BILIARY TRACT MALIGNANCIES:
Diagnosis and Staging

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OBJECTIVES

- Review the imaging findings of cancer of the gallbladder and cholangiocarcinoma
- Applications of MDCT, MR, MRCP, PET/CT in the staging of these neoplasms
- Suggest practice guidelines to promote early detection in high risk individuals
GALLBLADDER CARCINOMA EPIDEMIOLOGY

- 6th most common GI malignancy
- F:M 2.5-3 to 1 ratio
- Peak incidence 7th decade of life
- At autopsy, GB cancer accounts for 1-5% of malignancies with 20% being asymptomatic
- 5 year survival ~ 5%
GALLBLADDER CARCINOMA

EPIDEMIOLOGY

• Highly lethal cancer because anatomic factors promote early spread of tumor
• Median survival is 6 months indicating that most patients present with advanced tumor
• Early diagnosis is rare because there are no specific S+S of GB cancer
GALLBLADDER CANCER: RISK FACTORS

- Gallstones
- Female gender
- Age
- Smoking
- Choledochal cysts
- Sclerosing cholangitis

- Ethnic origin: Native Americans, Israelis, Chile, Northern Japan
- Obesity
- Typhoid infection
- Chemical exposure
GALLBLADDER CANCER PATHOGENESIS

- > 90% coexistent chronic cholecystitis and stones
- More common with 1 large stone rather than multiple smaller stones
- Gallstones > 3cm in size have a 10X increased risk of GB cancer
- GB cancer found in 27% of patients having surgery for Mirrizi syndrome compared to 1-2% for other indications
CHOLELITHIASIS

- 48 million Americans with gallstones
- 850,000 cholecystectomies annually
- 2,000 GB cancers found in specimens
- ~ Carcinoid in appendicitis
GALLBLADDER CANCER: PORCELAIN GALLBLADDER

Nearly 30% will have gallbladder cancer. Tend to have a poor prognosis because of liver invasion.
GALLBLADDER MASS
SEEN ON US: DDx

- Stone
- Cholesterol polyp
- Adenomyomatosis
- Tumefactive sludge
- Gallbladder cancer
- Congenital fold or septum
- Mets, adenoma, ectopic pancreas, hematoma
• GB polyps > 1cm are most likely to become malignant and are an indication for cholecystectomy
GALLBLADDER CANCER:
SITE OF ORIGIN

- 60% FUNDAL
- 30% BODY
- 10% NECK
**UNIQUE ANATOMIC FEATURES OF THE GALLBLADDER**

<table>
<thead>
<tr>
<th>Feature</th>
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<tbody>
<tr>
<td>Mucosa</td>
</tr>
<tr>
<td>Lamina propria</td>
</tr>
<tr>
<td>Smooth m layer</td>
</tr>
<tr>
<td>No musc mucosa</td>
</tr>
<tr>
<td>No submucosa</td>
</tr>
<tr>
<td>No serosa along hepatic surface</td>
</tr>
<tr>
<td>Perimusc CT of GB continuous with interlobular CT of the liver</td>
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</table>
GALLBLADDER CANCER: PATTERNS OF PRESENTATION

- Focal or diffuse mural thickening
- Intraluminal polypoid mass > 2cm
- Subhepatic mass replacing or obscuring the gallbladder
CARCINOMA WITH MURAL THICKENING: US

- Early diagnosis is difficult because of the small size of early masses and subtle wall thickening with CA can be obscured by gallstones
- Wide DDx of far more common disorders
DIFFERENTIAL DIAGNOSIS OF MURAL THICKENING

- Inadequate distention
- Acute and chronic cholecystitis
- Hepatitis, pancreatitis, R pyelonephritis
- Hyperplastic cholecystoses
- Low protein states
- Portal hypertension
GALLBLADDER CANCER:
PATTERNS OF PRESENTATION

- Focal or diffuse mural thickening
- Intraluminal polypoid mass > 2cm
- Subhepatic mass replacing or obscuring the gallbladder
Carcinoma as a Gallbladder Foossa Mass

- Most common presentation
- May be difficult to separate mass from liver on imaging
- Absence of a clearly distinct gallbladder and the presence of stones are clues
- Inhomogeneous enhancement following IV contrast on CT and MR.
- Internal necrosis on CT and MR
PATHWAYS OF TUMOR SPREAD

- Direct invasion of the liver, duodenum, colon and hepatoduodenal ligament
- Periportal and peripancreatic LAD
- Intraductal tumor extension
- Metastases to peritoneum
RESECTABILITY ASSESSMENT: GALLBLADDER CANCER

PATIENT FACTORS
- Age
- Medical condition
- Liver status
- Renal function
- Nutrition
- Sepsis

TUMOR FACTORS
- Liver invasion
- Colonic invasion
- Duodenal invasion
- Vascular invasion
- Liver metastases
- Peritoneal metastases
- Distant metastases
STAGING GALLBLADDER CANCER: NEVIN’S CRITERIA

- **Stage 1**: Mucosal involvement only
- **Stage 2**: Extension into muscularis
- **Stage 3**: Extension into serosa
- **Stage 4**: Involvement of regional LN
- **Stage 5**: Involvement of liver
<table>
<thead>
<tr>
<th>Staging</th>
<th>1 year survival</th>
<th>5 year survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE I</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>STAGE II</td>
<td>87</td>
<td>56</td>
</tr>
<tr>
<td>STAGE III</td>
<td>53</td>
<td>15</td>
</tr>
<tr>
<td>STAGE IV</td>
<td>58</td>
<td>16</td>
</tr>
<tr>
<td>STAGE V</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>
CHOLANGIOCARCINOMA

- 10-15% of hepatobiliary neoplasms
- 1/3 ICC, 2/3 ECC; 1.5-2:1, M:F; 6th decade
- 0.32→0.85/100,000 ICC 70s-90s in US
- 1.08→0.82/100,000 ECC 70s-90s in US
- Highest incidence in Thailand 96/100,000 ♂
  36/100,000 ♀
- ICC: 5 year survival < 5%
- ECC: 5 year survival ~ 15%
CHOLANGIOCARCINOMA: RISK FACTORS

- Age > 65
- PSC
- Liver flukes
  - *Opisthorchis viverrini*
  - *Clonorchis sinensis*
- Caroli’s disease
- Choledochal cysts
- BD adenoma and biliary papillomatosis
- Hepatolithiasis
- Cirrhosis
- Surgical biliary and enteric drainage
- Dioxin, vinyl chloride
**BENIGN vs MALIGNANT BILIARY STRICTURES**

- Smooth vs irregular margins
- Asymmetric vs symmetric narrowing
- Abrupt vs gradual tapering
- Presence or absence of double duct sign
INTRAHEPATIC CHOLANGIOCARCINOMA

- 1/3 - 1/5 OF ALL PRIMARY HEPATIC NEOPLASMS
- 2\textsuperscript{nd} MOST COMMON PRIMARY AFTER HCC
- 10\% OF ALL CHOLANGIOCARCINOMAS
- 6\textsuperscript{th} DECADE; M>F
• Delayed phase contrast enhancement correlates with the amount of fibrous stroma and frequency or perineural invasion.

• Tumors with > 2/3 delayed enhancement have a poorer prognosis than those with < 2/3 delayed enhancement.
INTRAHEPATIC CHOLANGIOCARCINOMA

81.8% of patients with severe stromal fibrosis showed markedly delayed hyperenhancement.

None of patients without stromal fibrosis showed hyperenhancement.

Valls Abdom Imag 25: 490-496, 2000
BISMUTH CLASSIFICATION OF HILAR CHOLANGIOCARCINOMAS

- **Type I**  Within CHD
- **Type II**  R and L HD
- **Type IIIa**  R $2^{nd}$ intra-hepatic duct
- **Type IIIb**  L $2^{nd}$ intra-hepatic duct
- **Type IV**  Bilateral $2^{nd}$ intrahepatic BD
PERIAMPULLARY CANCERS
ARISE WITHIN 2 CM FROM MAJOR PAPILLA

- Ampullary cancer
- Cholangiocarcinoma
- Pancreatic cancer
- Duodenal cancer
CHOLANGIOCARCINOMA STAGING

- 74.5% accuracy for prediction of resectability for hilar cholangiocarcinoma
- Arterial invasion 92.7%
- Portal vein invasion 85.5%
- Extent ductal involve 84.0%
- LN involvement 27.0%

Lee Radiology 239: 113-121, 2006
Efficacy of chemotherapy and external beam radiation therapy is dubious.

Surgery or liver transplantation offer the only opportunity for cure.

Most patients have either unresectable tumor or have other comorbidities that mitigate against surgery.

Palliative therapy: stenting and photo-dynamic treatment (laser therapy after a photsensitizer).
CHOLANGIOCARCINOMA: PET/CT

- PET/CT valuable for detecting unsuspected metastases
- PET/CT found 12/12 mets vs CT which found only 3/12

Anderson J Gastrointest Surg 8: 90-97, 2004
CHOLANGIOCARCINOMA:
UNRESECTABILITY CRITERIA

- Bilobar involvement
- Both hepatic ducts involved
- Adenopathy
- Perivascular fat plane invasion
- Encasement or occlusion of major vessel
- Invasion of adjacent organs
- Ascites
- Peritoneal metastases
- Unilateral vascular involvement and extensive contralateral tumor spread
# CHOLANGIOCARCINOMA: SURVIVAL

<table>
<thead>
<tr>
<th>Location</th>
<th>Resectability Rate</th>
<th>Resectable Med survival</th>
<th>Unresectable Med survival</th>
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<tbody>
<tr>
<td>Intrahepatic</td>
<td>15-20%</td>
<td>18-30 mo</td>
<td>7 months</td>
</tr>
<tr>
<td>Perihilar</td>
<td>--</td>
<td>8 months</td>
<td>5 months</td>
</tr>
<tr>
<td>Distal</td>
<td>50%</td>
<td>24 months</td>
<td>8 months</td>
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CONCLUSIONS

- Biliary tract neoplasms are uncommon but lethal neoplasms
- Surgery or transplantation offer the only chance for survival
- Improved survival will only come with earlier detection or breakthroughs in chemotherapy
WHAT CAN WE DO?

- Be less dismissive of GB polyps
- Investigate patients with WES sign
- Warning about stones > 3cm
- Alert surgeons about CA risk in Mirrizi’s
- Serial imaging in PSC and choledochal cysts: baseline PET?