



Core Curriculum in Emergency Radiology

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I. Objective

To define the content structure and study plan for the instruction of Radiology Residents rotating through Emergency Radiology rotations, and for Fellows in Emergency Radiology, during their Emergency Radiology Fellowship year.

II Curriculum and Recommendations for Study

A. Central Nervous System: James M. Provenzale, MD

- 1 Skull fractures
 2. Extra-axial hemorrhages
 - a. subdural hematoma
 - b. epidural hematoma
 3. Parenchymal injuries
 - a. cortical contusion
 - b. diffuse axonal injury
 - c. deep gray matter injury
 - d. brainstem injury
- 2 Subarachnoid hemorrhage
- 3 Vascular injuries
- 4 Penetrating injuries
- 5 Herniation syndromes
8. Cerebral infarction
 - a. arterial infarction
 - b. venous infarction
 - c. diffusion imaging appearance
 - d. perfusion imaging appearance
9. Non-traumatic hemorrhage
 - a. subarachnoid hemorrhage
 - b. parenchymal hemorrhage
10. Central Nervous system infections
 - a. meningitis
 - b. encephalitis
 - c. abscess/cerebritis
 - d. subdural empyema
 - e. spinal epidural abscess
 - f. osteomyelitis/discitis
- 6 Dural sinus thrombosis
- 7 Reversible posterior leukoencephalopathy syndrome
- 8 Pituitary apoplexy
14. Spinal trauma
 - a. spinal cord contusion
 - b. spinal epidural hematoma
 - c. nerve root avulsion

Suggested Readings:

Cerebral Infarction

Sorensen AG, Bounanno FS, Gonzalez RG, et al. Hyperacute stroke: evaluation with combined multisection diffusion-weighted and hemodynamically weighted echo planar MR imaging. *Radiology* 1996; 199:391-401

Truwit CL, Barkovich AJ, Gean-Marton A, Hibri , Norman D. Loss of the insular ribbon: another early CT sign of acute middle cerebral artery infarction. *Radiology* 1990; 176: 801-806

Tomsick TA, Brott TG, Chambers AA, et al. Hyperdense middle cerebral artery sign on CT: efficacy in detecting middle cerebral artery thrombosis. *AJNR* 1990; 11: 473-477

Elster AD, Moody DM. Early cerebral infarction: Gadopentate dimeglumine enhancement. *Radiology* 1990; 177: 627-632

Provenzale JM, Sorensen AG. Diffusion-weighted MR imaging in acute stroke: Theoretical considerations and clinical applications. *AJR* 1999; 173:1459-1468

Carotid and Vertebral Artery Dissection

Levy C, Laissy JP, Raveau V, et al. Carotid and vertebral artery dissections: Three-dimensional time-of-flight MR angiography and MR imaging versus conventional angiography. *Radiology* 1994; 190:97-103

Leclerc X, Godefroy O, Salhi A, Lucas C, Leys D, Pruvo JP. Helical CT for the diagnosis of extracranial carotid artery dissection. *Stroke* 1996; 27:461-466

Provenzale JM. Dissection of the internal carotid and vertebral arteries: Imaging findings. *AJR* 1995; 165:1099-1104

Intracranial Hemorrhage

Weisberg LA. Subcortical lobar intracerebral hemorrhage: clinical-computed tomographic correlations. *J Neurol Neurosurg Psychiatry* 1985; 48:1078

Kase CS, Caplan LR (eds). *Intracerebral hemorrhage*. Butterworth-Heinemann, Boston, 1994

Meyer JT, Gorey MT. Differential diagnosis of nontraumatic intracranial hemorrhage. *Neuroimaging Clin North Am* 1998;8:263-293 Dural Sinus

Thrombosis

Zimmerman RD, Ernst RJ. Neuroimaging of cerebral venous thrombosis. Neuroimaging

Clin North Am 1992;2:463-485 Virapongse C, Cazenave C, Quisling R, Sarwar M,

Hunter S. The empty delta sign:

Frequency and significance in 76 cases of dural sinus thrombosis. Radiology

1987;162:779-785

Casey SO, Alberico RA, Patel M, et al. Cerebral CT venography. Radiology

1996;198:163-170

Provenzale JM, Joseph GJ, Barboriak DP. Dural sinus thrombosis: findings on CT and MR imaging and diagnostic pitfalls. AJR 1998;170:777-783

Reversible Posterior Leukoencephalopathy Syndrome (Hypertensive Encephalopathy)

Hinchey J, Chaves C, Appignani B, et al. A reversible posterior leukoencephalopathy syndrome. N Engl J Med 1996;334:494-500

Schwartz RB, Mulkern RV, Gudbjartsson H, Jolesz F. Diffusion-weighted MR imaging in hypertensive encephalopathy: Clues to pathogenesis. AJNR 1998; 19:859-862

Brain and Spine Trauma Gentry LR, Godersky JC, Thompson B. MR imaging of head

trauma: Review of the distribution and radiopathologic features of traumatic lesions.

AJNR 1988; 9:101-110

Gentry LR. Godersky JC. Thompson B. MR imaging of head trauma: review of the

distribution and radiopathologic features of traumatic lesions. AJR. 150:663-72, 1988

Gentry LR, Godersky JC, Thompson B. Traumatic brainstem injury: MR imaging.

Radiology 1989; 171: 177-187

CNS Infections

Post MJD, Quencer RM, Montalvo BM, et al. Spinal infection: evaluation with MR

imaging and intraoperative US. Radiology 1988;169:765-771 Chang KH, Han MH, Roh

JK, et al. Gd-DTPA-enhanced MR imaging of the brain in

patients with meningitis: comparison with CT. AJNR 11:69-76, 1990

B. Face and Neck: James T. Rhea, MD

1. Facial fractures

a. Orbital fractures

Blow-out fracture

Blow-in fracture

Orbital apex fracture

b. Zygoma fractures

Isolated arch fracture

Zygomatic complex fracture

c. Nasal fractures

d. Naso-orbital-ethmoid fractures

Posteriorly displaced

Telescoped

e. Frontal fractures

f. Maxillary fractures

Dentoalveolar fractures

Maxillary sagittal fractures

LeFort fractures

g. Mandible fractures

2. Soft tissue injuries of the orbit

a. Post bulbar emphysema and hemorrhage

b. Extraocular muscle entrapment

c. Ocular injuries

Rupture

Laceration

Lens dislocation

Vitreous hemorrhage

Subchoroidal hemorrhage

1 Orbital cellulitis

2 Paranasal sinusitis

3 Laryngeal trauma

4 Parotitis and neck abscesses

Suggested Readings:

LeFort, R: E'tude experimentale sur les fractures de la machoire superieure. Rev Chir
23:208-227, 360-379, 479-507, 1901

Rhea JT, Rao PM, Novelline RA, Helical CT and three-dimensional CT of facial and orbital
injury, Radiologic Clinics of North America 37:489-513, 1999

Novelline RA, Head and neck CD-ROM, RSNA, Chicago, 1996 Novelline RA, Rao PM,
Rhea J, Sacknoff R, Lawrason N, CT diagnosis of orbital and ocular trauma, Radiographics

CD-ROM, Neuroradiology teaching atlas, 1996

Lawrason JN, Diagnostic imaging of facial trauma, In: Imaging in trauma and critical care, Mirvis SE, Young JWR, editors, Williams and Wilkins, Baltimore MD, 243-290, 1992

Harris JH, Face, including intraorbital soft tissues; and Castillo M, Acute conditions of the intraorbital soft tissues, In: The Radiology of Emergency Medicine, Harris JH, Harris WH, Novelline RA, editors, Williams and Wilkins, Baltimore MD, 36-119 and 121-126, 1993

Gean AD, Maxillofacial trauma, In: Imaging of head trauma, Gean AD editor, Raven Press, NY NY, 427-495, 1994

Som PM, Curtin HD, Head and neck imaging, Mosby, St. Louis, 1996

C. Spine: Diego Nunez, Jr., MD

Initial assessment issues = "Clearance" in the Emergency Department.

- ◆◆ The evaluation of low-risk patients
- ◆◆ The evaluation of high-risk patients (multitrauma)
- ◆◆ The evaluation in patients with neurologic deficits

Concept and Assessment of Instability Concept: Mechanism of injury, radiographic patterns, normal variants, frequently associated injuries.

1. Cranio-cervical / C1-C2

- a. Occipital condyle fracture
- b. Atlanto-occipital dislocation / subluxation
- c. Jefferson burst fracture
- d. Atlanto-axial rotary fixation
- e. C1 - posterior arch
- f. Dens fracture
- g. Hangman's fracture

2. C3-T1

- a. Anterior subluxation / whiplash syndromes
- b. Hyperextension sprain / spinal cord injury without radiographic abnormalities
- c. Wedge compression, spinous process fractures
- d. Burst compression
- e. Flexion tear drop fracture
- f. Bilateral facet dislocation
- g. Unilateral facet dislocation
- h. Articular mass and transverse process fractures
- i. Traumatic isolation of articular pillar / pedicolumnar separation
- j. Corner Avulsion Fracture (extension teardrop)
- k. Laminar fractures

- l. Facet dislocation with fracture
 - m. Acute ligamentous injuries
3. Thoraco-lumbar spine trauma
- a. Compression fracture
 - b. Burst Fracture
 - c. Chance fracture
 - d. Complex fracture-dislocation
 - e. Pathological fracture
- 1 Traumatic injuries to intervertebral disks
 - 2 Ostoemyelitis /discitis
 - 3 Epidural abscess
 - 4 Disk herniation

Suggested Readings:

Young JWR: Cervical spine trauma. (In) *Imaging in Trauma and Critical Care*, Mirvis SE & Young JWR (eds); Williams & Wilkins; Baltimore, MD; 1992, pp 291-379.

Berquist TH: Spinal trauma. (In) *Trauma Radiology*, McCort JJ & Mindelzun RE (eds); Churchill Livingstone; New York; 1990, pp 31-63(74).

Spine, including soft tissues of the pharynx and neck. (In) *The Radiology of Emergency Medicine*. Harris JH, Harris WH, (eds); Williams & Wilkins, Baltimore; 1999, pp 137-298.

Harris JH: Radiologic diagnosis of traumatic occipitovertebral dissociation: 1. Normal occipitovertebral relationships on lateral radiographs of supine subjects. 2. Comparison of three methods of detecting occipitovertebral relationships on lateral radiographs of supine subjects. *AJR* 1994;162:881-886,887-892

Rogers LF: Fractures of the sacrum. (In) *Radiology of Skeletal Trauma* (2nd Ed), Rogers LF (ed); Churchill Livingstone, New York; 1992, pp 1019-1023

D. Chest: Steven L. Primack, MD

- 1. Chest trauma
 - a. Rib fractures
 - b. Sternal and manubrial fractures
 - c. Hemothorax
 - d. Pneumothorax and pneumomediastinum
 - e. Mediastinal hemorrhage
 - f. Pulmonary contusion, laceration, hematoma
 - g. Tracheobronchial injury
 - h. Esophageal tear
 - i. Diaphragm injury
- 1 Pulmonary embolism
 - 2 Acute pulmonary infections

- 3 Aspiration pneumonia
- 4 Airway foreign bodies
- 5 Obstructive airway disease
- 6 ARDS: near-drowning, fat embolism syndrome
- 7 Esophageal rupture

Suggested Readings:

Penetrating and Nonpenetrating Chest Trauma. (In) *Diagnosis of Diseases of the Chest*, Fourth Edition. Fraser RS, Müller NL, Colman N, Paré PD; W.B. Saunders, Philadelphia; 1999, pp 2611-2657.

Chest. (In) *The Radiology of Emergency Medicine*, Fourth Edition. Harris, JH, Harris, WH; Lippincott, Williams & Wilkens, Philadelphia; 2000, pp 437-581

Chest Trauma. (In) *Imaging of Diseases of the Chest*, Second Edition. Armstrong P, Wilson AG, Dee P, Hanell DM; Mosby, St. Louis; 1995, pp 869-893.

Thrombosis and Thromboembolism. (In) *Diagnosis of Diseases of the Chest*, Fourth Edition. Fraser RS, Müller NL, Colman N, Paré PD; W.B. Saunders, Philadelphia; 1999, pp 1773-1843.

Shanmuganathan K, Mirvis S. Imaging diagnosis of nonaortic thoracic injury. *The Radiologic Clinics of North America* 1999; 37:533-551.

Imaging of Thoracic Trauma. Primack SL, guest editor. *Journal of Thoracic Imaging*, April 2000. (symposium issue) Kuhlman JE, Pozniak MA, Collins J, Knisely BL. Radiographic and CT findings of blunt chest trauma: Aortic injuries and looking beyond them. *RadioGraphics* 1998; 18:1085-1106.

Van Hise ML, Primack SL, Israel RS, Müller NL. CT in blunt chest trauma: indications and limitations. *RadioGraphics* 1998; 18:1071-1084.

Shackleton KL, Stewart ET, Taylor AJ. Traumatic diaphragmatic injuries: spectrum of radiographic findings. *RadioGraphics* 1998; 18:49-59.

Karabulut N, Goldman LR. The role of helical CT in the diagnostic work-up for pulmonary embolism. *Emergency Radiology* 1999; 6:10-16.

Goodman LR, Lipchik RJ, Kuzo RS. Acute pulmonary embolism: the role of computed tomographic imaging. *J Thorac Imaging* 1997; 12:83-86.

Greaves SM, Hart EM, Aberle DR. CT of pulmonary thromboembolism. *Semin Ultrasound CT MR* 1997; 18:323-337.

E. Cardiovascular Emergencies: Stuart Mirvis, MD

1. Myocardium and Pericardium
 - a. Myocardial infarction
 - b. Myocardial laceration
 - c. Myocardial contusion
 - d. Pericardial effusion & tamponade
 - e. Pneumopericardium & tamponade
2. Aorta
 - a. Aortic trauma
 - b. Aortic dissection
 - c. Aortic aneurysm
3. Pulmonary Edema & various etiologies
4. Thrombo-embolic disease
 - a. Deep venous thrombosis
 - b. Pulmonary embolism

Suggested Readings:

James CA. Magnetic resonance angiography in trauma. *Clin Neurosci* 1997;4:137-145

Harris JA, Bis KG, Glover JL, Bendick PJ, Shetty A, Brown OW. Penetrating atherosclerotic ulcers of the aorta. *J Vasc Surg* 1994;90-98.

Coady MA, Rizzo JA, Hammond GL, et al. Penetrating ulcer of the thoracic aorta: what is it? How do we recognize it? How do we manage it? *J Vasc Surg* 1998;27:1006-1015.

Gavant ML. Helical CT grading of traumatic aortic injuries. Impact on clinical guidelines for medical and surgical management. *Radiol Clin N Am* 1999;37:553-574.

Akbar K, Smith DC, Bansal RC, Catalano RD. Angiography in blunt thoracic aortic injury. *J Trauma* 1997;42:665-669.

Fabian TC, Richardson JD, Croce MA et al. Prospective study of blunt aortic injury: Multicenter trial of the American Association for the Surgery of Trauma. *J Trauma* 1997;42:374-380.

Sommer T, Fehske W, Holzknicht N, et al. Aortic dissection: a comparative study of diagnosis with spiral CT, multiplanar transesophageal echocardiography, and MR imaging. *Radiology* 1996;199:347-352.

Wicky S, Capasso P, Meuli R et al. Spiral CT aortography: an efficient technique for the diagnosis of traumatic aortic injury. *Eur Radiol* 1998;8:828-833.

Patel NH, Stephens KE Jr., Mirvis SE, et al. Imaging of acute thoracic aortic injury due to blunt trauma: a review. *Radiology* 1998;209:335-348.

Torossov M, Singh A, Fein SA. Clinical presentation, diagnosis, and hospital outcome of patients with documented aortic dissection: the Albany Medical Center experience, 1986 & 1996. *Am Heart J* 1999;137:154-161.

Sebastia C, Pallisa E, Quiroga S, et al. Aortic dissection: diagnosis and follow-up with helical CT. *Radiographics* 1999;19:45-60.

Creasy JD, Chiles C, Routh WD, Dyer RB. Overview of traumatic injury of the thoracic aorta, *Radiographics* 1997;17:27-45.

Sarasin FP, Louis-Simonet M, Gaspoz JM, Junod AF. Detecting acute dissection in the emergency department: time constraints and choice of the optimal diagnostic test. *Ann Emerg Med* 1996;28:278-288.

Duvernoy O, Coulden R, Yitterberg C. Aortic motion: a potential pitfall in CT imaging of dissection in the ascending aorta. *J Comput Assist Tomogr* 1995;19:569-572.

Nienaber CA, von Kodolitsch Y, Nicolas V, et al. The diagnosis of thoracic aortic dissection by noninvasive imaging procedures. *N Engl J Med* 1993;328:1-9.
Fisher RG, Sanchez-Torres M, Thomas JW, Whigham CJ. Subtle and atypical injuries of the thoracic aorta and brachiocephalic vessels in blunt thoracic trauma. *Radiographics* 1997;17:835-839.

Fultz PJ, Melville D, Ekanei A, et al. Nontraumatic rupture of the thoracic aorta: chest radiographic features of an often unrecognized condition. *AJR* 1998;171:351-357.

Tennant WG, Hartnell GG, Baird RN, Horrocks M. Inflammatory aortic aneurysm: characteristic appearance on magnetic resonance imaging. *Eur J Surg* 1992;6:399-402.

Von Kodolitsch Y, Simic O, Nienaber CA. Aneurysms of the ascending aorta: diagnostic features and prognosis in patients with Marfan's syndrome versus hypertension. *Clin Cardiol* 1998;21:817-824.

Halliday KE, al-Kutoubi A. Draped aorta: CT sign of contained leak of aortic aneurysms. *Radiology* 1996;199:41-43.

Vogelzang RL, Sohaey R. Infected aortic aneurysm: CT appearances. *J Comput Assist Tomogr* 1988;12:109-112.

Van de Wal HJ, Draaisma JM, Vincent JG, Goris RJ. Rupture of the supradiaphragmatic inferior vena cava by decelerating trauma: case report. *J Trauma* 1990;30:111-113.

Walsh A, Snyder HS. Azygous vein laceration following a vertical deceleration injury. *J Emerg Med* 1992;10:35-37.

Killeen KL, Poletti PA, Shanmuganathan K, Mirvis SE. CT diagnosis of cardiac and pericardial injuries. *Emerg Radiol* 1999;6:339-344.

Oliver TB, Murchison JT, Reid JH. Spiral CT in acute non-cardiac chest pain. *Clin Radiol* 1999;54:38-45.

Flamm SD, VanDyke CW, White RD. MR imaging of the thoracic aorta. *Magn Reson*

Imaging Clin N Am 1996;4:217-235.

Ho VB, Prince MR. Thoracic MR aortography: imaging techniques and strategies. Radiographics 1998;18:287-309.

E. Abdomen: O.Clark West, MD

1. Abdominal Trauma

- a. Hemoperitoneum and intraperitoneal fluid
- b. Hemodynamic status assessment
- c. Retroperitoneal hemorrhage
- d. Gas collections: intraperitoneal and retroperitoneal
- e. Active arterial extravasation on CT
- f. Splenic injuries
- g. Liver injuries
- h. Gallbladder and biliary injuries
- i. Bowel injuries
- j. mesenteric injuries
- k. Pancreatic injuries
- l. Renal injuries
- m. Adrenal injuries
- n. Bladder injuries: intraperitoneal and extraperitoneal
- o. Abdominal wall injuries and diaphragmatic hernias

2. Non-traumatic Abdominal Emergencies

- a. The peritoneal cavity

Ascities

Peritonitis

Abdominal abscess

- b. Liver and biliary tract Jaundice: obstructive and non-obstructive Cholecystitis
- c. Pancreatitis
- d. Urinary tract

Urinary stones

Infection

Pyelonephritis Renal abscess

- e. Adrenal hemorrhage
- f. Gastrointestinal tract Gastrointestinal hemorrhage Bowel obstruction Bowel infarction Bowel infection

Appendicitis Diverticulitis Infectious enteritis and colitis

- g. Epiploic appendagitis

- h. Inflammatory bowel disease

Crohn disease

Ulcerative colitis

Suggested Readings:

Baker SR, Cho KC, The Abdominal Plain Film with Correlative Imaging. Stamford, CT: Appleton & Lange, 1999.

Jeffrey RB, Jrl, Ralls PW. CT and Sonography of the Acute Abdomen. 2nd ed. Philadelphia: Lippincott-Raven, 1996.

McKenney KL. Ultrasound of Blunt Abdominal Trauma, The Radiology Clinics of North America 1999;37-879-894.

Novelline RA, Rhea JT, Bell T. Helical CT of Abdominal Trauma. The Radiology Clinics of North America 1999; 37; 591-612.

Rao PM, Rhea JT, Novelline RA. Helical CT of Appendicitis and Diverticulitis. The Radiology Clinics of North America 1999; 895-910

Smith RC, Levine J, Rosenfeld AT, Helical CT of Urinary Tract Stones: Epidemiology, Origin, Pathophysiology, Diagnosis and Management. The Radiology Clinics of North America 1999; 37: 911-952.

West OC, Jarolimek AM. Abdomen: Traumatic Emergencies In: The Radiology of Emergency Medicine. 4th ed. Philadelphia: Lippincott Williams & Wilkins, 2000:689-724.

West OC, Tamm EP, Kawashima A, Jarolimek AM. Abdomen: Non-traumatic Emergencies In: The Radiology of Emergency Medicine. 4th ed. Philadelphia: Lippincott Williams & Wilkins, 2000:583-657

I. Gynecological /Obstetrical Emergencies: Stephen Ledbetter, MD

- 1 Uterine trauma
- 2 Cervico-vaginal trauma
- 3 Feto-placental trauma
- 4 Ovarian cystic disease
- 5 Ovarian torsion
- 6 Pelvic inflammatory disease
- 7 Endometritis
- 8 Spontaneous abortion
- 9 Fetal demise
- 10 Subchorionic hemorrhage
- 11 Ectopic pregnancy
- 12 Placenta previa
- 13 Placental abruption and hemorrhage
- 14 Biophysical Profile

Suggested Readings:

Rumack CM, Wilson SR, Charboneau JW: Diagnostic Ultrasound 2nd Edition. Mosbyyearbook, St. Louis, Missouri,1998

Callen, PW: Ultrasonography in Obstetrics and Gynecology 3rd Edition. WB Saunders, Philadelphia, PA, 1994.

Abu-Yousef MM, Bleicher JJ, Williamson RA, Weiner CP. Subchorionic hemorrhage: sonographic diagnosis and clinical significance. *AJR Am J Roentgenol.* 1987 Oct;149(4):737-40.

Baltarowich OH, Kurtz AB, Pasto ME, Rifkin MD, Needleman L, Goldberg BB. The spectrum of sonographic findings in hemorrhagic ovarian cysts. *AJR Am J Roentgenol.* 1987 May;148(5):901-5.

Bromley B, Benacerraf B. Adnexal masses during pregnancy: accuracy of sonographic diagnosis and outcome. *J Ultrasound Med.* 1997 Jul;16(7):447-52.

Chow MM, Ho ES, Lee YH. Prenatal diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. *Ultrasound Obstet Gynecol.* 2000 Jan;15(1):28-35.

Estroff JA. Emergency obstetric and gynecologic ultrasound. *Radiol Clin North Am.* 1997 Jul;35(4):921-57.

Finberg HJ, Kurtz AB, Johnson RL, Wapner RJ. The biophysical profile. A literature review and reassessments of its usefulness in the evaluation of fetal well-being. *J Ultrasound Med.* 1990 Oct;9(10):583-91.

Gallagher P, Fagan CJ, Bedi DG, Winsett MZ, Reyes RN. Potential placenta previa: definition, frequency, and significance. *AJR Am J Roentgenol.* 1987 Nov;149(5):1013-5.

Hertzberg BS, Bowie JD, Carroll BA, Kliwer MA, Weber TM. Diagnosis of placenta previa during the third trimester: role of transperineal sonography. *AJR Am J Roentgenol.* 1992 Jul;159(1):83-7.

Hertzberg BS, Kliwer MA, Bowie JD. Adnexal ring sign and hemoperitoneum caused by hemorrhagic ovarian cyst: pitfall in the sonographic diagnosis of ectopic pregnancy. *AJR Am J Roentgenol.* 1999 Nov;173(5):1301-2.

Kaakaji Y, Nghiem HV, Nodell C, Winter TC. Sonography of obstetric and gynecologic emergencies: Part I, Obstetric emergencies. *AJR Am J Roentgenol.* 2000 Mar;174(3):641-9.

Kaakaji Y, Nghiem HV, Nodell C, Winter TC. Sonography of obstetric and gynecologic emergencies: Part II, Gynecologic emergencies. *AJR Am J Roentgenol.* 2000 Mar;174(3):651-6.

Kory LA. Diagnosis of ectopic pregnancy. *AJR Am J Roentgenol.* 2000 Oct;175(4):1185-6.

Laing, FC. Placenta previa: avoiding false-negative diagnoses. *J Clin Ultrasound.* 1981 Mar;9(3):109-13.

Lee EJ, Kwon HC, Joo HJ, Suh JH, Fleischer AC. Diagnosis of ovarian torsion with color Doppler sonography: depiction of twisted vascular pedicle. *J Ultrasound Med.* 1998 Feb;17(2):83-9.

Lowdermilk C, Gavant ML, Qaisi W, West OC, Goldman SM. Screening helical CT for evaluation of blunt traumatic injury in the pregnant patient. *Radiographics.* 1999 Oct;19 Spec No:S243-55; discussion S256-8.

Manning FA. Fetal biophysical profile. *Obstet Gynecol Clin North Am.* 1999 Dec;26(4):557-77.

Manning FA, Bondagji N, Harman CR, Casiro O, Menticoglou S, Morrison I. Fetal assessment based on the fetal biophysical profile score: relationship of last BPS result to subsequent cerebral palsy. *J Gynecol Obstet Biol Reprod (Paris).* 1997;26(7):720-9.

Moore L, Wilson SR. Ultrasonography in obstetric and gynecologic emergencies. *Radiol Clin North Am.* 1994 Sep;32(5):1005-22.

Wagner BJ, Woodward PJ, Dickey GE. From the archives of the AFIP. Gestational trophoblastic disease: radiologic-pathologic correlation. *Radiographics.* 1996 Jan;16(1):131-48.

Wolman I, Gordon D, Yaron Y, Kupferminc M, Lessing JB, Jaffa AJ. Transvaginal sonohysterography for the evaluation and treatment of retained products of conception. *Gynecol Obstet Invest.* 2000;50(2):73-6.

H. Male Genitourinary Emergencies: Stanford M. Goldman, MD

- 1 Urethral and penile trauma
- 2 Urethral foreign bodies
- 3 Urethral stones
- 4 Scrotal and testicular trauma
5. Acute non-traumatic scrotal conditions
 - a. Testicular torsion
 - b. Epididymitis
 - c. Orchitis
 - d. Acute fluid collections (Hydrocele, hematocele, pyocele)
 - e. Epididymoorchitis
 - f. Infarction
 - g. Abscess
 - h. Fournier's Gangrene

Suggested Readings:

Dunnick NR, Sandler CM, Amis ES Jr: *Newhouse Textbook of Uroradiology* 3rd Edition. Baltimore Williams and Wilkins 2000. Chapters on Urethra & Penis; Scrotum &

Contents (to be published).

Mitty HA, Fritzsche P, Dunnick NR, Sandler CM, Goldman SM: Genitourinary Tract disease Syllabus (4th series), Vol 30. American College of Radiology, Reston, Virginia, 1992. Pp 2-23.

Goldman SM, Sandler CM, Corriere JN Jr, McGuire EJ: Blunt Urethral Trauma: A New Unified Anatomical-Mechanical Classification. J Urol 157: 85-89, 1997.

Rumack CM, Wilson SR, Charboneau JW: Diagnostic Ultrasound 2nd Edition. Mosbyyearbook, St. Louis, Missouri, pp 812-821. 1998

I. Upper Extremity: Fred A. Mann, MD

- 1 Scapulothoracic dissociation
 2. Clavicle fractures and dislocations
 - a. Dislocations
- Sternoclavicular
- Acromioclavicular

- 2 Glenohumeral dislocations
- 3 Scapular fractures
 5. Humerus fractures
 - a. Proximal (head & neck)
 - b. Shaft
 - c. Supracondylar extra articular, including epicondyles intra articular, including unicondylar, bicondylar and capetellar fractures
- 4 Elbow dislocations
 7. Forearm fractures & dislocations
 1. Fractures
 - a. Processes
 - 4 coronoid process
 - 4 Radial tubercle
 - b. Distal radius
 - 4 Colles, Smith, Barton types
 - 4 Die-punch fracture radiolunate fossa
 - c. Defensive injuries to ulna, including classic nightstick
 2. Single bone fracture with associated dislocation non fractured bone
 - a. Monteggia
 - b. Galeazzi
 - c. Essex-Lopresti
 3. Dislocations
 - a. Elbow
 - b. Distal radioulnar joint
 - 5 Carpal bone fractures
 9. Carpal dislocations and malalignments
 - a. Perilunate spectrum
 - b. Carpal instability patterns
 10. Metacarpal fractures
 - a. Carpometacarpal fracture dislocations, including Fighters' equivalent

fractures

b. Extra articular fractures of the base, shaft and neck

11. Phalangeal fractures

a. Dislocations Simple Complex Ligament injuries, including those of the extensor mechanism, collateral ligaments

b. Fractures

Extra articular

Intra articular

Volar plate

Mallet type

Amputations

Suggested Readings:

Rogers LF. Radiology of Skeletal Trauma (Second Edition). Churchill Livingstone, New York; 1992

Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams & Wilkins, Baltimore, MD, Fourth Edition, 2000.

McCort JJ, Trauma Radiology. Churchill Livingstone, New York, NY. 1990.

Novelline RA. Advances in Emergency Radiology, Volumes II, Radiological Clinics of North America. WB Saunders, Philadelphia, PA, 1999.

West OC, Novelline RA, Wilson AJ, Categorical Course Syllabus on Emergency and Trauma Radiology. American Roentgen Ray Society, 2000

J. Pelvis and Hip: John H. Harris, Jr. MD, DSc

A. Pelvis

1. Fractures of isolated bones of the pelvis that do not involve the pelvic ring

a. iliac wing (Duvrney)

b. sacrum

c. coccyx

d. avulsion

ant. sup. iliac crest apoph. - sartorius m

ant. inf. iliac crest apoph. - rectus femoris m

ischial tuberosity - hamstring ms

lesser troch. apoph. (femur) - iliopsoas

2. Pelvic ring disruption. Disruption, ie., fracture or diastasis at two or more sites of the anterior and posterior pelvic arcs.

a. Mechanism of injury

lateral compression
anteroposterior compression

discrete: straddle injury diffuse:
open-book pelvic ring disruption
vertical shear

- b. Types of pelvic ring disruption
 - Malgaigne (ipsilateral)
 - bucket - handle (contralateral)
 - open - book
 - other fracture patterns without eponym

1 Insufficiency fractures
anterior pelvic arch
sacrum

2 Stress fractures

5. Acetabular fractures (Involve only one side of the pelvic ring. Occur concomitantly with PRD in approximately 12%.)

- a. posterior column (most common) rim
- b. anterior column
- c. both columns - above, or through, acetabulum but spare the lunate surface
- d. transverse ("T")

"T" with ant. column extension

"T" with post. column extension

B. Hip

1. Dislocation

- . a. Posterior or posterosuperior pure fracture-dislocation. Fracture involves posterior or posterosuperior acetabular rim
- b. Anterior (obturator)
- c. Central

2. Fractures (usually associated with dislocation).

- a. Posterior or posterosuperior acetabular rim
- b. Anterior (Involve the acetabular "tear-drop")
- c. Central

C. Proximal femur

1 Slipped capital femoral epiphysis (SCFE)

2 Salter-Harris physeal injuries

3. Fractures

- a. Head - usually associated with hip dislocation
- b. Neck

subcapital

transcervical

basicervical

c. Trochanteric

intertrochanteric

2 - part (proximal/distal fragments)

3 - part (prox./distal + 1 trochanter)

4 - part (prox./distal + each trochanter)

subtrochanteric

isolated fracture, greater trochanter

4. Avascular necrosis Stage I - radiograph negative Stage II - inhomogeneity of femoral head Stage III - Progressive inhomogeneity; trabecular disruption; "crescent" sign;
subcondral cortical disruption.
Stage IV - fragmentation of head

Suggested Readings:

Berquist TH, Coventry MB. The Pelvis and Hip. (In) Imaging of Orthopedic Trauma, 2nd ed.

Berquist TH, ed. Raven Press, 1992. Hip: 260-269; Pelvis: 228-240; Acetabulum; 240-246; Proximal femur: 269-272; 285-289.

Pelvis, acetabulum and hips. (In) The Radiology of Emergency Medicine. Harris JH, Harris WH,(eds); Williams & Wilkins, Baltimore; 2000, pp 725-814.

Young JWR: Fractures of the pelvis. (In) Imaging in Trauma and Critical Care, Mirvis SE & Young JWR (eds); Williams & Wilkins; Baltimore, MD; 1992, pp 380-420

Daffner RH: Pelvic trauma. (In) Trauma Radiology, McCort JJ & Mindelzun RE (eds); Churchill Livingstone; New York; 1990, pp 339-380 (In) Radiology of Skeletal Trauma (2nd Ed), Rogers LF (ed); Churchill Livingstone, New York; 1992; Fractures of the acetabulum, pp 1051-1074

Routt ML: Pelvic Fractures. & Mayo KA: Hip Joint: Acetabular Fractures. (In) Orthopaedic Trauma Protocols, Hansen ST & Swiontkowski MF (eds); Raven Press, New York, 1993; pp 225-236 & 243-254.

K. Lower Extremity: Eric A. Brandser, MD

- 2 Patella fractures
- 3 Tibial plateau fractures
- 4 Tibial spine avulsion fractures
- 5 Cruciate and other ligamentous injuries of the knee
- 6 Meniscus tears
- 7 Knee dislocations
- 8 Tibial stress fractures
- 9 Tibial and fibular shaft fractures
- 10 Tibial plafond fracture (pilon fractures)
- 11 Ankle mortise injury
- 12 Calcaneal fractures
- 13 Achilles tendon and ligamentous injuries of the ankle
- 14 Talus fractures
- 15 Talar and subtalar dislocations
- 16 Tarsal fractures
- 17 Tarso-metatarsal fracture dislocations (Lisfranc's fracture)
- 18 Metatarsal fractures
- 19 Toe fractures
- 20 Septic arthritis
- 21 Muscle injuries
- 22 Compartment syndrome
- 23 Diabetic muscle infarction
- 24 Diabetic foot infections

Recommended Reading List:

Radiology of Skeletal Trauma (2nd Ed), Rogers LF (ed); Churchill Livingstone, New York; 1992.

Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams & Wilkins, Baltimore, MD, Fourth Edition, 2000.

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L. Pediatric Emergencies: Carols J. Sivit, MD

1. Brain

A. Trauma

- 1 Cephalohematoma and capput succinadeum
- 2 Unintentional blunt and penetrating
- 3 Intentional (Battered child)

B. Infection

- 1 TORCH infections

- 2 Meningitis, cerebritis, cerebral abscess
- 3 Mastoiditis

C. Non-traumatic hemorrhage

- 1 Neonatal germinal matrix hemorrhage
- 2 AVM, aneurysm, moya-moya, coagulation disorders

D. Cerebral ischemia

- 1 Perinatal brain injury
- 2 Sickle cell disease

E. Imaging the child with seizures

2. Head & Neck

a. Trauma

- 1. Facial (orbit, zygoma, maxilla, mandible, frontal, nasal)

b. Infection

- 1 Croup
- 1 Epiglottitis
- 1 Retropharyngeal abscess
- 1 Parotitis
- 1 Orbital cellulitis

3. Spine

a. Trauma

- 1 Cervical spine
- 1 Thoracic spine
- 1 Lumbar spine

b. Infection

- 1 Osteomyelitis/discitis
- 1 Epidural abscess

c. Miscellaneous

1. Imaging the child with acute back pain

4. Chest

a. Trauma

- 1 Pulmonary contusion/laceration
- 1 Thoracic air leak
- 1 Mediastinal hemorrhage
- 1 Esophageal and airways injury
- 1 Chest wall injury

b. Infection

- 1. Pneumonia
 - a. Neonatal pneumonia
 - b. Bacterial pneumonia
 - c. Viral pneumonia
 - d. Opportunistic infection
- 2. Empyema & pleural disease
- c. Foreign body aspiration
- d. Neonatal respiratory distress

- 2 Respiratory distress syndrome
- 2 Meconium aspiration syndrome
- 2 Transient tachypnea of the newborn
 - e. Congenital heart disease
 - f. Congestive heart failure and pulmonary edema

- 5. Abdomen
 - a. Trauma
 - 1 Solid viscus injury
 - 1 Hollow viscus injury
 - 1 Peritoneal fluid, hemoperitoneum & active hemorrhage
 - 1 Hypoperfusion complex\
 - b. Non-traumatic hemorrhage
 - 1. Adrenal hemorrhage
 - c. Infection/Inflammation
 - 1 Appendicitis
 - 1 Pancreatitis
 - 1 Cholecystitis
 - 1 Cholangitis
 - 1 Pyelonephritis
 - d. Bowel obstruction
 - 1 Midgut malrotation
 - 1 Bowel atresias
 - 1 Intestinal intussusception
 - 1 Hirschsprungs disease
 - 1 Meconium ileus, meconium plug syndrome & meconium peritonitis
 - e. GI bleeding
 - f. Immunocompromised disorders
 - 2 Neutropenic typhlitis
 - 2 Pseudomembranous colitis
 - g. Obstructive uropathy
 - h. Urolithiasis

- 6. Pelvis
 - a. Trauma
 - 1. Bladder and urethral injury
 - b. Infection/Inflammatory
 - 1 PID
 - 1 Ovarian cystic disease & torsion

- 7. Scrotum
 - a. Trauma
 - b. Infection/Inflammatory
 - 1 Neonatal testicular torsion
 - 1 Testicular torsion in older children
 - 1 Epididymitis/Orchitis

- 8. Musculoskeletal
 - a. Trauma

- 1 Battered child
- 1 Growth plate injury
- 1 Toddlers fracture
- 1 Nursemaids elbow
- 1 Elbow injury & normal developmental variants
- 1 Biomechanical features of growing long bones
 - b. Infection
- 1 Osteomyelitis
- 1 Septic arthritis
- 1 Pyomyositis
 - c. Miscellaneous

1. Child with limp

9. Pediatric sedation & monitoring in the emergency setting

Suggested Readings:

Swischuk LE, Imaging of the Newborn, Infant & Young Child. Williams & Wilkins, 1997.

Kirks D. Practical Pediatric Imaging: Diagnostic Radiology of Infants & Children, Little Brown & Company, 1995.

Siegel MJ, Sivit CJ. Radiologic Clinics of North America: Imaging of the Acute Pediatric Abdomen, W.B. Saunders, July 1997.

Stringer DA, Babyn PS. Pediatric gastrointestinal imaging and intervention. B.C. Decker Inc, 2000.

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Harris JH, Mirvis SE. The Radiology of Acute Cervical Spine Trauma. Williams and Wilkins, Baltimore, MD, Third Edition, 1995.

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Stern EJ. Trauma Radiology Companion. Lippincott-Raven, Philadelphia, PA 1997.

Eustace SJ. Magnetic Resonance Imaging of Orthopedic Trauma. Lippincott Williams & Wilkins, Philadelphia, PA, 1999.

III. Recommended Textbooks

Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams & Wilkins,

Baltimore, MD, Fourth Edition, 2000.

Harris JH, Mirvis SE. The Radiology of Acute Cervical Spine Trauma. Williams and Wilkins, Baltimore, MD, Third Edition, 1995.

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Mirvis SE, Young JWR. Imaging in Trauma and Acute Care. Williams and Wilkins, Baltimore, MD, 1992.

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