abdominal Pain, Nonspecific

- *ACR Practice Guidelines for the performance of an ultrasound examination of the abdomen or retroperitoneum*, revised 2007.
- Scholl J. *A primary care approach to functional abdominal pain*. *Pediatr Nurs* 2007;33(3):247-259.

PACAB-3~Abdominal Sepsis (Suspected Abdominal Abscess)

- *ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess*, 2006.

PACAB-4~Flank Pain, Rule Out Renal Stone

- *ACR Appropriateness Criteria, Acute onset flank pain*, 2007.
- Wolf J. *Nephrolithiasis*. eMedicine, February 15, 2006, <http://www.emedicine.com>. Accessed September 18, 2007.

PACAB-5~Acute Gastroenteritis (Pediatric)

- Levine A. *Pediatrics, Gastroenteritis*. eMedicine, June 14, 2006, <http://www.emedicine.com>. Accessed September 28, 2007.
- CDC, *Managing Acute Gastroenteritis Among Children*, November 21, 2003, Vol.52, No. RR-16.

PACAB-6~Left Lower Quadrant Pain

- *Society for Surgery of the Alimentary Tract. Surgical Treatment of Diverticulitis*, Revised 5/2003. <http://www.ssat.com>. Accessed November 20, 2006.
- Salzman H and Lillie D. Diverticular disease: diagnosis and treatment. *Am Fam Physician* 2005 Oct;72:1229-1234 and 1241-1242.
- *ACR Appropriateness Criteria, Left Lower Quadrant Pain*, 2008.
- Cooperman A and Sherif A. *Diverticulitis*. eMedicine, July 7, 2006, <http://www.emedicine.com>. Accessed November 20, 2006.

PACAB-7~Left Upper Quadrant Pain

- *ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum*, revised 2007.

PACAB-8~Postoperative Pain Within 60 Days Following Abdominal Surgery

- *ACR Appropriateness Criteria, Suspected small bowel obstruction*, 2005.
- *ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess*, 2006.

PACAB-9~Right Lower Quadrant Pain, Rule Out Appendicitis

- Cobben LP, Groot I, Haans L, et. al. MRI for clinically suspected appendicitis during pregnancy. *AJR* 2004 Sept;183:671-675.
- Pedrosa I, Levine D, Eyvazzadeh AD, et al. MR imaging evaluation of acute appendicitis in pregnancy. *Radiology* 2006 Mar;238(3):891-899.
- *ACR Appropriateness Criteria, Acute abdominal pain and fever or suspected abdominal abscess*, 2006.

PACAB-10~Right Upper Quadrant Pain, Rule Out Cholecystitis

- *ACR Appropriateness Criteria, Right upper quadrant pain*, 2007.
- Barnes DS. *Gallbladder and Biliary Tract Disease. The Cleveland Clinic Disease Management Project*. July 9, 2002. <http://www.clevelandclinicmeded.com/diseasemangement>. Accessed Nov. 20, 2006.

PACAB-11~Abdominal Lymphadenopathy

- Bazemore AW and Smucker, DR. Lymphadenopathy and malignancy. *Am Fam Physician* 2002 Dec;66(11):2103-2110.
- Kanwar V. *Lymphadenopathy*. eMedicine, June 28, 2006, <http://www.emedicine.com>. Accessed September 20, 2007.
- Gow K. *Lymph Node Disorders*. eMedicine, May 15, 2006, <http://www.emedicine.com>. Accessed September. 20, 2007.

PACAB-12~Blunt Abdominal Trauma

- Geehan DM and Santucci RA. *Renal Trauma*. eMedicine, June 12, 2006, <http://www.emedicine.com>. Accessed September 11, 2007.
- Smith J. *Kidney, Trauma*. eMedicine, Feb 21, 2007, <http://www.emedicine.com>. Accessed Sept. 11, 2007.
- *ACR Appropriateness Criteria, Blunt abdominal trauma*, 2005.

PACAB-13~Gaucher's Disease

- vom Dahl S, Poll L, Di Rocco M, et. al. Evidence-based recommendations for monitoring bone disease and the response to enzyme replacement therapy in Gaucher patients. *Current Medical Research and Opinion* 2006;22(6):1045-1064.
- Weinreb NJ, Aggio MC, Andersson HC, et. al. *Gaucher disease type 1. Revised recommendations on evaluations and monitoring for adult patients*. *Semin Hematol* 2004 Oct;41(4 Suppl 5):15-22.

PACAB-14~Hernias

- Tranter SE and Thompson MH. Spontaneous passage of bile duct stones: frequency of occurrence and relation to clinical presentation. *Ann R Coll Surg Engl* 2003 May;85(3):174-177.
- Dattola P, Alberti A, Dattola A, et. al. Inguino-crural hernias: preoperative diagnosis and post-operative follow-up by high-resolution ultrasonography. A personal experience. *Ann Ital Chir* 2002 Jan-Feb;73(1):65-68.
- Lilly MC and Arregui ME. Ultrasound of the inguinal floor for evaluation of hernias. *Surg Endosc* 2002 Apr;16(4):659-662.
- Robinson P. *Imaging of Athletic Pubalgia*. Presented at: 33rd Annual Radiology Refresher Course of the international Skeletal Society, September 13-16, 2006; Vancouver, British Columbia, Canada.
- Manthey D and Nicks BA. *Hernias*. eMedicine, January 3, 2007, <http://www.emedicine.com>. Accessed September 11, 2007.

PACAB-15~Lipoma

- Scott-Conner CEH and Radebold K. *Lipomas*. eMedicine, April 17, 2006, <http://www.emedicine.com>. Accessed September 11, 2007.
- Gaskin CM and Helms CA. Lipomas, lipoma variants, and well-differentiated liposarcomas (atypical lipomas): results of MRI evaluations of 126 consecutive fatty masses. *AJR* 2004;182:733-739.

PACAB-16~Adrenal Cortical Lesions

- Hamrahian AH, Loachimescu AG, Remer EM, et. al. Clinical utility of noncontrast computed tomography attenuation value (Hounsfield units) to differentiate adrenal adenomas/hyperplasias from nonadenomas: Cleveland Clinic Experience. *J Clin Endocrinol Metab* 2005 Feb;90(2):871-877.
- Song JH, Chaudhry FS, Mayo-Smith WW. The incidental indeterminate adrenal mass on CT (>10H) in patients without cancer: Is further imaging necessary? Follow-up of 321 consecutive indeterminate adrenal masses, *AJR* 2007;189:1119-1123.
- Song JH, Chaudhry FS, Mayo-Smith WW. The incidental adrenal mass on CT:

Prevalence of adrenal disease in 1,049 consecutive adrenal masses in patients with no known malignancy. *AJR* 2008 May;190:1163-1168.

- *ACR Appropriateness Criteria, Incidentally discovered adrenal mass, 2007.*
- Motte-Remirez GA, Remer EM, Herts BR, et al. Comparison of CT findings in symptomatic and incidentally discovered pheochromocytomas. *AJR* 2005;185:684-688.
- Grumbach MM, Biller BMK, Braunstein GD, et al. Management of the clinically inapparent adrenal mass ("incidentaloma"). *Ann Intern Med* 2003;138:424-429.
- Uwaifo GI and Fojo AT. *Adrenal Carcinoma*. eMedicine, May 26, 2006, <http://www.emedicine.com>. Accessed September 11, 2007.
- Funder JW, Carey RM, Fardella C, et al. Case detection, diagnosis, and treatment of patients with primary aldosteronism: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab* 2008 Sept;93(9):3266-3281.
- Vuguin P. *Pheochromocytoma*. eMedicine, June 5, 2006, <http://www.emedicine.com>. Accessed September 18, 2007.
- Sweeney A. *Pheochromocytoma*. eMedicine, Sept 11, 2007, <http://www.emedicine.com>. Accessed September 18, 2007.

PACAB-17~Bowel Obstruction

- *ACR Appropriateness Criteria, Suspected small bowel obstruction, 2005.*

PACAB-18~ Diarrhea/Constipation and Bloating/Irritable Bowel

- American Gastroenterological Association Medical Position Statement: Guidelines for the evaluation and management of chronic diarrhea. *Gastroenterol* 1999;116:1461-1463.
- Schiller LR. Chronic diarrhea. *Gastroenterol* 2004;127:287-293.
- Arce DA, Ermocilla CA, Costa H. Evaluation of constipation. *Am Fam Physician* 2002;65(11):2283-2290.
- Cash BD, Rasgon NL, Sabesin SM, et al. Update on the management of adults with chronic idiopathic constipation. *J Fam Practice* 2007 June;56(6 Suppl):S13-S20.
- Qureshi W, Adler DG, Davila RE, et al. ASGE guideline: Guideline on the use of endoscopy in the management of constipation. *Gastrointest Endosc* 2005 Aug;62(2):199-201.
- Cortes E, Reid WM, Singh K, et al. Clinical examination and dynamic magnetic resonance imaging in vaginal vault prolapse. *Obstet Gynecol* 2004;103:41-46.
- Roos JE, Veishaupt D, Wildermuth S, et al. *Radiographics* 2002;22:817-832.
- Holten KB and Wetherington A. Diagnosing the patient with abdominal pain and altered bowel habits: Is it irritable bowel syndrome? *Am Fam Physician* 2003 May;67(10):2157-2162.
- Serper M. *Irritable bowel syndrome: evidence-based evaluation and management*. Patient Care Online, July 16, 2007, <http://www.patientcareonline.com>. Accessed September 20, 2007.
- El-Baba M. *Irritable Bowel Syndrome*. eMedicine, July 31, 2007, <http://www.emedicine.com>. Accessed September 20, 2007.
- American Gastroenterological Association Medical Position Statement: Guidelines on constipation. *Gastroenterol* 2000;119:1761-1778.

PACAB-19~ Inflammatory Bowel Disease, Rule Out Crohn's Disease or Ulcerative Colitis

- Hara AK, Leighton JA, Heigh RI, et al. Crohn's Disease of the small bowel: preliminary comparison among CT enterography, capsule endoscopy, small-bowel follow-through, and ileoscopy. *Radiology* 2006 Jan;238(1):128-134.

- *Cigna Healthcare Coverage Position. Subject: Capsule Endoscopy. Revised February 15, 2007.*
- Lin MF and Narra V. Developing role of magnetic resonance imaging in Crohn's disease. *Curr Opin Gastroenterol* 2008 March;24(2):135-140.
- *ACR Appropriateness Criteria, Crohn's disease, 2005.*

PACAB-20~ Liver Lesion Characterization

- Leifer DM, Middleton WD, Teefey SA, et. al. Follow-up of patients at low risk for hepatic malignancy with a characteristic hemangioma at US. *Radiology* 2000 Jan;214(1):167-172.
- Bruix J and Sherman M. Practice Guidelines Committee, American Association for the Study of liver Diseases. Management of hepatocellular carcinoma. *Hepatology* 2005 Nov;42(5):1208-1236.
- Yoon SS, Charny CK, Fong Y, et. al. Diagnosis, management, and outcomes of 115 patients with hepatic hemangioma. *J Am Coll Surg* 2003 Sep;197(3):392-402.
- Ferlicot S, Kobeiter H, Van Nhieu JT, et. al. MRI of atypical focal nodular hyperplasia of the liver: radiology-pathology correlation. *AJR* 2004;182:1227-1231.
- AGA technical review on nonalcoholic fatty liver disease. *Gastroenterol* 2002 Nov;123(5):1705-1725.
- Clouston AD, Powell BE. Nonalcoholic fatty liver disease: is all the fat bad? *Internal Medicine Journal* 2004;34:187-191.
- Adams LA, Angulo F, Lindor KD. Nonalcoholic fatty liver disease. *CMAJ* 2005 March;172(7):899-905.
- Bayard M, Holt J, Boroughs E. Nonalcoholic fatty liver disease. *Am Fam Physician* 2006 Jun;73(11):1961-1968.

PACAB-21~ Elevated Liver Function Test (LFT) Levels

- *ACR Appropriateness Criteria, Jaundice, 2008.*
- Tavill AS. Diagnosis and management of hemochromatosis. *Hepatology* 2001;33(5):1321-1328.
- Joffe S. *Hemochromatosis. eMedicine, March 11, 2005, <http://www.emedicine.com>. Accessed Nov. 20, 2006.*

PACAB-22~Spleen

- *ACR Practice Guidelines for the Performance of an ultrasound examination of the abdomen or retroperitoneum, revised 2007.*
- Kaplan LJ and Coffman D. *Splenomegaly. eMedicine, October 5, 2004, <http://www.emedicine.com>. Accessed November 21, 2006.*

PACAB-23~ Indeterminate Renal Lesion

- Higgins JC and Fitzgerald JM. Evaluation of incidental renal and adrenal masses. *Am Fam Physician* 2001;63:288-294 and 299.
- Hartman DS, Choyke PL, Hartman MS. A practical approach to the cystic renal mass. *Radiographics* 2004;24:5101-5115.

PACAB-24~Renovascular Hypertension

- Boldue JP, Oliva VL, Therasse E, et. al. Diagnosis and treatment of renovascular hypertension: a cost-benefit analysis. *AJR* 2005;184:931-937.

PACAB-25~Urinary Tract Infection (UTI)

- Lonergan GJ, Pennington DJ, Morrison JC, et. al. Childhood pyelonephritis: Comparison of gadolinium-enhanced MR imaging and renal cortical scintigraphy for diagnosis. *Radiology* 1998;207:377-384.
- Weiser AC, Amukele SA, Leonidas JC, et. al. *The role of gadolinium enhanced*

magnetic resonance imaging for children with suspected acute pyelonephritis. J Urol 2003;169:2308-2311.

- Mandell GA, Egli DF, Gilday DL, et. al. Society of Nuclear Medicine Procedure Guideline for Renal Cortical Scintigraphy in Children. Society Nuclear of Medicine Procedure Guidelines Manual.1997, pp.135 -139.
- Bjorgvinsson E, Majd M, Egli KD. *Diagnosis of acute pyelonephritis in children: Comparison of sonography and Tc-99m DMSA scintigraphy. AJR* 1991;157:539-543.
- Majd M, Nussbaum Blask AR, Markle BM, et. al. Acute pyelonephritis: comparison of diagnosis with Tc-99m DMSA SPECT, Spiral CT, MR imaging, and Power Doppler US in an experimental pig model. *Radiology* 2001;218: 101-108.

2009 PEDIATRIC AND CONGENITAL PELVIS IMAGING GUIDELINES

PACPV-1~GENERAL GUIDELINES

- The Pelvis Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Pelvis Imaging Guidelines.
- Pelvic imaging begins at the umbilicus and extends to the pubis.
- Prior to considering advanced imaging, patients should undergo a recent detailed history, careful gynecological and/or urological exam (including appropriate laboratory studies such as blood count, tumor markers, and gonadotropins if indicated), and the use of non advanced imaging modalities such as plain x-ray and ultrasound.
- Transvaginal ultrasound (TV) is the optimal study to evaluate pelvic pathology.
- To avoid radiation exposure, pediatric imaging should consider the use of ultrasound or
 - MRI where it is a clinical option.
 - MRI without contrast (CPT 72195) is the usual modality to view the pelvis.
 - MRI without and with contrast (CPT 72197) is appropriate for evaluating the ovary or retroperitoneum.
 - MRI of the pelvis with contrast only is essentially never performed. If contrast is indicated, MRI pelvis without and with contrast (CPT 72197) should be performed.
- If CT is performed, CT with contrast (CPT 72193) is the usual modality unless there is a contrast allergy or the study is looking for a renal stone in the lower pelvis.
- Pelvic CT or MRI may be indicated to further evaluate abnormalities seen on other imaging modalities such as plain x-rays, ultrasound, etc. if the results will affect patient management decisions and/or the results will assist in planning surgery.

PELVIC SIGNS AND SYMPTOMS — FEMALE

PACPV-2~ABNORMAL UTERINE BLEEDING

- Initial evaluation includes transvaginal ultrasound, saline infusion sonography, hysteroscopy and possible biopsy.
 - Premenopausal women should be treated conservatively with hormone therapy. If there is failure to respond to this treatment, evaluation by biopsy and/or hysteroscopy is indicated.
- MRI pelvis without contrast (CPT 72195) is indicated only if transvaginal ultrasound is unable to differentiate a submucous myoma from a polyp and the MRI results will affect surgical planning as stated by the surgeon.
- **References:**
 - *Obstet Gynecol* 2003;102:659-662
 - *Management of Abnormal Uterine Bleeding*. Slide presentation modified from: *APGO Educational Series on Women's Health Issues*

PACPV-3~AMENORRHEA

- Initial imaging should be by transvaginal (TV) ultrasound, hysterosalpingogram and/or hysteroscopy to look for genital and urinary tract abnormalities.
- Suspicion of a hormonally active adrenal tumor should be evaluated using PACAB-16.2 Adrenal Endocrine Tumors in the adult Abdomen guidelines.
- Pelvic imaging (CT pelvis with contrast [CPT 72193]) for androgen secreting ovarian tumors may be necessary if needed to plan surgery.
- Amenorrhea with intact uterus and history of normal puberty should be evaluated with TV ultrasound and endocrine work-up.
 - If pregnancy test is negative, then TSH, LH, FSH, and prolactin levels should be measured.
 - If prolactin is elevated refer to HD-28.1 Pituitary Microadenomas in the adult Head guidelines.
 - If FSH is lower than reference range, MRI brain without and with contrast (CPT 70553) can be performed.
 - If TSH, LH, prolactin, and FSH are within reference range, then a complete hormone evaluation should be performed (e.g. androgen hormones, etc.)
 - If ultrasound identifies the following entities then advanced imaging is not indicated unless requested for surgical planning by the operating surgeon:
 - Asherman's Syndrome (intrauterine scarring and adhesions)
 - Diagnosis is made using transvaginal ultrasound with/without saline infusion, hysterosalpingography and/or hysteroscopy.
 - Polycystic Ovarian Syndrome (PCO)
 - Androgen secreting ovarian tumor
 - Androgen secreting adrenal tumor
- Amenorrhea with genital tract abnormalities:
 - Suspected genital and urinary tract abnormalities should be evaluated initially with ultrasound of the abdomen and pelvis.
 - Patients with absent uterus or foreshortened vagina should have karyotype evaluation.
 - Advanced imaging is not generally indicated
- Amenorrhea with delayed puberty:
 - Initial evaluation includes measurement of thyroid function tests, bone age, LH, FSH and prolactin.
 - If LH and FSH are low or within the reference range and bone age is normal, then MRI brain without and with contrast (CPT 70553) can be performed.
 - If prolactin levels are elevated, then MRI brain without and with contrast with attention to the pituitary (CPT 70553) can be performed.
 - Advanced imaging of the abdomen/pelvis is not indicated.

- **Reference:**

- Bielak KM and Harris GS. *Amenorrhea*. eMedicine, March 12, 2008, <http://www.emedicine.com/ped/TOPIIC2779.HTM>. Accessed November 14, 2008

PACPV-4~ADENOMYOSIS

- Adenomyosis is a histologic diagnosis and imaging has limitations.
- Adenomyosis is suspected by history and physical examination.
- If hormonal therapy is going to be tried first, then MRI is not indicated in patients with suspected adenomyosis.
- Transvaginal (TV) ultrasound is the primary screening modality for imaging the female pelvis.
 - TV ultrasonography (along with color Doppler ultrasound) is the diagnostic procedure of choice for the initial evaluation of suspected adenomyosis and is useful to evaluate other potential etiologies of the patient's symptoms.
 - If transvaginal ultrasound is inconclusive or there has been a failure of several months of hormone suppression and a more definitive diagnosis is necessary for surgical planning only, MRI pelvis without contrast (CPT 72195) can be performed.

PACPV-5~SUSPECTED ADNEXAL MASS

- The adnexa includes the ovaries, Fallopian tubes, and ligaments that hold the uterus in place.
- Management of adnexal masses involves either observation or surgical intervention.
- Adnexal masses have a long list of diagnostic possibilities and ultrasound results must be correlated with history, physical exam, and laboratory testing.
 - Tumor markers useful for adnexal mass evaluation include:
 - CA-125 (epithelial cancer, leiomyoma, endometriosis, PID, inflammatory disease such as lupus, and inflammatory bowel disease)
 - Although CA-125 can be elevated with benign entities such as endometriosis, the elevated CA-125 titers generally do not increase over time in these patients.
 - Beta hCG, LDH, and AFP (germ cell tumors)
 - Inhibin A and B (granulosa cell tumor)
- Transvaginal (TV) ultrasound is the initial imaging study of choice. Transabdominal ultrasound may also be done but does not substitute for TV ultrasound.
 - Color Doppler ultrasound may be helpful in selected situations.

- MRI of the pelvis (CPT 72197 or 72195 if pregnant) for the evaluation of a pelvic mass is less sensitive and only slightly more specific than transvaginal ultrasound and usually adds little to the plan of care.
 - MRI may be useful in classifying malignant masses if requested by the operating surgeon.
 - **Reference:**
 - ACOG Practice Bulletin No. 83: Management of adnexal masses, July 2007
- CT of the pelvis without and with contrast (CPT 72194) is helpful as a preoperative study to evaluate for metastatic disease when cancer is known or suspected.
- **PV- 5.1 Simple Adnexal Cysts**
 - If TV ultrasound classifies an adnexal mass as a simple or thin walled cystic mass or follicular cyst (ovarian) or tubular cystic mass (fallopian tube):
 - Follow-up should be with TV ultrasound every 6 months for lesions ≤ 10 cm in both premenopausal and post menopausal women.
 - If elevated tumor markers are present, surgical intervention should be considered.
 - Advanced imaging may be appropriate for preoperative planning if requested by the operating surgeon.
 - Cysts > 10 cm with normal tumor markers have not been studied and the current recommendation is to consider surgical intervention.
 - Advanced imaging may be appropriate for preoperative planning if requested by the operating surgeon.
 - **Reference:**
 - ACOG Practice Bulletin No. 83: Management of adnexal masses, July 2007
- **PV- 5.2 Complex Adnexal Masses**
 - Complex adnexal masses are usually ovarian in origin, and in premenopausal women, most commonly represent hemorrhagic cysts or endometriomas.
 - Ultrasound characteristics usually suggest the diagnosis, and in premenopausal women, a follow up ultrasound can be done in six weeks or following a menstrual cycle to evaluate for resolution.
 - A pregnancy test is important to narrow the differential diagnosis.
 - If tumor markers are elevated or the mass is suspicious for primary ovarian cancer by TV ultrasound (ultrasound shows solid areas or excrescences and/or free abdominal/pelvic fluid), evaluation for surgical intervention should be considered.
 - Advanced imaging may be appropriate for preoperative planning if requested by the operating surgeon.

- An ovarian mass suspicious for metastatic disease (e.g. from breast, uterine, colorectal or gastric cancer) should be evaluated based on the appropriate Oncology Imaging guideline.
 - Advanced imaging such as MRI of the pelvis (CPT 72197 or 72195 if pregnant) should be considered only if classification of the ovarian mass will affect patient management decisions.
 - **Reference:**
 - ACOG Practice Bulletin No. 83: *Management of adnexal masses*, July 2007
- **PV- 5.3 Screening for Ovarian Cancer**
 - See ONC-20 Ovarian Cancer in the adult Oncology guidelines
 - Screening is done by TV ultrasound.

PACPV-6~ENDOMETRIOSIS

- Endometriosis is a surgical diagnosis and imaging is of little value unless the pelvic clinical exam is abnormal.
- Transvaginal (TV) ultrasound is the first line diagnostic exam for suspected endometriosis*.
 - **Hum Reprod* 2007;22(12):3092-3097
- In most patients, TV ultrasound followed by medical treatment or laparoscopy should be considered prior to advanced imaging.
 - Laparoscopy remains the definitive test for diagnosis and evaluation of endometriosis in most patients.*
 - **Eur Radiol* 2006 Feb;16(2):285-298
 - *ACOG Committee Opinion, Number 310, April 2005
- MRI has shown high accuracy for both anterior and posterior endometriosis and can enable complete lesion mapping prior to surgical excision of known endometriosis that was diagnosed during a previous surgery.*
 - **Eur Radiol* 2006 Feb;16(2):285-298
 - *Aeby TC, Hiraoka MKY. *Endometriosis*. eMedicine, May 15, 2006 <http://www.emedicine.com>. Accessed November 20, 2006

PACPV-7~PELVIC INFLAMMATORY DISEASE (PID)

- Ultrasound is the initial study for imaging of pelvic inflammatory disease (PID) that does not respond well to antibiotic therapy, or for complicated PID.
- In rare cases where there is extensive abscess formation as determined by ultrasound, CT of the abdomen and pelvis with contrast (CPT 74160 and CPT 72193) may be helpful.
- If a CT-guided percutaneous drainage procedure is planned, then CPT 77012 (CT guidance for needle placement) should be used rather than the CPT codes for diagnostic CT scans of the abdomen and pelvis.

PACPV-8~PELVIC PAIN/DYSPAREUNIA, FEMALE

- Complete clinical pelvic examination and transvaginal (TV) ultrasound are indicated for the initial evaluation of pelvic pain/dyspareunia.
- Pelvic pain/dyspareunia accompanied by fever, elevated WBC, failure of conservative treatment (including the use of hormones or antibiotics when appropriate), or palpable mass should be initially evaluated by TV ultrasound.
 - If TV ultrasound is normal, other causes should be considered such as chronic cystitis or bowel disease. Urological work-up, gastroenterology work-up, and laparoscopy should be performed prior to considering advanced imaging.
 - CT pelvis with contrast (CPT 72193) is only appropriate if TV ultrasound has equivocal findings.*
 - TV ultrasound with color Doppler should be performed if ovarian torsion is a consideration.
 - *ACOG Practice Bulletin No. 51: Chronic pelvic pain; March 2004 (Reaffirmed 2008)
- **Suprapubic pain:** If pain is recurrent or chronic and is associated with bladder urgency and pressure with negative urine cultures, failure of antibiotic treatment, and normal ultrasound and laboratory studies, then cystoscopy is indicated.
 - Imaging is not indicated in the evaluation of chronic suprapubic pain or chronic cystitis.

PACPV-9~LEIOMYOMATA

- Transabdominal and transvaginal ultrasound are the preferred screening procedures for leiomyomata.
- Abnormal uterine bleeding from suspected submucous leiomyoma should be evaluated by saline sonohysterography or panoramic hysteroscopy* initially.
 - If these studies are equivocal, and if imaging is needed for surgical planning, MRI pelvis without contrast (CPT 72195) can be performed.
 - *J Postgrad Med 1992;38:62
- Preoperative ultrasound should be performed prior to myomectomy.
 - If ultrasound is indeterminate, MRI pelvis without contrast (CPT 72195) may be considered if requested by the operating surgeon for surgical planning.
 - MRI pelvis without and with contrast (CPT 72197) can be performed if leiomyoma necrosis is suspected.
- MRI pelvis without and with contrast (CPT 72197) can be performed in those cases in which arterial embolization is being considered. MRI accurately assesses the number, location, and size of leiomyomata for pretreatment planning and post treatment response.*
 - *AJR 2003;181:851-856
 - For uterine artery embolization, size of the dominant fibroid must be considered. Some studies have reported treatment failure to be more likely with fibroids >8 cm.*

**Obstet Gynecol Surv 2002;57:810-815*

- There is no literature support for the addition of MRA pelvis (CPT 72198) to the preoperative evaluation.
- There are currently no published guidelines regarding follow up MRI in patients who have undergone uterine artery embolization.
 - Although there are no compelling data to support the need for follow up MRI in asymptomatic patients who are status post uterine artery embolization, consensus opinion suggests that one follow up pelvic MRI (CPT 72197) post embolization will be allowed 3 to 6 months after the procedure.
 - MRI results are used for prediction, and for some practitioners, any gadolinium accumulation is followed by another embolization.
 - In patients with persistent or recurrent symptoms, pelvic MRI without and with contrast (CPT 72197) should be performed.
 - In patients with fever, pain, or other acute symptoms status post embolization, pelvic MRI without and with contrast (CPT 72197) should be performed.

**J Vasc Interv Radiol 2004;15:115-120*

PACPV-10~PERIURETHRAL CYSTS AND URETHRAL DIVERTICULA

- Symptomatic infection of congenital periurethral glands can result in urethral diverticula. Symptoms include pain, urinary urgency, frequency of urination, recurrent urinary tract infection, dribbling after urination, or incontinence.
 - MRI pelvis without and with contrast (CPT 72197) is superior to transvaginal ultrasound for evaluating these entities but should be reserved for patients in whom ultrasound, voiding cytourethrography, or retrograde urethrography are equivocal.*

**ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infections in Women, 2008*

PACPV-11~FETAL MRI

- Ultrasound (ideally performed at a tertiary care center) remains the predominate modality for evaluating disorders related to the fetus and pregnancy overall. MRI is used as an adjunct to ultrasound in evaluating fetal abnormalities.
- Fetal MRI is appropriately reported as an MRI of the pelvis (CPT 72195).
- **Central Nervous System Evaluation:** MRI is used if ultrasound is equivocal and additional information is needed for counseling purposes.¹
- **Non-Central Nervous System Anomalies:** MRI may be used if needed for surgical planning.
- The use of MRI for evaluating fetal size (estimating weight), growth restriction, dystocia, or amniotic fluid volume as compared to ultrasound has not been established.¹

- The use of MRI to evaluate placenta accreta or any placenta implantation has not been established to be superior to ultrasound.¹
- Functional MRI in pregnancy has not been established.¹
- MRI is helpful in the antenatal evaluation of conjoined twins in whom postnatal separation is being anticipated.
- **Reference:**
 - ¹*Obstetrics & Gynecology* 2008;112:145-157

PACPV-12~PENIS–SOFT TISSUE MASS

- Soft-tissue lesions of the penis should be evaluated initially by high resolution Doppler ultrasound.
- If ultrasound is equivocal (not clearly benign, simple cyst or Peyronie’s disease) or if primary penile cancer is suspected, MRI of the pelvis without and with contrast (CPT 72197) can be performed.
- **References:**
 - *RadioGraphics* 2001;21:S283-S298
 - *RadioGraphics* 2005;25:1629-1638
 - *Clinical Radiology* 2003;58(7):514-523

PACPV-13~SCROTAL PATHOLOGY

- Acute scrotal pain, masses, trauma, inguinal hernia, varicocele, or inflammation should be evaluated by ultrasound initially.*
 - MRI pelvis without and with contrast (CPT 72197) can be used to evaluate abnormalities of the scrotum if ultrasound is inconclusive.
- *ACR Appropriateness Criteria, Acute Onset of Scrotal Pain, 2007*

PACPV-14~UNDESCENDED TESTIS

- Boys with a history of cryptorchid (undescended) testes have a several fold risk increase of testicular cancer.
 - It is important to diagnose and treat this condition either by bringing the undescended testis into the scrotum, or resecting the testis.
 - MRI abdomen and pelvis without and with contrast (CPT 74183 and 72197) can be performed.
 - MRI pelvis without and with contrast (CPT 72197) can be used to evaluate abnormalities of the scrotum if ultrasound is inconclusive.
- The pediatric population should be evaluated initially with ultrasound, and if inconclusive, MRI pelvis (CPT 72197) can be performed.* CT and MRI have a high false negative rate and in general are not reliable as diagnostic tools.
 - Urology evaluation is helpful in determining the most appropriate imaging pathway.

**Undescended Testicle or Cryptorchidism. Cornell University Dept. of Urology, 2006, <http://www.cornellurology.com/pediatrics>. Accessed November 21, 2006*

PEDIATRIC AND CONGENITAL PELVIS IMAGING GUIDELINE REFERENCES

PACPV-2~Abnormal Uterine Bleeding

- Breitkopf D, Goldstein SR, Seeds JW. ACOG Committee on Gynecologic Practice. ACOG technology assessment in obstetrics and gynecology. Number 3, September 2003. Saline infusion sonohysterography. *Obstet Gynecol* 2003;102:659-662.
- *Management of Abnormal Uterine Bleeding*. Slide presentation modified from: *APGO Educational Series on Women's Health Issues*.

PACPV-3~Amenorrhea

- Bielak KM and Harris GS. *Amenorrhea*. eMedicine, March 12, 2008, <http://www.emedicine.com/ped/TOPIC2779.HTM>. Accessed November 14, 2008.

PACPV-5~Suspected Adnexal Mass

- ACOG Practice Bulletin No. 83: *Management of adnexal masses* July 2007.

PACPV-6~Endometriosis

- Abrao MS, Goncalves MOC, Dias JA, et al. Comparison between clinical examination, transvaginal sonography and magnetic resonance imaging for the diagnosis of deep endometriosis. *Hum Reprod* 2007;22(12):3092-3097.
- Kinkel K, Frel KA, Balleyguier C, Chapron C. Diagnosis of endometriosis with imaging: a review. *Eur Radiol* 2006 Feb;16(2):285-298.
- *ACOG Committee Opinion*, Number 310, Endometriosis in Adolescents. *Obstet Gynecol* 2005 April;105:921-927.
- Aeby TC, Hiraoka MKY. *Endometriosis*. eMedicine, May 15, 2006, <http://www.emedicine.com>. Accessed November 20, 2006.

PACPV-8~Pelvic Pain/Dyspareunia, Female

- ACOG Practice Bulletin No. 51: *Chronic pelvic pain* March 2004 (Reaffirmed 2008).

PACPV-9~Leiomyomata

- Parasnis HB and Parulekar SV. Significance of negative hysteroscopic view in abnormal uterine bleeding. *J Postgrad Med* 1992;38:62.
- Jha RC, Takahoma J, Imaoka I. Adenomyosis: MRI of the uterus treated with uterine artery embolization. *AJR* 2003;181:851-856.
- Al-Fozan H and Tulandi T. Factors affecting early surgical intervention after uterine artery embolization. *Obstet Gynecol Surv* 2002;57:810-815.
- Andrews R. Patient care and uterine artery embolization for leiomyomata. *J Vasc Interv Radiol* 2004;15:115-120.

PACPV-10~Periurethral Cysts and Urethral Diverticula

- *ACR Appropriateness Criteria, Recurrent Lower Urinary Tract Infections in Women*, 2008.

PACPV-11~Fetal MRI

- Reddy UM, Filly RA, Copel JA. Prenatal imaging: Ultrasonography and magnetic resonance imaging. *Obstetrics & Gynecology* 2008;112:145-157.

PACPV-12~Penis—Soft Tissue Mass

- Pretorius ES, Siegelman ES, Ramchandani P, et al. MR imaging of the penis. *RadioGraphics* 2001;21:S283-S298.
- Singh AK, Saokar A, Hahn PF, et al. Imaging of penile neoplasms. *RadioGraphics* 2005;25:1629-1638.

- Wilkins C. Colour Doppler ultrasound of the penis. *Clinical Radiology* 2003;58(7):514-523.

PACPV-13~Scrotal Pathology

- *ACR Appropriateness Criteria, Acute Onset of Scrotal Pain, 2007.*

PACPV-14~Undescended Testis

- *Undescended Testicle or Cryptorchidism.* Cornell University Dept. of Urology, 2006, <http://www.cornellurology.com/pediatrics>. Accessed November 21, 2006.