The Biliary Cystadenoma: Evolving and Updated

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Disclosures

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Biliary Cystadenoma (BCA) – How common?

- Approximately **5-10%** of patients have hepatic cysts for which most are simple cysts.
- ~**5%** of all hepatic cysts are a **biliary cystic tumor (BCT)**
  - Biliary cystic tumors include BCAs, biliary cystadenocarcinomas (BCACs), and intraductal papillary mucinous neoplasms (IPMNs).
- Majority arise from the intrahepatic biliary ducts while a minority, ~**10%**, are found in the extrahepatic ducts.
BCA – What is it?

- Hypothesized to develop from embryonic ectopic rests of bile ducts
- However, since ~50% of BCAs contain endocrine cells then the origins may be from intrahepatic peribiliary glands
- Solitary, multilocular cystic lesions containing mesenchymal stroma
  - Epithelial mucin-producing layer, undifferentiated mesenchymal cells beneath the epithelium, and a fibrous, collagenous connective tissue layer
BCA – Mostly Females

- Classically, BCAs have ovarian-type stroma with expression of estrogen and progesterone receptors, which accounts for the large female predominance
  - Mean age is ~ 40-45 years

- In those lacking the classic mesenchymal stroma, there is no sex predilection
BCA – New classification

- Biliary cystic tumors with *ovarian-like stroma* in the cyst wall *without biliary ductal communication* are now what has been advocated to be classified as BCA/BCAC
- Mucin production by BCA or BCAC is contained within the cystic tumor and does not enter the bile ducts
Intraductal papillary neoplasms of the Bile Ducts (IPNBs)

Biliary cystic tumors that demonstrate ductal communication and lack ovarian-like stroma are now classified as IPNBs and not as BCAs or BCACs

- Papillary or villous neoplasms project into the bile ducts by a fibrovascular stalk
  - Thought that mucinous retention leads to cystic dilatation of duct
- Counterpart to pancreatic intraductal papillary mucinous neoplasm (IPMN)
- Develop from biliary epithelium, progressing from low grade dysplasia to invasive carcinoma
- Only about 33% of biliary IPMNs demonstrate visible mucus production unlike pancreatic main duct IPMNs, which almost all show visible mucus
BCA

Plain film – US – CT – MRI

Mass Effect:

• Exerts mass effect on surrounding structures. Notice the subtle bulge of the left hepatic contour by the biliary cystadenoma (blue arrows)

• Also note thin septa (yellow arrows) creating polygonal shaped cysts
BCA
Plain film – US – CT – MRI

Cystic:
• Cystic lesions vary from anechoic to mild low-level echogenicity depending on hemorrhagic, mucin and proteinaceous content. Has through transmission

Septations:
• Multiple thin septations and mural nodularity (arrows)

Calcification in wall or septa:
• Thin wall or septum may demonstrate acoustic shadowing

Mass Effect:
• Exerts mass effect on surrounding structures, including adjacent viscera, can compress bile ducts causing duct dilatation
BCA
Plain film – US – **CT** – MRI

**Cystic:**
- Usually fluid density. However, can be hyperattenuating depending on degree of proteinaceous or hemorrhage content

**Septations:**
- Multiple thin septations and mural nodularity

**Enhancement:**
- Septations and mural nodules may enhance and cannot reliably be used to differentiate BCA from BCAC

**Calcification:**
- Thin within wall or septum

**Mass Effect:**
- Exerts mass effect on surrounding structures, including adjacent viscera if exophytic, can compress bile ducts causing duct dilatation

**Pearls:**
- We have not observed simple hepatic cysts coexisting in patients with BCA!
- Additional BCAs as well as other liver lesions may coexist. Note a hemangioma (**arrows**) adjacent to a BCA

6 patients
BCA
Plain film – US – CT – MRI

Cystic:
- Appearance variable on T1 and T2 weighted sequences depending on degree of proteinaceous or hemorrhage content

Septations:
- Multiple thin septations and mural nodularity

Enhancement:
- Septations and mural nodules may enhance and cannot reliably be used to differentiate BCA from BCAC

Mass Effect:
- Exerts mass effect on surrounding structures, including adjacent viscera if exophytic, can compress bile ducts causing duct dilatation
‘Cysts-in-cyst’ Appearance: Rad + Path Correlate

A classic BCA CT image of “cysts-in-cyst” appearance with dominant cyst and multiple internal cysts. It bulges liver cortex on CT and at surgery.

Note careful surgical removal, ensuring an intact resection of cyst.

Notice the removed specimen with multiple cysts (yellow arrows). The movie on next slide shows wall incision followed by incisions into successive cysts to evaluate for malignancy.
BCA - ‘Cyst-in-cyst’

- The wall of a BCA contains one or more germinal centers that produce cysts that enlarge and may contain more germinal centers (each making “bubble blowing” sites)
- See a tiny cyst forming inside a cyst growing inside another cyst (arrow)
- A BCA must be completely removed, marsupialization may allow recurrence
BCAs arise from bile duct epithelium. Intrahepatic ducts have far greater surface area than the common bile duct. Thus, most arise within the liver.

Involvement of intra- or extrahepatic bile ducts may be seen with resultant biliary ductal dilatation and associating filling defects on MRCP and/or ERCP images.
BCA: Bile Duct Involvement

- On ERCP note the BCA causing biliary ductal dilatation and bulging into and causing a filling defect extending down to cystic duct insertion (blue arrows)
- On CT, MRI, and MRCP see the cyst bulging into the common bile duct (yellow arrows)
Management

- **Complete surgical resection** with negative margins is necessary for BCTs. If appropriately resected, there is ~5-10% rate of recurrence.
- If a cyst is aspirated for a presumed simple cyst and rapidly recurs, then it was likely a BCA and misdiagnosed.
- Fine needle aspiration or core needle biopsy of a suspected BCA should be avoided due to possible pleural and peritoneal dissemination if it is a BCAC.
BCAs need to be completed resected, not drained or marsupialized, to prevent recurrence. Above is chronological depiction of what happens if a BCA is not completely removed. CT, MRI, and ERCP images exemplify characteristic ‘cyst-in-cyst’ appearance of a BCA, inappropriately treated initially with drainage. Subsequently it recurred and was treated correctly with complete resection.
Prognosis

- Overall survival for BCA is > 90% at 18 yrs
- Prognosis of BCAC is worse than BCA with a 5 yr survival rate of ~65-70% after complete resection. For incomplete resection, the 5 yr survival rate was ~36%

CTs (left and right) and T2W (middle) images of BCAs. Note the characteristic germinal centers (yellow arrows) and polygonal (non-circular) cysts (green arrows)
Biliary Cystadenocarcinoma (BCAC)

BCAC are thought to arise either de novo or from malignant transformation of a BCA. BCACs are more likely to have mural or septal nodularity or papillary components. However, imaging cannot reliably differentiate between the two.

An example of pathologically proven BCAC is seen below and to the right with enhancing mural nodularity, multiple septations with scattered calcifications, and fluorodeoxyglucose (FDG) avid mural nodules.
Potential Differentials

- IPNB
- Hydatid Cysts
- Cystic or necrotic neoplasms
  - Embryonal sarcoma
- Liver Abscesses
- Atypical simple cyst

- Post traumatic cyst
- Hemorrhagic cyst
Intraductal papillary neoplasms of the Bile Ducts (IPNBs)

To the right is a suspected IPNB with dilated bile ducts that were filled with mucin. Mucin drained from the T-tube with a T-tube study shown at the upper right.

Notice the dilated bile ducts on the CT (lower right) with a cystic lesion within the right hepatic lobe with an internal punctuate calcification (yellow arrow). The mucin production and presumed bile duct communication is suggestive of an IPNB.

Case courtesy of Ellen Wolf from Montefiore
Liver Abscess

The clinical presentation (including abdominal pain, fevers, chills, weight loss, and fatigue) are helpful at differentiating liver abscesses from BCAs.

Imaging findings that are more predictive of a liver abscess include peripheral hyperemia and foci of air.

To the right are images from the same patient with a liver abscess causing mass effect including near complete effacement of the gallbladder.
Epithelioid Hemangioendothelioma

Rare hepatic vascular tumor often multifocal and occasionally contain calcifications. Often are peripheral in location with subcapsular retraction due to tumor related fibrosis and hypertrophy of uninvolved surrounding parenchyma.

Ultrasound typically shows hypoechoic lesions but can be heterogeneous or hyperechoic.

CT often demonstrates scattered hypodense lesions, some of which may coalesce, with peripheral predominate distribution, capsular retraction, and peripheral enhancement like in this example on the right.

MRI will show T1 weighted hypointense lesions with heterogeneous to hyperintense T2 signal and peripheral enhancement.
Differentiating an hydatid cyst from BCTs may be difficult due to similar ‘cyst-in-cyst’ appearances.

Features that may help differentiate a hydatid cyst from BCAs include: right hepatic lobe preference, history of exposure in an endemic area, serology markers, serpiginous linear components from broken daughter cyst membranes, round morphology of the cysts rather than polygonal shape, multiplicity, lack of septa, and may contain internal debris.
Hydatid Cyst

- Big single cyst without septa
- Amorphous density
- Multiple
Summary

- BCA are multi-loculated, cystic tumors without biliary tree communication that has a female predilection if it has ovarian-like stroma
  - Cystic lesions with biliary tree communication that lack ovarian-like stroma are now preferentially called IPNB
- Entire resection of a BCA is necessary to lower the rate of recurrence
- BCAs may undergo malignant transformation into BCAC. However, BCACs may also occur de novo
  - Imaging cannot reliably differentiate BCA from BCAC