CT Case Review Course: Abdomen & Pelvis

Cases 51-75

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University of Alabama at Birmingham

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Disclosures: None
Case 51

62-year-old man with severe abdominal pain, fever, nausea, and vomiting.
Case 51: What is the MOST likely cause of the gallbladder appearance?

1) Hepatocellular carcinoma
2) Cholangiocarcinoma
3) Hepatitis
4) Acute cholecystitis
Case 51: What is the MOST likely cause of the gallbladder appearance?

1) Hepatocellular carcinoma
2) Cholangiocarcinoma
3) Hepatitis
4) Acute cholecystitis
Signs of Acute Cholecystitis

Primary
- Cholelithiasis
- Impacted stone
- Sonographic Murphy’s sign

Secondary
- Gallbladder wall thickening (>3 mm)
- Pericholecystic fluid
- Sludge

Tertiary
- Leukocytosis/fever
Signs of Gangrenous Cholecystitis

- Rim sign Tc-99m HIDA
- Gallbladder (GB) wall sonolucencies
- Intramural fluid collections CT/MR
- Sloughed membranes GB lumen
- Disruption GB wall
- Lack GB wall enhancement
- Adjacent liver hyperenhancement
CT Signs Abscess

• Localized collection
  – Fluid
  – Air
• Peripheral stranding soft tissues
• Haziness fat
Case 52

57-year-old man with history of cholecystitis and acute abdominal pain.
Gallbladder Carcinoma

- Adenocarcinoma most common
- Female: Male = 4:1, Age >60
- Commonly misdiagnosed
  - Most unresectable at presentation
- Imaging findings
  - Porcelain gallbladder (risk factor)
  - Gallstones present 70-80%
  - Focal or diffuse soft tissue thickening
  - Metastasis periportal/peripancreatic nodes
  - Direct invasion liver
Classical Liver Divisions

From www.radiology assistant.com
Figure 26. Thick-slab coronal MIP image shows the branch of segment III (arrowhead) draining into the middle hepatic vein (M).
(a) PHA arteriography shows characteristic arch (arrow) of the LHA (arrowheads).
Couinaud Classification: Segmental Anatomy

• 8 functional, independent segments
  – Portal vein, hepatic artery, & bile duct
• Each can be resected, preserving remaining liver
<table>
<thead>
<tr>
<th></th>
<th>Segment</th>
<th>Subsegment</th>
<th>Sector</th>
<th>Segment</th>
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## Segments of the Liver

Adapted from: Dodd GD. Am J Roentgenol 1993

<table>
<thead>
<tr>
<th>Anatomic subsegment</th>
<th>Couinaud</th>
<th>Bismuth</th>
<th>Goldsmith and Woodburne</th>
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<tr>
<td>Caudate lobe</td>
<td>I</td>
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<tr>
<td>Left lateral superior subsegment</td>
<td>II</td>
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<td>Left lateral inferior subsegment</td>
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<tr>
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<td>VI</td>
<td>VI</td>
<td>Right posterior segment</td>
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<tr>
<td>Right posterior superior subsegment</td>
<td>VII</td>
<td>VII</td>
<td>Right posterior segment</td>
</tr>
</tbody>
</table>

Adapted from: Dodd GD. Am J Roentgenol 1993
Liver Segments

Superior Liver

Inferior Liver
Case 52: Which hepatic segment is MOST likely to be invaded by gallbladder carcinoma?

1) II
2) IV
3) VII
4) VIII
Case 52:
Which hepatic segment is MOST likely to be invaded by gallbladder carcinoma?

1) II
2) IV
3) VII
4) VIII
Case 53

57-year-old man with right upper quadrant pain, marked lately, with prior outside ultrasounds unavailable.
Case 53:
What is the commonly accepted upper limits for common bile duct diameter?

1) >2mm
2) >6mm
3) >12mm
4) >20mm
Case 53:
What is the commonly accepted upper limits for common bile duct diameter?

1) >2mm
2) >6mm
3) >12mm
4) >20mm
CT: Pancreatic adenocarcinoma

- **Enhancement:**
  - Peak pancreas 40 sec (5 sec post-aorta)
  - Tumor < Pancreas
  - Neuroendocrine tumors hyperenhance

- **CT protocol:**
  - Nonenhanced
  - Late arterial (pancreas phase)
  - Portal venous phase (routine enhancement)
Pancreatic CT Protocol

- Nonenhanced: Calculi
- Late arterial (pancreas phase):
  - adenocarcinoma appears low
  - NET hyperenhances
  - Hypervascular mets (e.g., renal cell)
- Portal venous phase (routine):
  - Nodes, liver mets, ducts, veins
Vascular Involvement
Surgical resection: Superior Mesenteric Vein (SMV)
Tumor & SMV: “Teardrop”
Case 54

55-year-old with abdominal pain, nausea, and vomiting.
Acute Pancreatitis

- Clinical symptoms often nonspecific
- Labs ↑: Amylase, Lipase, ALT
- Marshall scoring system: clinical severity
# Marshall Scoring System

<table>
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<tr>
<th>Organ System</th>
<th>Score</th>
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<tr>
<td></td>
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<tr>
<td>Respiratory (PO2/FIO2)</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Renal (serum creatinine, µmol/l)</td>
<td>&lt;134</td>
</tr>
<tr>
<td>Cardiovascular (systolic blood pressure, mmHg)</td>
<td>&gt;90</td>
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</table>
Acute Pancreatitis: Diagnosis

- 2 of the following:
  - Clinical pain/presentation classic
  - Serum lipase or amylase $\geq 3$ times normal
  - Characteristic CT findings
Acute Pancreatitis
Acute Pancreatitis Over Time

7 days

14 days
Early Acute Necrotizing Pancreatitis
Acute Interstitial Edematous Pancreatitis vs. Acute Necrotizing Pancreatitis?
Early Acute Necrotizing Pancreatitis

• Disease severity:
  – 1\textsuperscript{st} week: based clinical
  – Thereafter: morphologic changes
Acute Pancreatitis

- 1992 Atlanta Classification
- 2007 Revised criteria Acute Pancreatitis Working Group

Disease severity:
- 1st week: based clinical
  - Patients die multi-organ system failure
- Thereafter: morphologic changes
  - Complications seen on CT become leading cause morbidity & mortality
Case 54:
What is the MOST common cause of pancreatitis?

1) Gallstone Impaction
2) Pancreatic adenocarcinoma
3) Alcohol abuse
4) Pancreas divisum
Case 54:
What is the MOST common cause of pancreatitis?

1) Gallstone Impaction
2) Pancreatic adenocarcinoma
3) Alcohol abuse
4) Pancreas divisum
Case 55

69-year-old woman with primary sclerosing cholangitis.
Cholangiocarcinoma

- <1% of all cancers
- Type of adenocarcinoma arising from bile duct epithelium
- 2/3 arise common hepatic duct or common bile duct
- Spreads along ducts into liver, gallbladder, duodenum and pancreas
- Involves adjacent nodes
- Intraperitoneal involvement common
Cholangiocarcinoma: Predisposing Conditions

- Choledochal cyst
- Ulcerative colitis
- Caroli disease
- *Clonorchis sinensis* infection
- Primary sclerosing cholangitis
Case 55: What is a Klatskin Cholangiocarcinoma?

1) Intraductal polypoid mass
2) Pancreatic/ampullary mass
3) Peripheral infiltrating liver lesion
4) Hepatic hilar/portal lesion
Case 55: What is a Klatskin Cholangiocarcinoma?

1) Intraductal polypoid mass
2) Pancreatic/ampullary mass
3) Peripheral infiltrating liver lesion
4) Hepatic hilar/portal lesion
Case 56

61-year-old man with weight loss and vague abdominal pain, referred after abnormal ultrasound.
Case 56: Which of the following tumors MOST likely shows hepatic lesions with arterial enhancement?

1) Breast carcinoma
2) Colon carcinoma
3) Recurrent Lymphoma
4) Squamous cell lung cancer
Case 56: Which of the following tumors MOST likely shows hepatic lesions with arterial enhancement?

1) Breast carcinoma
2) Colon carcinoma
3) Recurrent lymphoma
4) Squamous cell lung cancer
Arterial Phase Enhancing Liver lesions

- Hepatocellular carcinoma (HCC)
- Neuroendocrine tumors
- Renal cell carcinoma
- Thyroid carcinoma
- Choriocarcinoma
- +/- Melanoma
- Breast Cancer
Case 57

63-year-old woman with chronic hepatitis C.
Nodular Hepatic Lesions

- **Regenerative**
  - Often seen in cirrhosis
  - Rarely >20 mm

- **Dysplastic/Neoplastic**
  - Larger nodules in cirrhotics usually neoplastic
Hepatocellular Carcinoma

- Arterial enhancement with portal venous washout
- Minority are hypovascular or best seen portal venous phase
- Appearance may vary with lesion size
  - Small: homogeneously enhance
  - Larger: Heterogeneous or mosaic patterns
HCC: CT Enhancement

Noncontrast

Arterial

Portal Venous
Case 57: What percentage of primary hepatic tumors are due to hepatocellular carcinoma?

1) 5%
2) 20%
3) 50%
4) 90%
Case 57: What percentage of primary hepatic tumors are due to hepatocellular carcinoma?

1) 5%
2) 20%
3) 50%
4) 90%
Case 58

72-year-old male with esophageal cancer.
Cystic Pancreatic Lesions

• Commonly Found
• CT: AJR 2008;191 802.
  – 2.6% (73/2832) MDCT scans
  – 85% solitary
• MR: Radiology 2002;223:547
  – 19.6% (283/1444 scans)
  – 56% solitary
  – Increased prevalence with age
Common Cystic Pancreatic Lesions

- Pseudocyst 30%
  - Document prior pancreatitis
  - Can mimic IPMN
- Mucinous Neoplasm 30%
  - Intraductal papillary mucinous neoplasm or tumor (IPMN or IPMT) 20%
    - Can cause recurrent acute pancreatitis
  - Mucinous cystic neoplasm (10%)
- Serous neoplasm (10%)
Pseudocysts

- Unilocular, thick walled
- >2cm (Macrocystic)
- Near water attenuation
- Can mimic mucinous cystic neoplasms
- Make sure history of acute pancreatitis
Serous Neoplasm

- “Grandmother lesion”: Women > 60
- Rarely malignant
- Polycystic multilocular, <2cm cysts
- Central scar with calcification frequent
Mucinous Cystic Neoplasm

- “Mother lesion”: Women 40-60 yrs
- Body & tail pancreas
- Often have peripheral calcification
- Can mimic pseudo cysts
IPMN

- > 60 y/o, male > female
- Often presents with pancreatitis
- Previously misdiagnosed chronic pancreatitis
- Side branch or main pancreatic duct
  - Macro or microcystic lesions
  - Dilated duct
- Mucin production
  - may hinder ERCP
  - May be seen on endoscopy
- MR may help demonstrate connection to duct
IPMN: Management

- Significant risk develop malignancy
- Risk high grade dysplasia or invasive cancer is time dependent
- Surveillance needed

- Berland LL, et al. “Managing incidental imaging findings on abdominal CT” JACR 2010; 10(7): 754-773
Asymptomatic Patient with Incidental Pancreatic Cystic Mass

Detected on CT, MRI (with or without contrast) or US

ASYMPTOMATIC PATIENT WITH INCIDENTAL PANCREATIC CYST

- **<2 cm**
  - Single follow-up in 1 yr, preferably MRI
  - Stable: Benign, no further follow-up
  - Growth: Uncharacterized cystic mass
    - Follow-up yearly
  - Growth: Uncharacterized cystic mass
    - Follow-up every 6 mo for 2 years

- **2-3 cm**
  - Imaging characterization, preferably MRI/MRCP
  - Uncharacterized cystic mass
  - Follow-up yearly
  - BD-IPMN
  - Follow-up every 2 yr
  - Serous cystadenoma
  - Follow-up every 2 yr

- **>3 cm**
  - Serous cystadenoma
    - Consider resection when ≥ 4 cm
  - Uncharacterized cystic mass or other cystic neoplasm
    - Cyst aspiration
  - Resect, depending on co-morbidities and risk
Case 58: What is the MOST likely cause for the patient’s cystic pancreatic lesion?

1) Pseudocyst
2) IPMN
3) Mucinous cystic neoplasm
4) Serous cystic neoplasm
Case 58: What is the risk of malignancy in a pancreatic main branch intraductal papillary mucinous neoplasm (IPMN)?

1) Pseudocyst
2) IPMN
3) Mucinous cystic neoplasm
4) Serous cystic neoplasm
Case 59

91-year-old female with abdominal pain.
Case 59: What is the most common site of gastrointestinal stromal tumor (GIST) origin?

1) Stomach
2) Duodenum
3) Jejunum & ileum
4) Colon and appendix
Case 59: What is the most common site of gastrointestinal stromal tumor (GIST) origin?

1) Stomach
2) Duodenum
3) Jejunum & ileum
4) Colon and appendix
GIST: Background

- Incidence 10-20 per million
- Rare children (<1%), almost all stomach
- Common neurofibromatosis type 1
- Diverse appearance: nodular, cystic, diverticular
- Liver/pancreatic involvement can stimulate primary tumors in these organs
GIST: Prognosis

• Metastatic risk:
  – Gastric
    • Low: <10 cm & ≤ 5 mitosis/hpf
    • High: >5 mitosis/hpf & >5 cm diameter
  – Intestinal
    • >5 cm independent mitotic rate at least moderate risk
    • <5 cm & < 5 mitosis/50 hpf: Low
GIST: Treatment

• Surgery
• KIT kinase inhibitors
• Imatinib mesylate
  – 70-85% disease control
  – Increasingly faced resistance
• Sunitinib
Case 60

91-year-old male after automobile accident with chest wall/shoulder pain. No focal tenderness or reported pain in abdomen.
Case 60: What is the best treatment option for the small bowel finding?

1) Contrast small bowel follow through
2) Nasogastric tube & make patient “NPO”
3) Schedule surgery
4) No treatment needed
Case 60: What is the best treatment option for the small bowel finding?

1) Contrast small bowel follow through
2) Nasogastric tube & make patient “NPO”
3) Schedule surgery
4) No treatment needed
Case 61

61-year-old woman with cramps, left lower quadrant pain, and hematochezia.
Case 61: What is the MOST likely cause for the colon’s appearance?

1) Contrast artifact
2) Acute diverticulitis
3) Obstructing adhesion
4) Colon carcinoma
Case 61: What is the MOST likely cause for the colon’s appearance?

1) Contrast artifact
2) Acute diverticulitis
3) Obstructing adhesion
4) Colon carcinoma
Case 62

93-year-old man with a large ventral hernia, nausea, vomiting, and abdominal pain.
Case 62: What is the BEST test to diagnose diverticulitis?

1) Ultrasound
2) Barium enema
3) Enhanced CT
4) Enhanced MRI
Case 62: What is the BEST test to diagnose diverticulitis?

1) Ultrasound
2) Barium enema
3) Enhanced CT
4) Enhanced MRI
Case 63

49-year-old man with leukemia and right lower quadrant abdominal pain.
Case 63: The patient’s condition worsens, & days later the estimated GFR is 60. Which exam is contraindicated?

1) Enhanced MRI
2) Contrast CT
3) Colonoscopy
4) Water-soluble contrast enema
Estimated GFR (eGFR)

- Calculated value assessing renal function
- Radiologists alter contrast doses
  - Consider dose reduction when ≤ 60
  - Consider alternatives ≤ 30-40
- Based on:
  - Serum creatinine
  - Age, gender, weight
Nephrogenic Systemic Fibrosis (NSF)

- Risk following gadolinium MR contrast
  - 4.6% yearly, hospitalized patients with renal failure
  - 2 patients with eGFR 30-60
- Incidence end stage renal failure patients
  - eGFR< 15: 2.4%
- JACR review on NSF: 2008; 5:21-56
Typhlitis

- Life threatening, necrotizing enterocolitis
- Neutropenic colitis
- Most common with hematologic malignancies causing neutropenia on chemotherapy
- Common ileocecal region
Case 63: The patient’s condition worsens, & days later the estimated GFR is 65. Which exam is contraindicated?

1) Enhanced brain MRI
2) Contrast chest CT angiography
3) Colonoscopy
4) Water-soluble contrast enema
Case 64

28-year-old woman on antibiotics with flank pain, bacteruria, and leukocytosis.
Case 64: What is the MOST likely explanation for the renal findings?

1) Acute pyelonephritis
2) Chronic pyelonephritis
3) Xanthogranulomatous pyelonephritis
4) Emphesematous pyelonephritis
Case 64: What is the MOST likely explanation for the renal findings?

1) Acute pyelonephritis
2) Chronic pyelonephritis
3) Xanthogranulomatous pyelonephritis
4) Emphesematous pyelonephritis
Case 65

42-year-old male had right lower back pain and facial drooping and then fell from a roof.
Case 65: What is the MOST likely explanation for the renal findings?

1) Acute pyelonephritis
2) Polyarteritis Nodosa
3) Cortical infarcts
4) Lacerations
Case 65: What is the MOST likely explanation for the renal findings?

1) Acute pyelonephritis
2) Polyarteritis Nodosa
3) Cortical infarcts
4) Lacerations
Case 66

67-year-old female with adenopathy on physical exam.
Case 66:
What percentage of lymphoma patients present with renal involvement?

1) 5%
2) 25%
3) 50%
4) 75%
Case 66: What percentage of lymphoma patients present with renal involvement?

1) 5%
2) 25%
3) 50%
4) 75%
Case 67

52-year-old male with hematuria and abnormal ultrasound.
Case 67:
What is the most common etiology of a solid renal tumor?

1) Clear cell tumor
2) Renal lymphoma
3) Renal angiomyolipoma
4) Transitional cell carcinoma
Renal Cell Carcinoma
Renal Cell Carcinoma

- 3% adult malignancies
- 90-95% of tumors arise from kidneys
  - Epithelial cells proximal tubules
- Associated Von Hippel-Lindau disease
- Subtypes:
  - Clear cell
  - Sarcomatoid
  - Rhabdoid
5 year survival rates

- Stage I 94%
- Stage II 79%
- Stage III 18%
- Stage IV: 0-20%
- Renal vein involvement common
  - may not markedly worsen prognosis (25-50%)
Case 67: What is the most common etiology of a solid renal tumor?

1) Clear cell tumor
2) Renal lymphoma
3) Renal angiomyolipoma
4) Transitional cell carcinoma
Case 68

45-year-old female with hematuria and flank pain.
Case 68:
In the type of mass demonstrated, what is its most characteristic feature?

1) Contrast enhancement
2) Rapid contrast washout
3) Lack of calcification
4) Negative Hounsfield measurement
Case 68:
In the type of mass demonstrated, what is its most characteristic feature?

1) Rapid contrast washout
2) Lack of calcification
3) Negative Hounsfield measurement
4) Water density Hounsfield measurement
Case 69

72-year-old female with fevers and chronic renal insufficiency.
Case 69: What is the MOST common site of origin for carcinoid tumors?

1) Stomach
2) Small Bowel
3) Mesentery
4) Lung
Case 69: What is the MOST common site of origin for carcinoid tumors?

1) Stomach
2) Small Bowel
3) Mesentery
4) Lung
Case 70

45-year-old female with abdominal swelling.
Case 70:
What is the MOST likely cause for the findings?

1) Pseudomyxoma peritonei
2) Complicated pancreatitis
3) Metastatic ovarian carcinoma
4) Metastatic adenocarcinoma
Pseudomyxoma peritonei
Case 70:
What is the MOST likely cause for the findings?

1) Pseudomyxoma peritonei
2) Complicated pancreatitis
3) Metastatic ovarian carcinoma
4) Metastatic adenocarcinoma
Case 71

69-year-old woman with abnormal pelvic ultrasound.
Case 71:
The fat-fluid level containing mass is most likely related to which of the following?

1) Dermoid
2) Mucinous ovarian tumor
3) Endometrioma
4) Hemorrhagic corpus luteum cyst
Case 71:
The fat-fluid level containing mass is most likely related to which of the following?

1) Dermoid
2) Mucinous ovarian tumor
3) Endometrioma
4) Hemorrhagic corpus luteum cyst
Case 72

33-year-old woman with cervical mass and decreased urine output.
Case 72: What is the utility of PET in cervical cancer?

1) Evaluate mediastinal node
2) Assess uterine contents
3) Exclude omental disease
4) Identify occult pelvic lymph node involvement
Case 72: What is the utility of PET in cervical cancer?

1) Evaluate mediastinal node
2) Assess uterine contents
3) Exclude omental disease
4) Identify occult pelvic lymph node involvement
Right Hydronephrosis
Case 73

56-year-old woman with a pelvic mass and abnormal ultrasound.
Case 73:
What is the MOST common cause of primary uterine malignancies?

1) Leiomyosarcoma
2) Clear cell tumor
3) Adenocarcinoma
4) Papillary carcinoma
Case 73:
What is the MOST common cause of primary uterine malignancies?

1) Leiomyosarcoma
2) Clear cell tumor
3) Adenocarcinoma
4) Papillary carcinoma
Uterine Carcinomas

- 95% are cancers of endometrium
- Only 3% cancer deaths
- 70-75% women diagnosed stage I
- CA 125 used as a marker
  - > 40 has 78% sensitivity for nodal metastases
- CT useful assess disease extent
- PET complements CT
Case 74

18-year-old woman, previously healthy, with missed abortion 13 weeks ago. Large masses seen on pelvic ultrasound.
Case 74:
What is the most likely explanation for the findings?

1) Pregnancy
2) Missed abortion
3) Polycystic ovarian disease
4) Gestational trophoblastic disease
Check the pregnancy test:

- BHC = 855,058
Case 74:
What is the most likely explanation for the findings?

1) Pregnancy
2) Missed abortion
3) Polycystic ovarian disease
4) Gestational trophoblastic disease
Gestational Trophoblastic Disease

• Hydatiform Mole – Partial & Complete
  – Molar pregnancy
  – Suction curettage
  – Monitor HCG weekly for plateau or spike
  – Risk HCG > 100,000
  – Requires chemotherapy if occurs

• Placental site trophoblastic tumor

• Choriocarcinoma

• Gestational neoplasia
Case 75

67-year-old man with an abdominal aortic aneurysm and elevated PSA.
Case 75:
What is the MOST likely diagnosis for the pelvic findings?

1) Hematoma
2) Radiation change
3) Primary bladder cancer
4) Metastatic disease
Case 75: What is the MOST likely diagnosis for the pelvic findings?

1) Hematoma
2) Radiation change
3) Primary bladder cancer
4) Metastatic disease
Bladder Cancer

• Subtypes:
  • Transitional cell carcinoma: 90%
  • Squamous cell cancer: 3-8%  
    – World wide 75%
    – Inflammation
    – bladder stones, persistent catheters, schistosomiasis
  • Adenocarcinoma: 1-2%
Thanks to:

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Honggang Liu, M.S.
Michelle McNamara, M.D.

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