Differentiating hepatic Mucinous Cystic Neoplasms (MCNs) from Biliary Cysts (BCs): value of radiological findings and cyst classification according to internal complexity

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Authors: R. Cannella\textsuperscript{1}, A. Furlan\textsuperscript{2}, M. El Hag\textsuperscript{2}, A. Tsung\textsuperscript{2}, A. A. Borhani\textsuperscript{2}; \textsuperscript{1}Palermo/IT, \textsuperscript{2}Pittsburgh, PA/US
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Aims and objectives

Hepatic mucinous cystic neoplasms (MCNs), previously known as biliary cystadenomas or biliary cystadenocarcinoma, are rare tumors originating from the biliary duct system, most commonly occurring in middle-age women. The pre-operative diagnosis of hepatic MCNs is often challenging due to their rarity and heterogeneous imaging presentation. An accurate differentiation from the significantly more commonly encountered benign hepatic cysts (HCs) is important to select patients that may benefit from a radical surgical excision, due to the increased risk of malignant transformation.

Therefore, the main purpose of our study was to compare the imaging features, septa distribution and outcome of hepatic MCNs with hepatic cyst. We also attempt to classified the spectrum of imaging appearance of cystic lesions in different type according to the risk of being a MCNs.
Methods and materials

The institutional review board approved this HIPAA-compliant retrospective study which was performed in a tertiary high-volume center for the treatment of liver disease. The requirement for informed consent was waived.

Population

A search of the pathological records between January 2008 and July 2018 was performed in to identify patients meeting the following inclusion criteria: i) age ≥ 18 year; ii) at least one pathologically proven hepatic cystic lesions who underwent complete or partial resection; iii) presence of cross-sectional imaging (i.e. contrast-enhanced CT or MRI) performed within 6 months of lesion resection.

Imaging analysis

For each lesion the following imaging features were recorded by two abdominal radiologists: i) presence of biliary dilatation or perfusion abnormality adjacent to the cyst; ii) cyst density in HU (Hounsfield Unit) by drawing a region of interest in the largest cross section; iii) presence of septa, thickness (thick septa were scored if ≥ 2 mm), number (classified as multiple when >3), location, calcification and enhancement of the septa; iv) wall thickening (when the cyst wall was ≥ 2 mm), calcification and enhancement; v) presence of mural nodule (i.e. wall or septa solid nodule), intra-cystic debris (i.e. internal dependent debris not definitely related to blood products), hemorrhage (i.e. internal component with density or intensity typical of blood products) or daughter cyst (i.e. smaller cyst within the largest cyst). The internal septa were defined thick if measured more than 2 mm, otherwise they were classified as thin septa. An imaging feature was considered positive when it was seen in at least one imaging modality.

Each reader classified the cysts on each CT, MR or US studies according to the spatial distribution of internal septa and cystic internal complexity in 6 different types, ranging from type 0, when there were no septa of internal complexity, to type 5, characterized by multiple septa or wall thickening, calcifications or internal nodules.

Statistical analysis

Differences in frequencies of categorical variables, between MCNs and benign hepatic cysts, were assessed using the Pearson #2 or Fisher exact test. Differences in mean between continuous variables were evaluated using the independent samples t-test (age,
lesion size) or Mann-Whitney U test (density). Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated for the combination of the six most discriminative parameters.

Statistical significance level was set at p<0.05. Statistical analysis was conducted by using SPSS software (Version 20.0. Armonk, NY, USA: IBM Corp).
Results

Population

The final study population consisted of 224 patients (187 females, 37 males) with 224 cystic lesions. There were 189 patients (155 females, 34 males) with simple hepatic cyst and 35 patients (32 females, 3 males) with MCNs. Multiple cystic lesions were significantly more commonly associated to HCs compared to MCNs (n=139, 75.5% vs n=7, 20.0%, p<0.001). There was no significantly difference in predominant lobe location (p=0.702) or pre-operative imaging diagnostic test (p>0.627). In most instances, pre-operative imaging involved CT alone (n=101, 40.0%), whereas fewer patients underwent CT + US (n= 58, 25.9%) or CT + MRI (n= 21, 9.3%) and 23 (10.2%) patients were imaged with all three modalities.

Imaging features of MCNs vs HCs

Multiple imaging features were significantly different among HCs and MCNs. Biliary duct dilatation and perfusion abnormality were noted in 9 (25.7%) and 4 (11.4%) MCNs, respectively (p=0.001 and p=0.022). Internal septa were significantly more common in MCNs than in HCs (n=29, 82.9% vs n=79, 41.8%, p<0.001). Particularly, thick, multiple and central septa were most frequently seen in MCNs (p<0.001). On post-contrast images septa enhancement was registered in 19 (54.3%) MCNs and in 9 (4.8%) HCs (p<0.001). MCNs were significantly associated with the presence of wall thickening (p=0.022), wall enhancement (p=0.005), mural nodule (p=0.002) and daughter cyst (p=0.001). Contrariwise, intracystic hemorrhage was seen in 21 (11.1%) HCs and in none of MCNs (p=0.051).

The six most discriminative findings, biliary dilatation, presence of septa, septa enhancement, wall enhancement, mural nodule and daughter cyst were considered to assess the diagnostic accuracy. The combination of 2 or more of these imaging features had a sensitivity of 74.1%, specificity of 88.4%, PPV of 53.2% and NPV of 94.4% for the diagnosis of MCNs.

Septa classification

On CT images MCNs were most commonly classified as type 3 (n=10, 32.3%) or type 4 (n=10, 32.3%). Overall, 38%, 83% and 100% of the type 3, 4 and 5, respectively, were MCNs. On MR and US images the type 4 was also the most common presentation of MCN
occurring in 56.6% (n=5) and 33.3% (n=3) of cases, respectively. Overall the diagnosis of MCNs was made in 56% of type 4 lesions on MR and 44% on US.
Fig. 1: Axial non-contrast CT scan showing MCNs with multiple internal septa.

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Fig. 2: MRI on T2-weighted imaging demonstrating MCNs with multiple internal septa.

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Fig. 3: Axial contrast-enhanced CT shows MCNs with multiple internal septa and with enhancement on portal-venous phase.

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Conclusion

In conclusion, biliary dilatation, presence of septa, septa enhancement, wall enhancement, mural nodule and daughter cyst were the most discriminative findings for differentiate a MCNs form a non-neoplastic HCs. The classification of cystic lesions according to the septa may be helpful to improve the radiological diagnosis of indeterminate hepatic cyst.
Personal information

Roberto Cannella

Abdominal Imaging Division, Department of Radiology, University of Pittsburgh, 200 Lothrop street, Pittsburgh, PA 15213, USA

Section of Radiology - Di.Bi.Med., University Hospital "Paolo Giaccone", Via del Vespro 127, 90127 Palermo, Italy

e-mail: rob.cannella89@gmail.com
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