MINISTRY of Health
Shaping Fiji's Health

PRACTICE GUIDELINES

FOR THE

RADIOLOGY SERVICE

OF THE

MINISTRY OF HEALTH, FIJI ISLANDS

September 2010

Foreword

The Radiology service of the Ministry of Health Fiji Islands joined Clinical Services Network on May 2010. This has led to several consultations and meetings on how the Radiology Service could improve itself and how to serve its clientele best. Part of strengthening and improving the Radiology Service is to come up and write its own practice guidelines to standardize the performance of several radiological procedures and ultrasound scanning practices across the all radiology and ultrasound service under the Ministry of Health.

This is the first edition of Practice Guidelines that will be used by the Radiology Service of Ministry of Health. Other Practice Guidelines are in the planning stage and will be added in due time.

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PRACTICE GUIDELINE FOR THE PERFORMANCE OF BARIUM SWALLOW (ESOPHAGOGRAMS) IN ADULTS

INTRODUCTION

A barium swallow involves partially filling the esophagus with barium liquid while X-ray images are taken (1) Radiographic examination of the esophagus is an effective way for evaluating morphology and motor function (2).The radiologic examination of the esophagus should establish the presence or absence , nature and extent of disease with diagnostic quality study using the minimum radiation dose necessary.

INDICATIONS AND CONTRAINDICATIONS

Indications (3):

Dysphagia, pain on swallowing
Abdominal pain,
Blood stained vomitus
Unexplained weight loss
Assessment of site of perforation.
Contraindications:
Recent gastric or esophageal surgery

SPECIFICATION OF THE EXAMINATION

The request form must specifically indicate a request for a barium swallow for the patient. Adequate clinical details and history should also be indicated. The request for the examination should be from one of the SOPD clinics or GP's.

A. **Patient Preparation**

Check patient identification
Check for pregnancy .State if female
Patient must be fasted for 6 hours with a minimum of 2 hours
The procedure should be explained to the patient prior to the examination
The patient must sign a consent form for the examination
Check sensitivity to drugs used.

B. Examination preliminaries

Medical history should be taken
Appropriate laboratory results and other examinations must be reviewed prior to the examination

C. Examination Technique

A chest x-ray may be taken initially prior to Barium Swallow procedure

1. Single Contrast Barium Swallow

In single contrast, only barium solution is used as radio-opaque material
The picture must be exposed at the minimum of two dimensions for better evaluation (A.P and lateral views).The entire esophagus must be visualized in AP, Lateral and both. The Esophagus must be demonstrated to be barium filled. Mucosal relief films should also be taken. The gastro-esophageal junction should demonstrate its relaxation with flow of barium from the esophagus to the stomach.
The esophagus is assessed for reflux and motility disorders.

2. Double Contrast Barium Swallow

In double contrast, barium solution and air is used to distend the oesophagus.
Smaller lesion can be visualized better with double contrast studies. The picture must be exposed at the minimum of two dimensions for better evaluation (A.P and lateral views).The entire esophagus must be visualized in AP, Lateral and both. The Esophagus must be demonstrated to be barium filled mucosal relief films should also be taken. The gastro-esophageal junction should demonstrate its relaxation with flow of barium from the esophagus to the stomach.
The esophagus is assessed for reflux and motility disorders.

DOCUMENTATION

The report should indicate if it's a single or double contrast study. The amount of contrast must be given. The study of the esophagus should indicate abnormalities in the mucosal outline, presence of mass lesions, gastro-esophageal reflux or any motility disturbances noted during the examination

EQUIPTMENT SPECIFICATIONS

The examination should be performed with fluoroscopic and radiographic equipment meeting OHS standards.
Additional equipment such as oxygen gas and suction should be ready on standby should the need arises.
Radiation protection accessories such as gloves goggles, aprons, badge thyroid collars etc. should be on hand and ready for use.

RADIATION SAFETY IN IMAGING

In all radiographic examinations the ALARA/ ALARP principle should always be applied to the radiographer and to the patient.

AFTER CARE OF PATIENTS AND EXAMINATION REVIEW

Patients will be allowed to leave after the completion examination only after the radiologist has reviewed the images. Questionable radiologic findings may need repeat fluoroscopic examination to resolve the issue. Correlation with endoscopic and histopathological findings should be done when feasible.

REFERENCES:

http://www.fmhs.auckland.ac.nz/soph/centres/goodfellow/cpe/resources/swallow.aspx

http://www.emedicinehealth.com/barium_swallow/article_em.htm#Barium Swallow Introduction

ACR Practice Guidelines for the performance of Barium Swallow in Adults- on line

Freeny,Patrick and Stevenso, Giles, Margulis and Burhenne's Alimentary Tract Radiology 5th edition. Mosby

Sutton, David and Young, Jeremy W.R, A Concise Textbook of Clinical Imaging, 2nd edition, Mosby.

PRACTICE GUIDELINE FOR THE PERFORMANCE OF BARIUM MEAL (UPPER GASTROINTESTINAL EXAMINATION) IN ADULTS

INTRODUCTION

Barium examination of the stomach and duodenum is the primary method of evaluation of the these organs . Radiologic examination of the stomach and esophagus should establish the presence or absence , nature and extent of disease with diagnostic quality study using the minimum radiation dose necessary.

INDICATIONS AND CONTRAINDICATIONS

Indications:

Dyspepsia
Unexplained weight loss
Abdominal masses
Upper GI tract hemorrhage or iron deficiency anaemia
Assessment of perforation and or post surgery
Gastrointestinal reflux

Contraindications:

Large bowel obstruction
Immediate or impending gastric/abdominal surgery

SPECIFICATION OF THE EXAMINATION

The request form must specifically indicate a request for a Barium Meal study for the patient. Adequate clinical details and history should also be indicated. The request for the examination should be from one of the SOPD clinics or GP's

A.Patient Preparation

Check patient identification
Check for pregnancy .State if female
Patient must be fasted for 6 hours with a minimum of 2 hours
The procedure should be explained to the patient prior to the examination
The patient must sign a consent form for the examination
Check sensitivity to drugs used.

B. Examination preliminaries

Medical history should be taken
Appropriate laboratory results and other examinations must be reviewed prior to the examination

C. Examination Technique

A plain abdominal x-ray is taken as the initial film

Technique

The patient takes the gas producing agent and is requested not to burp.
The patient is then takes the barium mixture.
The patient is made to roll to 2 full turns counterclockwise so that barium can coat the stomach
Then a series of fluoroscopically guided films is taken in a variety of positions to demonstrate the stomach, duodenal cap and first part of duodenum.

Typical Film Series

Position	Demonstrates
Supine RAO	Antrum and greater curve
Supine	Antrum and body
Supine LAO	Lesser curve
Supine Left Lateral	Fundus
Prone	Duodenal loop
Prone,RAO,Supine,LAO Erect RAO, LAO	Duodenal Cap series
Erect	Fundus
Erect Chest AP, LAO , RAO	Esophagus
Supine Abdomen AP	Stomach and small intestines

DOCUMENTATION

The report should indicate if it's a single or double contrast study. The amount of contrast must be given. The study of the stomach should indicate abnormalities in the mucosal outline, presence of mass lesions , ulcerations, distensibility or , gastro-esophageal reflux . The duodenum is reviewed for its mucosal outline, shape and presence or mass lesions or ulcerations.

EQUIPMENT SPECIFICATIONS

The examination should be performed with fluoroscopic and radiographic equipment meeting OHS standards.
Additional equipment such as oxygen gas and suction should be ready on standby should the need arises.
Radiation protection accessories such as gloves, goggles, aprons, badge thyroid collars etc. should be on hand and ready for use.

RADIATION SAFETY IN IMAGING

In all radiographic examinations the ALARA /ALARP principle should always be applied to the radiographer and to the patient.

AFTER CARE OF PATIENTS AND EXAMINATION REVIEW

Patients will be allowed to leave after the completion examination only after the radiologist has reviewed the images. Questionable radiologic findings may need repeat fluoroscopic examination to resolve the issue. Correlation with endoscopic and histopathological findings should be done when feasible

REFERENCES:

http://www.e-radiography.net/technique/git/bameal.htm

ACR Practice Guidelines for the performance of Barium Meal Examination in Adults- on line

Freeny ,Patrick and Stevenso, Giles, Margulis and Burhenne's Alimentary Tract Radiology 5th edition. Mosby

Sutton, David and Young, Jeremy W.R, A Concise Textbook of Clinical Imaging, 2nd edition, Mosby

PRACTICE GUIDELINE FOR THE PERFORMANCE OF SMALL BOWEL SERIES IN ADULTS

INTRODUCTION

A **small bowel follow-through**, also called **small bowel series**, is a radiologic examination of the small intestine from the distal duodenum/duodenojejunal junction to the ileocecal valve (1). The radiologic examination of the small bowel should establish the presence or absence , nature and extent of disease with diagnostic quality study using the minimum radiation dose necessary.

INDICATIONS AND CONTRAINDICATIONS

Indications:

Negative upper endoscopy and negative lower endoscopy
Investigation of a small bowel abnormality found on other medical imaging

Specific Indications:

Suspected small bowel neoplasm, e.g. small bowel cancer
Hematochezia
Positive fecal occult blood test
Suspected small bowel obstruction that has been managed conservatively
Inflammatory bowel disease (Crohn's disease)

SPECIFICATION OF THE EXAMINATION

The request form must specifically indicate a request for a Small Bowel Series study for the patient. Adequate clinical details and history should also be indicated. The request for the examination should be from one of the SOPD clinics or GP's

A. Patient Preparation

Check patient identification
Check pregnancy state if female
Patient must be fasted for 6 hours with a minimum of 2 hours
The procedure should be explained to the patient prior to the examination
The patient must sign a consent form for the examination
General psychological preparation and examination outline.
Check sensitivity to drugs used.

B. Examination preliminaries

Medical history should be taken. Appropriate laboratory results and other examinations must be reviewed prior to the examination

C. Examination Technique

The attending physician and radiographer should tailor the small bowel examination to the individual patient as warranted by clinical circumstances and condition of the patient to produce a diagnostic quality examination. (2)

Technique

The patient is given a 1 to 2 glasses of barium solution and lies down supine on the table**.**

Typical Film Series:

Intermittent films AP abdominal films are taken after 10 to 15 minutes intervals to visualize the movement of the barium through the small intestines. The procedure is terminated once the contrast reaches the ileo-ceacal valve and colon.
Fluroscopy with compression of all accessible bowel loops including the terminal ileum with appropriate images to demonstrate pathology

Documentation:

The report should indicate the amount of contrast used and a comment on the intestinal transit time should be made. The mucosal outlines are evaluated and masses demonstrated must be described as to size, location and effect on the surrounding tissues

EQUIPMENT SPECIFICATIONS

The examination should be performed with fluoroscopic and radiographic equipment meeting OHS standards.
Additional equipment such as oxygen gas and suction should be ready on standby should the need arises.
Radiation protection accessories such as gloves goggles, aprons, badge thyroid collars etc. should be on hand and ready for use.

RADIATION SAFETY IN IMAGING

In all radiographic examinations the ALARA /ALARP principle should always be applied to the radiographer and to the patient.

AFTER CARE OF PATIENTS AND EXAMINATION REVIEW

Patients will be allowed to leave after the completion of the examination only after the radiologist has reviewed the images. Questionable radiologic findings may need repeat fluoroscopic examination to resolve the issue. Correlation with endoscopic and histopathological findings should be done when feasible.

REFERENCES:

http://en.wikipedia.org/wiki/Small_bowel_follow-through

ACR Practice Guidelines for the performance of Barium Small Bowel Examination in Adults- on line

Freeny ,Patrick and Stevenso, Giles, Margulis and Burhenne's Alimentary Tract Radiology 5th edition. Mosby

Sutton, David and Young, Jeremy W.R, A Concise Textbook of Clinical Imaging, 2nd edition, Mosby

PRACTICE GUIDELINE FOR THE PERFORMANCE OF BARIUM ENEMA IN ADULTS

INTRODUCTION

A barium enema (or BE), also known as a lower GI (gastrointestinal) series, is a radiographic exam used to view the **large intestine**. The purpose of a barium enema is to demonstrate the anatomy and morphology of the large intestine. The large intestine frames the abdomen and is divided into six sections. These include the rectum, sigmoid colon, descending colon, transverse colon, ascending colon, and cecum. The radiologic examination of the large intestine should establish the presence or absence , nature and extent of disease with diagnostic quality study using the minimum radiation dose necessary.

INDICATIONS AND CONTRAINDICATIONS

The indications for barium enema examination include, but are not limited to the following:

Ulcerative colitis - ulcerations and inflammation of the large intestine
Crohn's disease - ulcerations and inflammation occurring in any part of the GI tract (mouth to anus)
Infection or inflammation, such as diverticulitis (inflammation of pouches of the colon wall)
Obstructions and polyps (growths)
Cancer
Unusual bloating or lower abdominal pain
Changes in bowel movements, such as chronic diarrhea or constipation, or passing of blood, mucus, and/or pus

Contraindications:

Suspected bowel perforation
Severe ulcerative colitis
Pregnancy
Toxic megacolon
Acute abdominal pain

SPECIFICATION OF THE EXAMINATION

The request form must specifically indicate a request for a Barium Enema study for the patient. Adequate clinical details and history should also be indicated. The request for the examination should be from one of the SOPD clinics or GP's

A. Patient Preparation

Check patient identification
Check pregnancy status if female
Patient must be fasted for 6 hours.
A two-day bowel preparation with low residue diet and laxatives is done prior to the examination
The procedure should be explained to the patient prior to the examination
The patient must sign a consent form for the examination
General psychological preparation and examination outline.
Check sensitivity to drugs used.

B. Examination preliminaries

Medical history should be taken
Appropriate laboratory results and other examinations must be reviewed prior to the examination

C. Examination Technique

A plain abdominal x-ray is taken as the initial film

Technique

Single Contrast Study

In a single-contrast study the colon is filled with barium, which outlines the colon and a series of x-rays are taken to demonstrate the entire colon

In a Single Contrast Study the patient is positioned on the examination table and an x-ray film is taken to ensure the bowel is clean. The radiologist or technologist will then insert a small tube into the rectum and begin to instill, using gravity, a mixture of barium and water into the colon. A series of x-rays are taken as the barium flows from the rectum to the cecum. When the entire colon is coated, an AP abdominal film is taken.

Double Contrast Study

In a Double Contrast Study the patient is positioned on the examination table and an x-ray film is taken to ensure the bowel is clean. The radiologist or technologist will then insert a small tube into the rectum and begin to instill, using gravity, a mixture of barium and water into the colon. A series of x-rays are taken as the barium flows from the rectum to the cecum. When the entire colon is coated, an AP abdominal film is taken then the barium the barium solution is evacuated. Air is pumped through the tube to distend the colon. Serial x-rays are then taken to demonstrate the rectum, sigmoid, descending, transverse and ascending colon and the cecum. All views should demonstrate the colonic loops barium coated, unfolded and air –filled.

Typical Film Series

Rectum	Lateral view
Sigmoid	AP View
Descending	AP, RAO
Transverse	AP , RAO, LAO
Ascending	AP, LAO
Cecum	AP , RAO
Rectum	Translateral views
Sigmoid	Prone- caudal View
Entire colon	Right and left lateral decubitus views

DOCUMENTATION

The report should indicate if it is a single or double contrast studies. The extent of the colon demonstrated. A comment of the distensibility of the colon is made. Lesions such as masses, annular narrowing or mucosal irregularities are also described. Any limitations of the radiologic examination should be described and additional studies should be suggested when appropriate.

EQUIPMENT SPECIFICATIONS

The examination should be performed with fluoroscopic and radiographic equipment meeting OHS standards.
Additional equipment such as oxygen gas and suction should be ready on standby should the need arises. Radiation protection accessories such as gloves goggles, aprons, badge thyroid collars etc. should be on hand and ready for use.

RADIATION SAFETY AND IMAGING

In all radiographic examinations the ALARA /ALARP principle should always be applied to the radiographer and to the patient.

PATIENT AFTER CARE AND EXAMINATION REVIEW

Patients will be allowed to leave after the completion examination only after the radiologist has reviewed the images. Questionable radiologic findings may need repeat fluoroscopic examination to resolve the issue. Correlation with endoscopic and histopathological findings should be done when feasible.

REFERENCES:

http://www.enotes.com/nursing-encyclopedia/barium-enema

http://www.webmd.com/digestive-disorders/barium-enema

http://www.docboard.org/me/rules/allch095.htm

Freeny ,Patrick and Stevenso, Giles, Margulis and Burhenne's Alimentary Tract Radiology 5th edition. Mosby

Sutton, David and Young, Jeremy W.R, A Concise Textbook of Clinical Imaging, 2nd edition, Mosby

PRACTICE GUIDELINES FOR THE PERFORMANCE OF EXCRETORY UROGRAPHY (IVU)

INTRODUCTION

The guideline has been developed to assist physicians supervising the peroformance or interpretation of excretory urography imaging test that can provide information about the kidneys and urinary tract. It is not possible to detect all abnormalities using EU.

Excretory urography is particularly helpful in visualizing the collecting system and ureters and in evaluating ureteral obstruction, compression, or displacement. In certain circumstances, such as during pregnancy, a limited excretory urogram can be tailored to provide diagnostic information with a lower radiation dose than helical multidetector CT.

DEFINITION

Excretory urography is a radiographic examination of the urinary tract that uses intravenous (IV) iodinated contrast media in conjunction with plain radiographic and possibly tomographic images.

The terms intravenous urography (IVU) and intravenous pyelography (IVP) are used as synonyms for EU. In this guideline, the term “contrast media” refers specifically to water soluble iodinated contrast media that are administered intravenously.

GOAL

The goal of excretory urography is to detect anatomic and physiologic abnormalities of the urinary tract by obtaining a timed series of planar radiographs and when appropriate, tomographic radiographs of the urinary tract.

INDICATIONS, CONTRAINDICATIONS, AND CAUTIONS

A. Indications

1. Evaluation of the presence, or continuing presence, of suspected or known ureteral obstruction.
2. Assessment of the integrity of the urinary tract following trauma or therapeutic interventions, or when cross-sectional imaging is inappropriate or unavailable.
3. Assessment of the urinary tract for suspected congenital anomaly, when thought to be more appropriate than cross-sectional imaging.
4. Assessment of the urinary tract for lesions that may explain hematuria, for infection or abnormalities that may predispose mass, or for possible lesions of the urothelium when cross-sectional examinations using US, CT or MRI are either unavailable or felt to be inappropriate for the clinical circumstance.

B. Contraindications and Cautions

There are reported relative contraindications to the administration of high-osmolality iodinated contrast media (HOCM) in patients with multiple myeloma, sickle cell disease and pheochromocytoma.

Those with impaired renal function may require special medication and hydration regimens.

SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for excretory urography should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

A. Patient Selection and Preparation

- Appropriate history should be obtained.
- Patients should be evaluated for factors predisposing them to anaphylactoid or idiosyncractic reaction, possible renal impairment, or other conditions such as diabetes and dehydration that could increase the chances of an adverse reaction to contrast media.

B. Injection of Iodinated Contrast Media

- After intravenous access is obtained, contrast media is injected.

C. Image Acquisition

1. Preliminary image(s) to check positioning an technique.
2. Postcontrast sequential images, and possibly tomograms, should be obtained to evaluate the kidneys, upper collecting systems, ureters, and urinary bladder. These images should be monitored to provide a study tailored to address the clinical question(s).

RADIATION SAFETY IN IMAGING

Facilities is consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width.

References

1. American College of Radiology. *Manual on Contrast Media*. 2007. Available at http://acr.org/secondarymainmenucategories/quality_safety/contrast_manual.aspx. Accessed June 10, 2008.

2. Cohan RH, Ellis JH, Garner WL. Extravasation of radiographic contrast material: recognition, prevention, and treatment. *Radiology* 1996;200:593-604.

PRACTICE GUIDELINE FOR THE PERFORMANCE OF ADULT CYSTOGRAPHY AND URETHROGRAPHY

INTRODUCTION

This guideline has been developed to assist radiologists performing cystography and urethrography in adult patients. Properly performed cystography and urethrography are diagnostic radiological imaging tests that can provide information about the urethra, bladder, and occasionally the ureters.

DEFINITION

Cystography and urethrography consist of imaging the bladder and/or urethra before, during and after administration of contrast via urethral or cystostomy catheter. Alternative terms for these studies include cystourethrography, voiding cystourethrography, and retrograde urethrography.

GOAL

The goal of cystography and/or urethrography is to detect the presence or absence of anatomic and/or functional abnormalities of the lower urinary tract by producing a series of diagnostic quality images.

INDICATIONS

Indications for cystography include, but are not limited to, evaluation of:

1. Recurrent urinary tract infections.
2. Vesicoureteral reflux.
3. Baldder contour.
4. Bladder diverticula.
5. Suspected rupture.
6. Fistulae.
7. Integrity of postoperative anastomoses or suture lines.
8. Bladder outlet obstruction.
9. Incontinence.
10. Hematuria.
11. Neoplasia.

Indications for urethrography include, but are not limited to, evaluation of:

1. Urethral diverticula.
2. Urethral strictures
3. Bladder outlet or urethral obstruction.
4. Trauma.
5. Recurrent urinary tract infection.

SPECIFIC OF THE EXAMINATION

The written or electronic request for a cystography and/or urethrography examination should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

A. Appropriate history

B. If a urinary catheter is not in place, the urethra or bladder should be catheterized using aseptic technique. An appropriate volume of contrast should be administered to demonstrate the anatomic structures of interest. The examination should be tailored to the needs of the individual patient. Fluoroscopy can optimize diagnostic yield, especially during voiding studies. Clinical judgement should guide decisions about contrast quantity and use of infusion or injection technique.

C. Appropriate images should be produced to demonstrate normal and abnormal findings with the minimum radiation dose necessary to achieve an optimal study.

RADIATION SAFETY IN IMAGING

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width.

References

1. Amis ES Jr, Blaivs JG. The role of the radiologist in evaluating voiding dysfunction. *Radiology* 1190;175:317-318.

2. Barbaric ZL. Autonomic dysreflexia in patients with spinal cord lesions: complication of voiding cystourethrography and ileal loopography. *AJR* 1976;127:293-295.

PRACTICE GUIDELINE FOR THE PERFORMANCE OF VOIDING CYSTOURETHROGRAPHY IN CHILDREN

INTRODUCTION

Voiding cystourethrography is a radiographic and fluoroscopic study of the lower urinary tract. It requires aseptic bladder catheterization, instillation of iodinated contrast media, fluoroscopic observation, and recorded images (film, digital, or video) of the opacified structures. The purpose of the examination is to assess the bladder, urethra, postoperative anatomy, and micturation in order to determine the presence or absence of bladder and urethral abnormalities, including vesicoureteral reflux.

INDICATIONS AND CONTRAINDICATIONS

Clinical indications for voiding cystourethrography include, but are not limited to:

- Urinary tract infection.
- Dysuria.
- Dysfunctional voiding.
- Hydronephrosis and/or hydroureter.
- Bladder outlet obstruction.
- Hematuria
- Trauma
- Incontinence.
- Neurogenic dysfunction of the bladder, e.g. spinal dysraphism.
- Congenital anomalies of the genitourinary tract.
- Postoperative evaluation of the urinary tract.

There are no absolute contraindications for voiding cystourethrography. Potential benefits must outweigh the minor risks of the procedure.

SPECIFICATIONS OF EXAMINATION

A. Patient Selection and Preparation

The study should be performed only for an appropriate clinical indication.

B. Technique

Sedation is typically not required for voiding cystourethrography. When available, child-life specialists may be useful to facilitate catheterization and the remainder of the examination through use of education, distraction, and relaxation techniques. In circumstances when sedation may be clinically indicated, the child must be monitored during and following the examination, using current guidelines.

If a recent abdominal image is not available, a preliminary abdominal radiograph fluoroscopic image capture, or digitally acquired spot image may be obtained before instilling contrast media in order to detect opaque calculi or other calcifications and to evaluate anatomy such as skeletal anomalies. Selective use of a lateral image may be useful to evaluate the sacrum if there is a concern for sacral anomalies. A digitally acquired spot image or radiograph may be preferable to fluoroscopic image capture in specific clinical situations needing superior spatial resolution.

In Males

- To diminish sensation or pain, aseptic retrograde instillation of a topical anesthetic into the urethral may be performed.
- The catheter size should be appropriate for the child's age or urethral caliber.
- Catheters without balloons are preferred.
- In premature or extremely small infants, a 5-French catheter is preferred.
- Above this age, an 8-French catheter is preferred, unless a smaller catheter is appropriate for the urethral anatomy, such as urethral stricture, or if there is inability to catheterize with a larger catheter.
- A catheter larger that 8-French may be used in adolescents.
- One should avoid placing loops of catheter in the bladder because they could become knotted, possibly requiring invasive retrieval.
- In patients with phimosis, the foreskin should not be completely retracted for catheterization.

In Females

- The catheter may be secured with tape to the adjacent thigh or perineum.
- In boys, a strip of tape may be placed on the catheter extending longitudinally along the dorsum of the penis to the symphysis.
- Circumferential placement of tape around the penis is discouraged.
- After the catheter placement, the bladder should be drained prior to instillation of contrast media, and s sterile urine specimen should be retained for culture if clinically indicated.
- Patient positioning for each part of the examination is important.
- Oblique views of the right and left sides of the full bladder should be obtained to profile each ureterovesical junction.
- When vesicoureteral reflux occurs, the degree of reflux should be documented by imaging the renal fossae in the frontal projection.
- The entire urethra should be demonstrated during the voiding phase.
- Males should be positioned obliquely during voiding, without superimposition of the hips.
- In most young children, the entire urethra will be visible on a single voiding image.
- In adolescent boys, separate images of the posterior and anterior urethra may be necessary.
- Images without the catheter are preferable, but pertinent pathology may be demonstrated with the catheter in place.
- The female urethra is generally imaged in the frontal projection, and catheter removal is not necessary.
- In older males, initiation of voiding may be easier with the fluoroscopic table tilted to 30 to 45 degrees or with the patient standing.

Assessment of the study should include the following:

- Presence or absence of reflux.
- Grade of reflux and at what point in the examination it occurred.
- Intrarenal reflux should be noted, if present.
- Appearance of the entire urethra.
- Site of insertion of ureter(s) when visualized by reflux.
- Bladder contour, location, capapcity, and residual volume.
- Bladder lumen and filling defects, such as ureteroceles, clot, or other masses.
- Appearance of the spine and pelvic bones.
- Presence or absence of opaque calculi, calcifications, or other foreign bodies.
- Presence or absence of extravasation or evidence of fistula.

RADIATION SAFETY IN IMAGING

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width.

ACKNOWLEDGMENTS

ACR

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Suggested Reading

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Urine culture from bag specimens in young children:Are the risks too high? J Pediatr 2000;137:221-226.

2. Bisset GS 3rd, Strife JL, Dunbar JS. Urography and voiding cystourethrography: findings in girls with urinary tract infection. AJR 1987;479-482.

3. Blickman JG, Taylor GA, Lebowitz RL. Voiding cystourethrography: the initial radiologic study in children with urinary tract infection. Radiology 1985;156:659-662.

4. Cleveland RH, Constantinou C, Blickman JG, Jaramillo D. Webstaer E. Voiding cystourethrography in children: value of digital fluoroscopy in reducing radiation dose. AJR 1992;158:137-142.

5. Connollu LP, Treves ST, Connolly SA, et al.
Vesicoureteral reflux in children: Incidence and severity in sibilings. J Urol 1997;157:2287-2290.

6. DiPietro MA, Blane CE, Zerin JM. Vesicoureteral reflux in older children: concordance of ultrasound and voiding cystourethrographic findings. Radiology 1997;205:821-822.

7. Ditchfiled MR, Grattan-Smith JD, de Campo JF, HutsoJM. Voiding cystourethrography in boys: does the presence of the catheter obscure the diagnosis of posterior urethral valves? AJR 1995;164:1233-1235.

PROFESSIONAL AND CLINICAL STANDARDS TO FOLLOW IN PERFORMING ULTRASOUND PROCEDURES

- Dress appropriately and always wear a personal identification badge.
- Introduce yourself to patients; put them at ease and make them comfortable as possible.
- Practice courteous and respectful interaction with patients and staff.
- Conversations with patients should be proper and professional. Never talk about sonographic findings or give a patient your opinion of the study results. **Only sonologists/radiologists can legally render a diagnosis.**
- Check identity of patients against patient folders, National Health Number (NHN); always make sure you have the correct patient.
- Briefly explain the examination to the patient.
- Instruct the patient in a slow, clear, and appropriate manner.
- When required, assist the patient in dressing in a gown.
- Assist the patient onto the examination table. Drape the patient properly for the exam and make sure he or she is as comfortable as possible.
- Be familiar with sterile procedure.
- Be familiar with ioslation policies.
- Be familiar with procedures to assist sonologists/radiologists or clinicians with special studies.
- Transabdominal pelvic studies require the patient to have a full bladder to better delineate pelvic structures. This can cause patient discomfort; therefore every effort should be made to perform the study as quickly as possible.

DESCRIBING SONOGRAPHIC FINDINGS

- Some institutions require sonographers to fill out a data sheet and also include a technical impression, summary or observation immediately following a study. Written documentation becomes part of the medical records. For this reason, sonographer's technical observation should be documented in a way as not to be legally compromising. **By virtue of education, training, and legal parameters, sonologists/radiologists exclusively render diagnoses.**
- Writing or describing technical observations requires restraint and the careful selection of appropriate terminology.
- Abnormal findings should be described according to location, size, composition, number, and any complications associated with adjacent structures.
- If a sonographer fails to note an abnormality in their technical observation but demonstrates the abnormality on the images, he or she has performed within the legal guidelines of the scope of the practice for diagnostic medical sonographers.

PROPER USE OF ULTRASOUND EQUIPMENT / ERGONOMICS

- Utilize proper body mechanics when moving patients, ultrasound equipment, stretchers and wheelchairs.
- Adjust equipment to user size and have any accessories on hand prior to scanning.
- Maintain good body posture.
- Chairs should be height adjustable and include and adjustable lumbar support to encourage an upright posture.
- Chairs should swivel, allowing easy rotation from patient to machine without affecting body alignment.
- Tables should have an access from all sides and be height adjustable as much as possible.
- Transducer cables should be suitable in length for unrestricted use.

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SCANNING PROTOCOL FOR ABNORMAL FINDINGS

PURPOSE

- Provide a standardized scanning protocol for evaluating and documenting pathology regardless of the type.
- Provide criteria for evaluating and documenting abnormal sonographic findings.
- Support the legal premises that **only radiologists/sonologists can give a diagnostic interpretation** of an ultrasound study.
- Provide the guidelines for describing abnormal sonographic findings within the legal parameters for sonographers.
- Provide sonographers with the knowledge base necessary to relate pathologic sonographic findings to interpreting physicians in an accurate and professional manner.

CRITERIA FOR EVALUATING ABNORMAL FINDINGS

- All pathology visualized by ultrasound in some way disrupts the normal sonnographic pattern of the organ or structure involved and may alter its shape, size, contour, contour, position, or textural appearance.
- When the normal homogenous texture of organ parenchyma is interrupted by disease, the parenchyma assumes an irregular or heterogenous, pattern. Key findings can be used to help detect parenchymal changes. The changes may be **diffuse** (infiltrative throughout the organ or focal, in a specific area) or **localized** (single or multiple).
- Infiltrative changes suggests diffuse disease that may appear subtle to very obvious depending on the severity and progression of the disease. Sonographers should look for characteristics changes in overall organ echo texture, size, shape, and position, and any associated complications with adjacent structures. Each diffuse disease has its own distinctive criteria that may include all or only some of these characteristics. For focal change in diffuse disease sonographers should look for isolated areas with change in organ echo texture, size, and possible displacement of adjacent structures.
- A localized change in the normal appearance of organ parenchyma represents a mass or multiple masses, which are circumscribed as solid, cystic, or complex according to its composition.
- When determining the origin of pathology it may be helpful to classify disease as intraorgan or extraorgan. **Intraorgan** features to look for are 1) disruption of the normal internal architecture, 2) external bulging of organ capsules, 3) displacement or shift of adjacent structures. **Extraorgan** features include 1) displacement of other organs and structures, 2) obstruction of other organs or structures from view, 3) internal invagination of organ capsules, 4) discontinuity of organ capsules.
- Masses are generally distinctive in appearance and unless very small, readily identified. In some cases, the organ that a mass arises from is obvious; in others it can be difficult to determine the origin. The close proximity of body structures, location, and size of the mass can make usually present the greatest challenge, especially if their size obstructs the organ of origin and complicates adjacent structures.

- Certain disease processes are accompanied by the formation of calculi, which interrupt the normal appearance of an organ. Typically, calculi or "stones" are distinguished by the fact that they reflect and absorb sound waves, creating an echogenic or bright anterior surface and dark to anechoic posterior shadow. These acoustic shadows usually have sharp, well-defined edges.
- Some abnormalities are a result of obstruction due to calculi, disease, or compromise from an adjacent enlarged organ or mass. All of these present sonographically as deviations from the normal appearance and size of the structure(s) they are associated with.
- Abnormalities such as vascular aneurysms are due to a break down or weakening of structure, which present sonographically as deviations from the normal appearance and size.
- There are certain body structures such as lymph nodes,that are generally not appreciated sonographically unless they are abnormal.

CRITERIA FOR DESCRIBING ABNORMAL FINDINGS

- It is not necessary to be familiar with specific diseases and abnormalities to describe them sonographically. A sonographer benefits, however, from having a broader knowledge of specific abnormalities and pathologic processes because they can affect interdependent body systems.
- When diffuse disease is present, organ texture may be described as heterogeneous (random pattern), rough, patchy, or coarse as opposed to smooth. With advanced diffuse disease, the appearance of the parenchyma may also be interrupted with multiple necrotic or blood filled spaces.
- When diffuse disease causes either infiltrative (generalized) or focal areas of enlargement of an organ, the sonographer must determine the extent of increase and describe whether any adjacent structures exhibit associated complications. All or part of a diseased organ may extend far beyond its normal boundaries. This process can displace other organs and structures from their normal positions or block them from view. With some disease processes of the liver, for example, the right lobe shrinks and the left lobe and caudate lobe enlarge. The large caudate lobe can cause pressure on the inferior vena cava, leading to vena caval hypertension, which may contribute to renal failure in some patients. While these findings are typical of liver cirrhosis, an example of how a sonographer should describe the abnormality is :

  "Liver appears heterogeneous with irregular and slightly indented contour. Parenchyma is highly echo-genic with scattered hypo-echoic areas. Intra-hepatic vessels are not well visualized. Right lobe is markedly small. The inferior vena cava appears compressed by the markedly enlarged caudate lobe."

- An example of focal enlargement that affects adjacent structures is focal enlargement of the pancreas head. Pressure from the enlarged head can obstruct or constrict, stenose, or dilate the common bile duct. In some cases, the duodenum becomes obstructed as well. While these findings are consistent with chronic pancreatitis, an example of how a sonogrpaher should describe them is :

  " Pancreas appears heterogenous and hyperechoic. Small, shadowing calcifications throughout, and irregular outline are noted. Head appears focally enlarged: 6 cm anteroposterior. Common bile duct measures 12 mm. The duodenum is not visualized."

- A localized parenchymal change is described as a mass, defined according to composition.
- Localized changes or masses should be described according to origin (or location), size, composition, number, and any associated complications with adjacent structures or body systems :

I.) Origin :

a) Described by the organ, structure, or the site where an abnormality is located.
Example : *…intrahepatic tail mass, just anterior to the left kidney, slightly indenting the abdominal aorta…*

b) In some cases the exact origin of an abnormality cannot be sonographically distinguished so the location or site is described by structures immediately adjacent to the abnormality.
Example : *…the mass is superior to the iliac arteries inferior to the superior mesenteric artery, posterior to the splenic vein and body of the pancreas, and anterior to the aorta.*

II.) Size :

a) Volume measurements **in order** **(L X W X AP = V)** are required for all abnormal findings.
b) Careful placement of measurement calipers at the leading margins of an abnormality provides accurate dimensions.
c) When multiple masses are present and can be differentiated from each other, they should be measured individually.

III.) Composition :

a) Sonography cannot definitely distinguish between malignant and benign masses. However, providing the interpreting physician with ultrasound images of the correct composition of an abnormality can help to increase the percentage of correct diagnoses made prior to biopsies or surgery.
b) Composition is resolved by evaluating an abnormality at high- and low-gain technical settings. This technical range should demonstrate any variations in echodensities.
c) Masses have the following classic sonographic presentations :

(1) Solid Masses :

- Although there are numerous varieties of solid masses or neoplasms, they are all composed of one thing, tissue. A solid mass is visualized sonographically as echogenic shades of gray that represent its internal composition. The level of echogenicity and appearance of tissue texture depend on what type of localized disease is present, the degree of its echogenicity, and its effect on internal architecture.
- The sonographic appearance of solid masses is variable. They can appear isosonic to the organ parenchyma they are part of, distinguishable only by its walls or they can appear anechoic, homogenous, or heterogeneous with low, moderate, or highly reflective echo textures.
- Vascular, interstitial, and collagen components, and the presence of any necrosis can influence the appearance of solid or soft tissue masses.
- In some cases, the walls amy be poorly defined and the contour can appear irregular

(2) Cystic Masses :

- To be considered a true cyst, the mass in question must meet three sonographic criteria :
  (a) The first criterion is that it contains no internal echoes; it must appear anechoic. In some cases, it is normal to visualize "cystic noise' or low level echoes near the anterior wall of the mass, however, echoes never occur in the posterior postion of a true cyst.
  (b) The second criterion is that the ealls of the cyst must be well-defined, thin, and smooth.
  (c) The final criteria is not met, the mass is not a true cyst. A mass that meets one or more of these criteria is daid to be cystic in nature.
- If one of the three criteria is not met, the mass is not a true cust. A mass that meets one or more of theses criteria is said to be cystic in nature.
- Some cystic masses contain single or multiple septations; thin, bright, membranous inclusions.

(3) Complex Masses :

- A mass containing fluid or solid components is said to be complex. Complex masses may be primarily cystic or primarily solid.
- Wall appearance of a complex mass is variable, from well-defined and smooth to poorly defined and irregular.
- The internal composition of a mass may change with time. An example is a solid mass, which generates over time. This process usually means that the solid mass begins to liquefy and thereby assume a complex appearance.

Note : Normal lymph nodes are structures that usually cannot be visualized sonographically. If detected, they measure less than 2 cm in diameter, and appear as multiple anechoic or low-gray masses. Enlarged lymph nodes can be present in the abdomen, pelvis, retroperitoenum (par-aortic, paracaval, and peripancreatic), splenic hilum, and porta hepatic. Wherever they appear, enlarged nodes typically compromise the organ or structure thay are close to. Their conographic characteristics could be describes as :

"Liver appears heterogeneous with multiple, low-gray, 2 cm masses displacing the portal vein anterolaterally."

or

"Multiple homogenous, low-gray masses surrounding and displacing the aorta near the level of the renal arteries. Right ureter was visualized and followed to renal pelvis, which appears enlarged. Dilatation appears to extend into calices. Renal parenchyma appears thinned"

(In this case, external pressure from the mass of lymph nodes obstructed the ureter and caused dilatation of the renal collecting system.)

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LIVER SCANNING PROTOCOL

PURPOSE

- Provide a standardized scanning protocol for evaluating the liver.

SONOGRAPHIC APPEARANCE

- The normal liver can be described as homogenous, with mid-gray to moderately echogenic parenchyma. Portions of blood vessels that appear anechoic may be seen scattered throughout liver parenchyma.
- Normal liver parenchyma is generally described as hyperechoic relative to normal renal cortex.
- Hepatic vessels and ducts display anechoic lumens surrounded by variations of bright, echogenic walls.
- Portal and hepatic veins are seen as echo free tubular structures branching throughout the lobes of the liver. To differentiate between the two, follow their branches back toward the porta hepatic or IVC, respectively.
- The ligaments and fissures of the liver appear highly reflective due to the fat and collagen within and around them.

NOTE : It is important to be able to distinguish portal veins from hepatic veins. Some radiographers/sonographers use the difference often noted in the sonographic appearance of their walls. Typically, portal vein walls appear highly echogenic due to the reflective collagen that encases them, while the walls of hepatic veins appear as if they have no distinguishable margins because their walls contain minimal collagen. This however, is not a reliable way to make the distinction between these two vessels because smaller portal vein braches may lack these surrounding echoes and in some cases, bright, reflective walls have been visualized surrounding the larger hepatic vein tributaries. These vessels have different branching patterns as well. Therefore, hepatic vessels must be traced back to their origin, either the main portal vein or the IVC.

NORMAL VARIANTS

- **Riedel's lobe :** Inferior extension of the right lobe.
- **Absence of the left lobe :** Very rare. Results from occlusion of the left hepatic vein due to abnormal extension of neonatal spasm of the ligamentum venosum.
- Multiple size and shape variations.

PATIENT PREP

- The patient should fast for 8-12 hours prior to the study. This ensures normal gallbladder and biliary tract dilatation and reduces the stomach and bowel gas anterior to the pancreas. This is significant because the liver, biliary tract, gallbladder, and pancreas are interdependent systems.
- If the patient has eaten, still perform the exam.

TRANSDUCER

- 3.0 MHz or 3.5 MHz.
- 5.0 MHz for very thin patient. It may be necessary to use 5.0 MHz for a patient's left lobe and 3.0 or 3.5 MHz for the right lobe.

BREATHING TECHNIQUE

- Deep, held inspiration.

Note : Different breathing techniques should be used whenever the suggested breathing technique does not produce the desired results.

PATIENT POSITION

- Supine.
- Left posterior oblique, left lateral decubitus, sitting semierect to erect or prone as needed.

Note : Different patient positions should be used whenever the suggested position does not produce the desired results.

REQUIRED IMAGES

Longitudinal Images :

- Left lobe to include its inferior margin and the abdominal aorta.
- Left lobe to include the diaphragm and caudate lobe.
- Right lobe to include the IVC where it passes through the liver.
- Right lobe to include the main lobar fissure, gallbladder, and portal vein.
- Right lobe to include part of the right kidney for parenchymal comparison.
- Right lobe to include the dome and the adjacent pleural space.

Axial Images :

- Left lobe to include its lateral margin.
- Left lobe to include the ligamentum teres. (Depending on liver size and shape, it may be possible to take an axial image that includes the left lobe's lateral margin and the ligamentum teres.)
- Right lobe to include hepatic veins.
- Right lobe to include the right and left branches of the portal vein.
- Right lateral inferior lobe.
- Right lobe to include the dome and the adjacent pleural space.

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GALLBALDDER AND BILIARY TRACT SCANNING PROTOCOL

PURPOSE

- Provide a standardized scanning protocol for evaluating the gallbladder and biliary tract.

SONOGRAPHIC APPEARANCE

- The normal bile-filled gallbladder appears longitudinally as an anechoic, oblong structure with bright, thin walls. Axial sections appear anechoic, round or oval structures with bright thin walls.
- The area where the neck of the gallbladder joins the cystic duct is described as the spiral valve due to its tortuous appearance. This reference is to appearance only because there is no valvular action..
- Bile-filled common duct appears longitudinally as an anechoic tubular structure with bright, thin walls. Axial sections of the duct appear as a small anechoic, round structures with bright, thin walls.

NORMAL VARIANTS

Gallbaldder :

I. Shape Variations :

a) **Segmental Contractions :** These "segments" disappear when the patient

changes position or fasts.

b) **Phyrigian Cap :** The fundus is folded over giving the gallbladder a "capped" appearance.

II. Position Variations :

a) The position and location of the gallbladder is variable because it is suspended by long mesentery.
b) Very rare, deep fossa, intrahepatic gallbladder.

III. Septations :

a) May partially or totally divide the gallbladder.

Biliary Tract :

I. Duplications :

a) Although very rare, the common duct may be partially or completely duplicated.

II. Level Variations :

a) The level of the junction of the cystic duct and common hepatic ducts is variable.

III. Septations :

a) May partially or totally divide the cystic duct, producing various degrees of double gallbladder.

PATIENT PREP

- The patient should fast for 8-12 hours prior to the study. This ensures normal gallbladder and biliary tract dilatation and reduces the amount of bowel gas.
- If the patient has eaten within, still perform the exam.

Note : A nonvisulaized gallbladder is indicative of either gallbladder disease or the patient recently eating. Therefore, it is essential to determine when the patient last ate.

TRANSDUCER

- 3.0 MHz or 3.5 MHz.
- 5.0 MHz for very thin patient.

BREATHING TECHNIQUE

- Deep, held inspiration.

Note : Different breathing techniques should be used whenever the suggested breathing technique does not produce the desired results.

PATIENT POSITION

- The gallbladder and biliary tract study is performed with the patient in two different positions.

- Supine and left lateral decubitus.
- Left posterior oblique, sitting semierect to erect or prone as needed.

Note : Different patient positions should be used whenever the suggested position does not produce the desired results.

REQUIRED IMAGES

GALLBLADDER

- Long axis image of the gallbladder.
- Longitudinal and axial images of the gallbladder fundus and body.
- Longitudinal and axial images of the gallbladder neck.

BILIARY TRACT

- Common hepatic duct.
- Common bile duct with anterior to posterior measurement.

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PANCREAS SCANNING PROTOCOL

PURPOSE

- Provide a standardized scanning protocol for evaluating the pancreas.

SONOGRAPHIC APPEARANCE

- The texture of the pancreas is rather coarser than that of the liver. The echogenicity of the normal pancreas alters according to age (Bates 2004).
- In a child or young person it may be quite bulky and relatively hypoechoic when compared to the liver.
- In adulthood, the pancreas is hyperechoic compared to normal liver, becoming increasingly so in elderly, and tending to atrophy.
- The pancreas does not have a capsule and its margins can appear rather ill-defined, becoming infiltrated with fat in later life.
- The main pancreatic duct can be usually be visualized in the body of pancreas, where its walls are perpendicular to the beam.
- The common bile duct can be seen in the lateral portion of the head and the gastroduodenal artery lies anterolaterally. The size of the uncinate process varies.

Note : The age related changes are highly significant to the sonographer; what may be considered normal in an elderly person would be abnormally hyperechoic in a younger one, and may represent a chronic inflammatory state. Conversely a hypoechoic pancreas in an older patient may represent acute inflammation, whereas the appearances would be normal in a young person.

NORMAL VARIANTS

- The size, shape, and lie of the pancreas are normally variable.
- The duct of Santorini is a normal variant accessory duct.

PATIENT PREP

- The patient should fast for 8-12 hours prior to the study. This reduces the amount of stomach and bowel gas anterior to the pancreas and ensures normal gallbladder and biliary tract dilatation, which is significant because the pancreas and biliary tract are interdependent systems. It has been recommended by experienced ultrasound practitioners that when scanning the abdomen, pancreas may be studied first before the stomach is filled with gas obscuring the view for pancreatic survey.
- It the patient has eaten still attempt the examination because in some cases, stomach content can displace gas and serve as a "window" for the sound beam. Also, for this reason, the patient can be given 2 to 4 cups of water or non-carbonated drink to provide a sonic window and displace any gas in the stomach that may be obscuring the view of the pancreas. In most cases, this fluid technique works best if the patient is sitting erect.

Note : When using a fluid technique, peristalsis can cause the fluid to pass very quickly through the stomach and duodenum not allowing enough time to fully evaluate the area of interest. Therefore, peristaltic-reducing drugs can be administered to patient to slow peristaltic action down.

TRANSDUCER

- 3.0 MHz or 3.5 MHz.
- 5.0 MHz for very thin patient.

BREATHING TECHNIQUE

- Deep, held inspiration.

Note : Different breathing techniques should be used whenever the suggested breathing technique does not produce the desired results.

PATIENT POSITION

- Supine.
- Sitting semi-erect to erect, left posterior oblique, left lateral decubitus, or prone as needed.

Note : Different patient positions should be used whenever the suggested position does not produce the desired results.

REQUIRED IMAGES

Longitudinal Images :

- Long axis image of the pancreas to include as much head, uncinate, body, tail, and pancreatic duct a possible.
- Pancreatic body and neck to include the splenic vein.
- Pancreatic head to include the uncinate process and common bile duct (if bile-filled).

Axial Images :

- Pancreatic head to include the common bile duct (if bile-filled).
- Pancreatic neck and uncinate process to include the superior mesenteric vein.
- Pancreatic body to include the splenic vein.
- Pancreatic tail.

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Reference :

Bates, JA 2004, How, Why and When – Abdominal Ultrasound 2nd ed, Churchill Livingstone, An imprint of Elsevier Limited,China, pp. 135.

Tempkin, B.B. 2009, Ultrasound Scanning : Principles and Protocols, Saunders, an imprint of Elsevier Inc., St. Louis, Missouri, pp. 129-150.

SPLEEN SCANNING PROTOCOL

PURPOSE

- Provide a standardized scanning protocol for evaluating the spleen.

SONOGRAPHIC APPEARANCE

- The parenchyma of the spleen is homogenous, with medium-level echoes and even texture that is described as isosonic or hypoechoic when compared to the normal liver.
- Outer contour is smooth with posterior location of the reflective diaphragm.
- In some cases, small vascular branches can be seen interspersed within the splee. They appear as anechoic, round or tubular structures. Arterial walls usually appear brighter than venous walls, however, the larger venous structures can clearly be distinguished from the smaller arterial branches at the level of the splenic hilum.
- Spleen appears hyperechoic relative to the renal cortex of the left kidney.

NORMAL VARIANTS

- **Accessory Spleen :**

a) Splenic tissue found separate from the organ; most often at the splenic hilum.
b) Sonographic appearance is the same as normal splenic tissue.

- **Asplenia :**

a) Rare absence of the spleen often associated with congestive heart disease.

PATIENT PREP

- None.

TRANSDUCER

- 5 MHz for intercostals or lateral subcostal scanning approaches.
- 3.0 or 3.5 5.0 MHz for anterior or posterior scanning approaches.

BREATHING TECHNIQUE

- Deep, held inspiration.

Note : Different breathing techniques should be used whenever the suggested breathing technique does not produce the desired results.

PATIENT POSITION

- Right lateral decubitus.
- Supine, sitting semi-erect to erect, and prone as needed.

Note : Different patient positions should be used whenever the suggested position does not produce the desired results.

REQUIRED IMAGES

Longitudinal Images :

- Long axis image of the spleen.
- Superior longitudinal image of the spleen to include the adjacent pleural space.
- Inferior longitudinal image of the spleen to include part of the left kidney for parenchymal comparison.

Axial Images :

- Spleen to include both anterior and posterior margins.
- Spleen to include the anterior margin and splenic hilum.
- Spleen to include posterior margin.

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RENAL SCANNING PROTOCOL

PURPOSE

- Provide a standardized scanning protocol for evaluating the kidneys.

SONOGRAPHIC APPEARANCE

- The renal cortex appears homogenous, with midgray or medium to low-level echoes that are hyperechoic relative to the normal liver.
- The medullary pyramids are visualized only when they contain urine. They appear anechoic or hypoechoic relative to the renal cortex depending on the amount of urine they contain.
- Normal kidneys have smooth contour with bright renal capsule.
- Renal sinus appears highly reflective with variable contour because of the fat it contains.
- The infundibula and renal pelvis are not seen if collapsed; otherwise, they are urine filled and appear anechoic.
- Ureters are not normally seen.

NORMAL VARIANTS

I. Dromedary Humps :

a) Cortical bulge(s) on the lateral border of the kidney that appear the same as normal renal cortex.

II. Hypertrophied Column of Bertini :

a) Enlarged columns of renal cortex that vary in size and indent the renal sinus.
b) They appear the same as normal renal cortex.

III. Double Collecting System :

a) The renal sinus is divided by a hypertrophied column of Bertini.
b) The appearance is the same as normal renal cortex and two normal renal sinuses.

IV. Horshoe Kidney :

a) The kidneys are connected, usually at the lower poles.
b) Except for their connection, the kidneys appear otherwise normal.

V. Renal Ectopia :

a) One or both kidneys may be found outside the normal renal fossa.
b) Other locations include the lower portion of the abdominal or pelvic cavities and in rare cases they may be found in the intrathoracic area. Except for the location, the kidney(s) appears otherwise normal.

PATIENT PREP

- None.

TRANSDUCER

- 3.0 MHz or 3.5 MHz.
- 5.0 MHz for very thin patient.

BREATHING TECHNIQUE

- Deep, held inspiration.

Note : Different breathing techniques should be used whenever the suggested breathing technique does not produce the desired results.

PATIENT POSITION

Right Kidney

- Supine.
- Left posterior oblique, left lateral decubitus, and prone as needed.

Left Kidney

- Right lateral decubitus.
- Prone as needed.

Note : Different patient positions should be used whenever the suggested position does not produce the desired results.

REQUIRED IMAGES

RIGHT KIDNEY

Longitudinal Images :

- Long axis image of the right kidney with superior to inferior measurement.
- Right kidney superior pole.
- Right kidney inferior pole.
- Right kidney just medial to the long axis.
- Right kidney just lateral to the long axis to include part of the liver for parenchyma comparison.

Axial Images :

- Right kidney superior pole.
- Right kidney midportion to include the hilum with anterior to posterior measurement.
- Right kidney inferior pole.

LEFT KIDNEY

Longitudinal Images :

- Long axis image of the left kidney with superior to inferior measurement.
- Left kidney superior pole.
- Left kidney inferior pole.
- Left kidney just anterior to the long axis.
- Left kidney just posterior to the long axis.

Axial Images :

- Left kidney superior pole.
- Left kidney mid-portion to include the hilum with anterior to posterior measurement.
- Left kidney inferior pole.

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Scope and Application	This CPG is intended for use by all health care workers in their daily care of patients who undergo radiological procedures
Effective Date	2010
Supercedes Policy Number	Not applicable
Review Responsibilities	The Chairperson of the Radiology CSN will initiate the review of this guidelines every 3 years from the date of issue or as required.
Further Information	Radiology CSN Chairperson

RESPONSIBILITY:

CPG Owner: National Radiology CSN

CPG Writer: Ministry of Health **Date: 2010**

Endorsed:

National Medicines & Therapeutic Committee, MOH

Date: 23 November 2010

Endorsed:

National Health Executive Committee, MOH

Date: 25 November 2010