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Recommendations for the Management of Incidental Hepatobiliary Findings in Adults: Endorsement and Adaptation of the 2017 and 2013 ACR Incidental Findings Committee White Papers by the Canadian Association of Radiologists Incidental Findings Working Group

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Abstract

The Canadian Association of Radiologists Incidental Findings Working Group consists of both academic subspecialty and general radiologists and is tasked with adapting and expanding upon the American College of Radiology incidental findings white papers to more closely apply to Canadian practice patterns, particularly more comprehensively dealing with the role of ultrasound and pursuing more cost-effective approaches to the workup of incidental findings without compromising patient care. Presented here are the 2020 Canadian guidelines for the management of hepatobiliary incidental findings. Topics covered include initial assessment of hepatic steatosis and cirrhosis, the workup of incidental liver masses identified on ultrasound and computed tomography (with algorithms presented), incidental gallbladder findings (wall thickening, calcification, and polyps), and management of incidental biliary dilatation.

Résumé

Le groupe de travail sur les découvertes fortuites de l'Association canadienne des radiologistes regroupe à la fois des universitaires spécialisés et des radiologistes généralistes. Sa tâche consiste à adapter et à développer les livres blancs sur les découvertes fortuites de *l'American College of Radiology* pour les rendre plus proches et utiles aux modes de pratiques canadiennes, notamment en traitant de façon plus complète la place des ultrasons et en poursuivant des démarches plus rentables dans l'exploration des découvertes fortuites, sans compromettre les soins aux patients. Nous vous présentons ici les lignes directrices canadiennes 2020 pour la gestion des découvertes hépatobiliaires fortuites. Les thèmes abordés incluent l'évaluation initiale d'une stéatose et d'une cirrhose hépatique, le bilan exploratoire des masses hépatiques découvertes fortuitement à l'échographie et à la tomodensitométrie (avec présentation d'algorithmes), les découvertes fortuites concernant la vésicule biliaire (épaississement de la paroi, calcification et polypes), ainsi que la gestion de la découverte fortuite d'une dilatation des voies biliaires.

Keywords

incidental findings, hepatic, biliary, hepatobiliary, management

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In 2018, the CAR Incidental Findings Working Group was formed and tasked with either adapting preexisting American College of Radiology (ACR) guidelines to meet the concerns of the CAR membership or authoring new recommendations. The main focus of the working group was to expand upon the body of work produced by the ACR on the management of incidental imaging findings.[1] The CAR Working Group initially tackled the problem of incidental renal masses and produced their first paper in 2019, an endorsement and adaptation of the 2017 ACR Incidental Findings Committee white paper on the incidental renal mass in adults.[2,3] This initial article by the CAR Working Group expanded the use of ultrasound (US) in the management of the incidental renal mass in order to reduce radiation exposure to patients and provide more cost-effective care in the Canadian medical system, where access to computed tomography (CT) and especially magnetic resonance imaging (MRI) can often be limited.

The consensus of the Working Group was that management of incidental hepatobiliary findings was the next logical topic to pursue as it was felt that there was again a need to expand the role of US beyond the previously published guidelines by the ACR.[4] A need was identified for an additional flowchart detailing the management of the incidental liver mass discovered on US.

The Working Group consists of both academic subspecialty and general radiologists and includes the primary author of the 2013 ACR white paper. The ACR white papers were reviewed and areas of discrepancy with Canadian practice patterns, difficulties in following the guidelines as written, or areas in which an alternative approach was more cost-effective were evaluated. In order to support any changes, a literature database in the cloud was established consisting of the references used by the ACR committees, and additional papers were added which had become available since those publications providing supporting evidence of any proposed changes. The literature review demonstrated that the 2017 ACR papers remain the most comprehensive practice recommendations for the incidental liver mass. More recent European practice management recommendations for gallbladder (GB) polyps have been released[5] and were included in the literature review. Any and all changes to the ACR papers were discussed as a group for consensus. A draft of the article was posted on the CAR website for membership feedback prior to submission for publication and all member comments were addressed prior to article submission.

The Working Group again wishes to acknowledge the preexisting work of the ACR Incidental Findings Committee and presents this document as an endorsement and adaptation of their white paper, building on the foundations the ACR has previously laid out. While the flowcharts and tables presented are based on the best available scientific evidence, there are still significant gaps in the literature, and ultimately these flowcharts represent consensus recommendations rather than a fully evidence-based standard of care.

Parenchymal Liver Disease

Steatosis

Liver steatosis is critical for the radiologist to recognize, as it allows them to distinguish between common pseudo masses produced by areas of focal fatty change or deposition from true incidental liver masses. Today, liver biopsy and histologic analysis are still considered the gold standard for grading steatosis,[6] but a rapid assessment and grading can be accomplished with US. The presence of diffuse increased echogenicity of the liver, increased discrepancy between the echogenicity of the liver and adjacent kidney, and loss of echogenic walls of the portal triads are considered signs of steatosis.[6] Although subjective visual assessment of steatosis has wide inter- and intra-observer variability[7] and modest sensitivity and specificity,[8,9] a semi-qualitative grading should be attempted. A simple rule of thumb to grade steatosis on US is:

1. mild – diffuse increase echogenicity throughout the liver but still good penetration through the liver,
2. moderate – diffuse increase in echogenicity, decreased through transmission, and poor visualization of portal triads and hepatic architecture but the diaphragm can still be distinguished from the liver, and
3. severe – all of the above, but the diaphragm cannot be visualized.[7,10,11]

The hepatorenal index is an alternative method for grading hepatic steatosis on US, where the echogenicity of the liver is compared with adjacent kidney and a ratio >1.28 is 100% sensitive for significant steatosis,[12,13] although this method is often more time-consuming and not widely used in clinical practice.

The CT criteria for diagnosing hepatic steatosis on noncontrast examinations are the following: absolute liver attenuation less than 40 Hounsfield units (HU), liver attenuation 10 HU less than the spleen attenuation, and a liver to spleen attenuation ratio of less than 1. On portal venous phase contrast-enhanced CT examinations, the criteria for steatosis are liver attenuation 20 HU less than the spleen.[14,15] Accurate diagnosis of steatosis on arterial phase contrast-enhanced CT is limited due to normal heterogenous liver parenchymal enhancement.

Cirrhosis

Liver cirrhosis is a progressive chronic disease characterized by liver fibrosis,[16] and although liver biopsy is still considered the gold standard, specific features on US, CT, and MRI can be used to diagnose, or at least suspect, underlying cirrhosis. Patients with cirrhosis are at increased risk of hepatic malignancy, primarily hepatocellular carcinoma. Recognizing the multimodality imaging features of cirrhosis is critically important in the management of an incidental liver mass. The presence of cirrhosis may also be incidentally detected on routine imaging, automatically placing the patient in the high-risk category. The morphologic changes of the liver are directly related to the severity of the cirrhosis.[16] Early signs of cirrhosis include

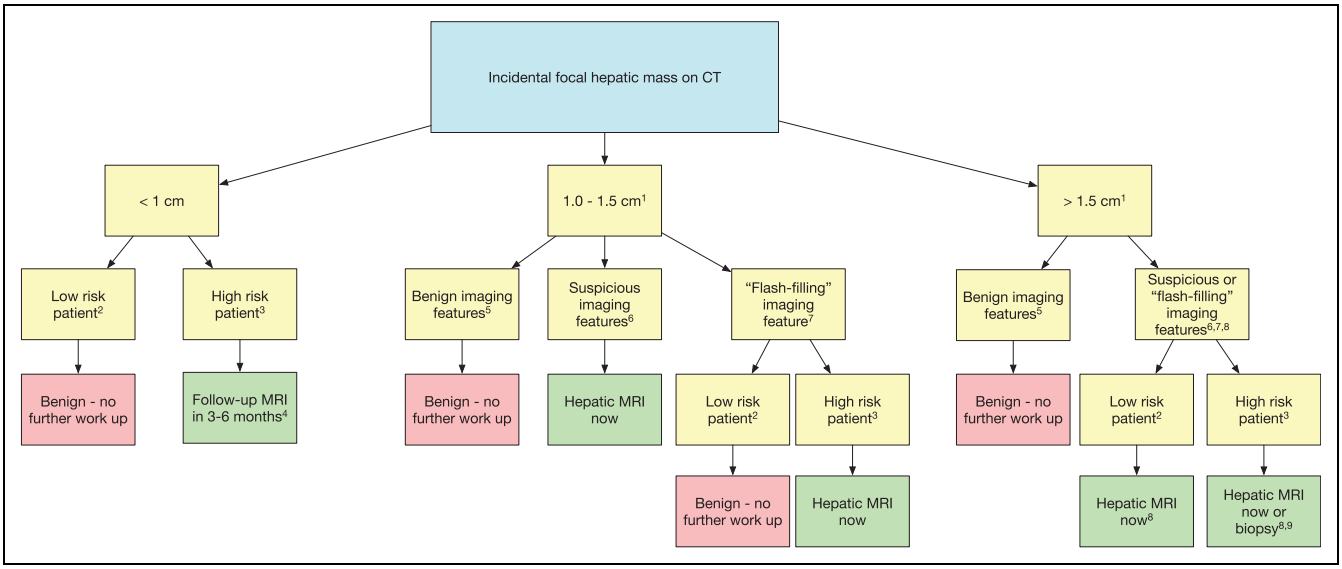

Figure 1. Incidental liver mass on CT. [1]If inadequate imaging is available to ascertain the presence of benign versus malignant features in a ≥ 1 cm mass, MRI is advised. [2]Low-risk patient: no known primary malignancy or hepatic risk factors (cirrhosis, hepatitis, alcoholism, nonalcoholic steatohepatitis, sclerosing cholangitis, primary biliary cirrhosis, choledochal cyst, hemochromatosis and other hereditary hepatic conditions, anabolic steroid use, or elevated tumor markers). [3]High-risk patient: history of malignancy or hepatic risk factors as previously defined. [4]Follow-up MRI in 3 to 6 months. May need shorter term follow-up in some scenarios. Computed tomography follow-up is also acceptable in a patient with cancer who is due for routine CT surveillance. [5]Benign features: sharp well-defined margin, homogeneous low attenuation (≤ 20 HU) and characteristic features of hemangiomas, FNH, focal fatty sparing or deposition, or perfusional changes. If pseudoenhancement is present, a benign cyst may measure > 20 HU; radiologist discretion is necessary. [6]Suspicious features: ill-defined margins, heterogeneous density, mural thickening or nodularity, thick septa, and intermediate to high attenuation on portal venous phase imaging (> 20 HU in the absence of pseudoenhancement). If both pre- and postcontrast CT is available, enhancement > 20 HU is a suspicious feature. Magnetic resonance is recommended to evaluate. [7]"Flash-filling" feature: uniform hyperenhancement relative to hepatic parenchyma on arterial phase (including late arterial/early portal venous phase) postcontrast imaging. If additional postcontrast phases are available to characterize the lesion as benign (eg, hemangioma) or suspicious (eg, hepatocellular carcinoma) the lesion should be placed in one of those respective categories and not here. [8]Incidental hepatic lesions that are > 1.5 cm and do not have benign features should undergo prompt MRI. Direct biopsy (without MRI) may be appropriate in some scenarios. Differentiation of FNH from adenoma is important, especially if larger than 3 cm and subcapsular in location; for such patients, MRI with gadoxetate disodium is recommended. [9]If biopsy is pursued, core biopsy is preferred over fine needle aspiration. CT indicates computed tomography; FNH, focal nodular hyperplasia; MRI, magnetic resonance imaging.

widening of the porta hepatis, interlobular fissure, and pericholecystic space.[17] These subtle changes are more easily detected on CT or MRI, especially enlargement of the periportal fat greater than 1 cm measured between the anterior wall of the right portal vein and the posterior edge of the medial segment of the left hepatic lobe.[18,19] Segmental hypertrophy of the lateral segments II/III of the left hepatic lobe and caudate lobe, and segmental atrophy of the medial segment IV of the left hepatic lobe and posterior segments VI and VII of the right hepatic lobe are late findings of cirrhosis, best appreciated on CT or MRI.[16,20] Lacelike or reticular enhancement and confluent hepatic fibrosis (wedge-like areas of delayed hyperenhancement) are other features seen on post contrast CT or MRI[20] in later stages of cirrhosis.

On US, the most common detectable feature is surface nodularity reflecting macro regenerative nodules and fibrous septa, but other features such as regenerative nodules displacing vessels or accentuated hyperechoic portal triads causing a "coarsened hepatic echotexture" can also be seen.[21] Assessment with a high-frequency linear probe with the storage of cinematic clips can help discern early subtle fibrotic changes to the liver surface. An enlarged portal vein (>13 mm), splenomegaly, portal systemic varices, and ascites are all signs of portal hypertension which would lead one to suspect underlying cirrhosis.[20-22] The diameter of main portal vein can vary widely between normal subjects and care must be taken not to suggest portal hypertension when a dilated portal vein is seen in isolation.[23] Elevated hepatic artery velocities (>120 cm/s) can also be seen in cirrhosis,[22] though acute biliary pathology can also cause elevated hepatic artery velocities.[24]

Hepatic steatosis and cirrhosis are the most commonly encountered incidental parenchymal disease on US and CT, and the Working Group has elected not to provide specific management recommendations because the management may vary significantly in the various local and regional practices across Canada. The reporting radiologist may wish to include the incidental parenchymal finding in their radiology report impression, as it may lead to important lifestyle changes for the patient. The evaluation of the background liver parenchyma is important for the management of the incidental liver mass discussed below.

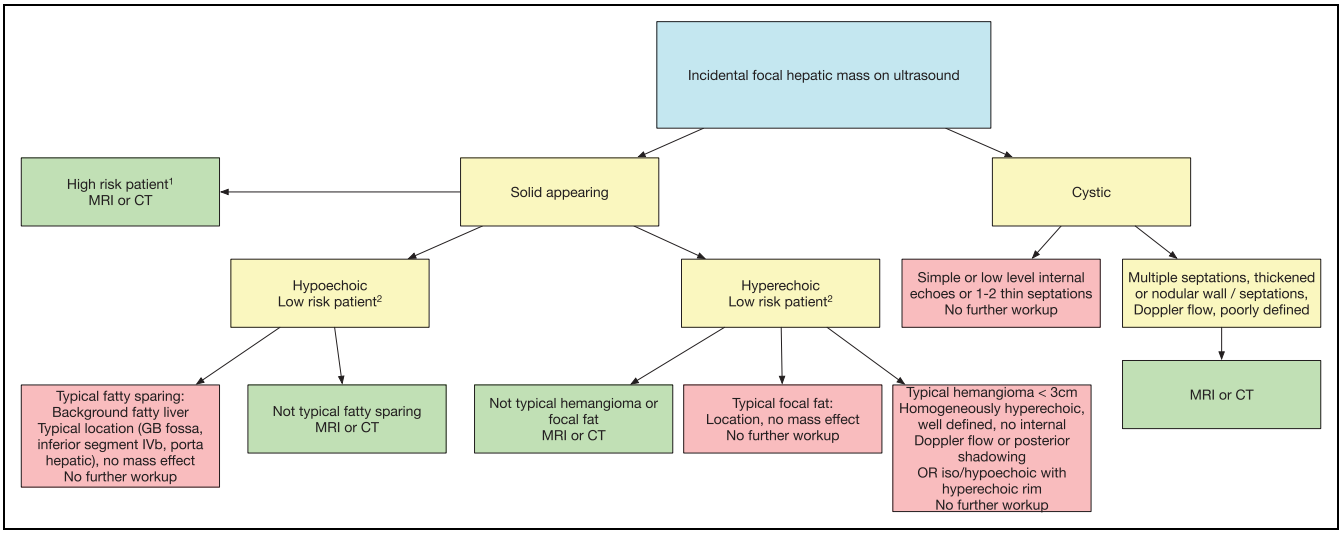

Figure 2. Incidental liver mass on ultrasound. [1]Low-risk patient: no known primary malignancy or hepatic risk factors (cirrhosis, hepatitis, alcoholism, nonalcoholic steatohepatitis, sclerosing cholangitis, primary biliary cirrhosis, choledochal cyst, hemochromatosis and other hereditary hepatic conditions, anabolic steroid use, or elevated tumor markers). [2]High-risk patient: history of malignancy or hepatic risk factors as previously defined.

Incidental Liver Masses

An incidental liver mass is any hepatic mass that is identified in a patient imaged for an unrelated reason.[4] Such lesions are common, found in 10% to 33% of all patients imaged, ranging from those otherwise healthy to those at higher risk of having a malignant liver mass (eg, history of cancer or cirrhosis).[25-31] The overwhelming majority of these incidental masses are benign, especially in a low risk patient, and even in oncology patients 50% to 80% of small incidental liver masses are benign.[29,31-36] The risk that an incidental hepatic mass is malignant increases with age or in the setting of a known malignancy with high propensity to metastasize to the liver, such as colorectal or pancreatic cancer.[37,38] The 2017 ACR white paper was created as a tool to help manage incidental liver masses appropriately, attempting to avoid overdiagnosis and expensive follow-up of typically benign incidental masses while still diagnosing clinically significant masses.[4] The CAR incidental working group aims to adapt these guidelines to better fit in the Canadian health care system and expand on the management of the incidental liver mass found on US.

Considerations Applicable to All Flowcharts

These flowcharts (Figures 1 and 2) are intended for adults who are 18 years of age or older and should not be applied to individuals who have a known liver mass for which the initial CT or US was requested to evaluate. Whenever possible, the patient's previous imaging should be reviewed to confirm the lesion is new. Knowledge of the patient's clinical history is paramount when assessing an incidental liver mass in order to place the patient in either a low- or high-risk group stratification, changing the management paradigm of the lesion. The reader is strongly encouraged to be familiar with the reporting considerations outlined in the ACR 2017 White Paper for management of incidental liver masses (Table 1). It is generally accepted that incidental masses discovered on abdominal contrast-enhanced MRI for other reasons (ie, workup of a renal mass) can be adequately assessed at that time as either benign or malignant without the aid of these recommendations. Noncontrast MRI imaging such as magnetic resonance cholangiopancreatography, is often insufficient to accurately diagnose incidental liver lesions. Furthermore, these recommendations are for managing the incidental liver lesion found on abdominal CT or US and may not be applicable to the management of an incidental liver lesion seen on a nontailored examination (eg, breast MRI or CT chest).

Risk Factors

When dealing with an incidental liver mass on any modality such as US, CT, or MRI, clinical history is vitally important to categorize the patient as either high or low risk, as this will aid in the application of the proposed flowcharts. High-risk patients are those with a current or prior history of malignancy (particularly, those that commonly metastasize to the liver), cirrhosis, and hepatic risk factors.[4,39] Hepatic risk factors include hepatitis, alcoholism, nonalcoholic steatohepatitis, sclerosing cholangitis, primary biliary cirrhosis, choledochal cyst, hemochromatosis and other hereditary hepatic conditions, and anabolic steroid use. Elevated tumor markers also increase risk; however, elevations of routine liver enzymes (alanine transaminase, aspartate transaminase, bilirubin, etc) do not specifically increase risk of malignancy in the absence of other clinical and historical risk factors.[27,39-43] Oral contraceptive use or exogenous estrogen increases the patient risk of hepatic adenomas necessitating further evaluation of incidental liver lesions.[44,45] Low-risk patients are typically younger (<45 years old[26]), have no history of

Table 1. Summary of Lesion Characteristics and Reporting Considerations.[a]

Lesion characteristics	Reporting considerations
Size	– Most lesions <1 cm are benign, even in high-risk patients – New lesion <1 cm in a high-risk patient warrants follow-up
Attenuation	– Simple cysts in low risk patients: −10 to +20 Hounsfield units (HU), homogenous, sharply marginated, and no enhancement, nodularity or septations – Some liver metastases (ovarian and gastrointestinal stromal tumors) can appear cystic
Homogeneity vs complexity	– Multiple regions of interest should be placed through the lesion to determine if the lesion is homogeneous or complex – Thickened wall, peripheral enhancement, mural nodules, and thick septa raise the possibility of malignancy
Enhancement pattern	– Hepatic cysts should show <20 HU change between pre- and post-contrast-enhanced images – Pseudoenhancement may occur in small lesions; when attenuation measurements can be inaccurate, discretion by the radiologist is required – If pre- and post-contrast-enhanced CT images are available, >20 HU of enhancement should be considered suspicious in the absence of characteristic features of a benign lesion – Flash-filling enhancement is defined as uniform hyperenhancement relative to hepatic parenchyma on arterial phase images (including late arterial/early portal venous phases). If other phases are available to further characterize the lesion as either benign or malignant, the lesion should not be put in the "Flash-filling" category in Flowchart 1
Margin	– Benign lesions have smooth margins. – Malignant lesions could have smooth, irregular or ill-defined margins
Multiplicity	– Multiple lesions in a patient with cancer raises the suspicion for metastatic disease – Identify largest lesion and/or one that demonstrates the most concerning features as the index lesion for follow-up – Benign hepatic cysts and biliary hamartomas are often multiple
Growth pattern	– Growing lesions are concerning for malignancy – Absence of growth over 1-year strongly favors a benign lesion
Location	– Transient hepatic attenuation differences on CT (THADs) and transient hepatic intensity differences on MRI (THIDs) are caused by changes of hepatic parenchymal enhancement due to altered bloody supply; commonly peripheral and can mimic liver lesions – Altered venous drainage can cause focal fatty change or sparing near falciform ligament and gallbladder fossa

[a]Adapted from Management of Incidental Liver Lesions on CT. A white paper of the ACR Incidental Findings Committee 2017.[4]

malignancy, and are without known hepatic dysfunction or the above risk factors. Risk stratification is dependent on the available or provided clinical history. In cases where the clinical history is unknown and the patient or liver lesion is felt to be at low risk, it is important to clearly state that the lesion is most consistent with a benign lesion and requires no further evaluation, provided the patient is at low risk and has no evidence of extrahepatic malignancy or chronic hepatic disease.[39]

Flowchart 1: Incidental Liver Mass on CT

The working group reviewed the most current ACR 2017 recommendations and performed a complete review of the literature in the English language for new guidelines and evidence available. It was of the opinion of the working group that the 2017 ACR guidelines were the most up to date available for managing an incidental liver lesion found on CT. Commonly encountered benign hepatic lesions include hepatic cysts, perfusional changes, hemangiomas, and focal nodular hyperplasia (FNH). Hepatic cysts and perfusional changes are addressed in Table 1. Hemangiomas and FNHs have typical imaging features that, when present, allow a diagnosis to be confidently made without the need of further workup. Hepatic hemangiomas typically show peripheral discontinuous nodular enhancement in the arterial phase with gradual fill-in on more delayed phases becoming either isodense or hyperdense to background liver.[46-49] Smaller hemangiomas (usually < 1 cm[50]) can be "flash-filling," uniformly hyperenhancing on arterial phases, which can be difficult to distinguish from hypervascular metastases or hepatocellular carcinoma; however, malignant liver lesions typically become hypodense to the liver on the portal venous phase.[46-49] Focal nodular hyperplasia typically demonstrates avid arterial hyperenhancement, becoming isodense in the portal venous and later phases, and can have a delayed hyperenhancing central scar.[46-49] While there are times when a suspected hemangioma or FNH does not show typical diagnostic features and may require further imaging evaluation or close follow-up, such additional workup is beyond the scope of this article.

The Working group assessed the flowchart for any modifications pertinent to the Canadian system. As stated in the ACR 2017 paper, MRI is the preferred modality for further characterization of the incidental liver lesion. It provides superior tissue contrast for detection and characterization of lesions, increased certainty regarding enhancement, and avoids ionizing radiation.[4] Several studies have shown that contrast-enhanced

MRI is more sensitive and specific than contrast-enhanced CT, especially for hepatocellular carcinoma,[51-53] although both modalities have excellent diagnostic accuracy for lesions >2 cm in size.[54,55] Even in the Canadian health care system, MR is becoming increasingly available and should still be the preferred modality. Given that the majority of incidental liver lesions are benign even in high risk patients, a modest time delay between initial detection and complete characterization of the lesion on MRI is generally acceptable. If there is a time constraint or accessibility issues affecting MRI availability, multiphase CT remains adequate for most lesions. In specific cases, where the liver can be accurately characterized as cirrhotic (detailed in the Parenchymal Liver Disease section), the Working group strongly suggests an attempt should be made to characterize the incidental lesion using the most current version of Liver Imaging Reporting and Data System,[56] especially if there are multiple phases available in order to decrease MRI referrals when appropriate. Unfortunately, despite US being much more widely available and cost effective, no robust data is available to support using US instead of CT or MRI in the routine workup of incidental liver lesions.

Although not explicitly stated in the flowchart, a lesion that is well visualized on previous comparison studies, showing no change in imaging features for at least 1 year, may be considered clinically insignificant in a low-risk patient.[4]

Flowchart 2: Incidental Liver Mass on US

A new flowchart to address the management of the incidental liver mass identified on US (conventional, non-contrast-enhanced) was created. This flowchart begins with the decision of whether or not the mass is cystic or solid appearing. In the solid appearing branch of the flowchart, if the patient is at high risk (as previously defined above), more definitive imaging with either CT or MRI is recommended regardless of the size of the lesion, with MRI as the preferred modality.

Incidental liver masses found on US in a low-risk patient are statistically most likely benign.[27] Management can be based on the echogenicity of the mass compared to the background liver. If the lesion is hypoechoic compared to a background fatty liver (hyperechoic), and in a typical location for focal fatty sparing (adjacent to GB fossa, segment 4B, porta hepatis),[14] geographic in shape and without mass effect or containing undistorted vessels,[57] no further follow-up is required. The majority of focal lesions found on US represent focal fatty sparing, simple cysts, and hemangiomas.[58] If the lesion is hypoechoic or heterogeneous and not typical for focal fatty sparing, further assessment with MRI or CT is necessary. No quality evidence is currently available in the literature to support only US follow-up without initial characterization using CT or MRI. If doubt remains in either the imaging characteristics or risk level of the patient, the radiologist should consider recommending further imaging or correlation with clinical risk status by the ordering physician.

Hyperechoic masses compared to background liver are also commonly identified on US. If the US appearance is in keeping with focal fat (geographic areas of hyperechogenicity in locations similar to focal fatty sparing) or typical for a hemangioma (less than 3 cm, homogenously hyperechoic, well-defined, and no internal Doppler flow or posterior acoustic features OR iso/hypoechoic centrally with hyperechoic rim), no further workup is necessary in the low risk patient.[27,39] If the lesion does not appear characteristic of these benign lesions, further assessment with MRI or CT is required.

If the lesion is cystic, simple cysts do not require any further workup. For cysts containing low-level internal echoes from prior hemorrhage or infection or containing 1 to 2 thin septations, no further workup is necessary. Complex cysts are those that contain more numerous or thickened septations (typically greater than 3 mm) or the lesion contains internal nodularity or vascularity. These may be post-traumatic, infectious/inflammatory, or neoplastic and require further workup with MRI or CT.[59] Factors increasing the statistical likelihood of a biliary neoplasm over a benign cyst include upstream biliary dilation, left hepatic lobe location, and absence of cysts elsewhere in the liver.[60,61]

Incidental Biliary and GB Findings

In 2013, the ACR released their white paper on managing incidental GB and biliary findings.[62] The Working Group reassessed this paper and did an extensive literature search for any new or developing management recommendation for incidental GB and biliary findings. The ACR 2013 white paper is up to date except for more current literature on GB calcifications and biliary duct dilation which generally agrees with the conclusion of the ACR 2013 recommendations, save for recent European recommendations for management of GB polyps.[5]

The format of the summary table from the 2013 ACR paper has been adopted with slight modifications (Table 2). Specific comments are detailed below pertaining to developments and new literature since 2013, as well as modifications pertaining to the Canadian health care system.

Gallbladder Wall Calcifications With No Mass on CT—"Porcelain GB"

In 2013, the ACR did not recommend any follow-up imaging for GB wall calcifications (either focal or diffuse). Their rationale was that no data was available to predict the value of follow-up on a yearly basis, and they felt the probability benefit was likely a fraction of 1%.[62] If follow-up imaging was elected, they recommend contrast-enhanced CT as the preferred modality as it is more likely to identify an associated mass and the diffuse wall calcification would obscure evaluation of the GB lumen on US. At the time of that publication, the ACR committee referenced 2 large surgical series where the risk of GB cancer in the general population was about 0.6% to 0.8%, and up to 7% in patients with a partially calcified wall.[63,64] A systemic literature review in 2013 and retrospective cohort study in 2018 had similar results of these quoted surgical series.[65,66]

Table 2. Summary of Diagnosis and Evaluation of Incidental Findings of the Gallbladder and Bile Ducts.

Finding	Finding/diagnosis	Action
Gallstones, no mass	Gallstones	If symptomatic, ultrasound, or surgical referral
Gallbladder wall calcification, no mass	Focal or diffuse wall calcification (porcelain gallbladder)	Surgical referral, no follow-up recommended. If followed as per surgery, use contrast-enhanced CT
Dense gallbladder contents (20-100 HU)	Sludge, excreted contrast, hemorrhage, gallstones	No evaluation or follow-up recommendations for this finding
Diffuse gallbladder wall thickening >3 mm, no mass	Hepatitis, congestive heart failure, liver disease, pancreatitis, hypoproteinemia	No evaluation or follow-up recommendations for this finding
Focal gallbladder wall thickening or mass	Polyp, gallbladder cancer, cholesterolosis, adenomyomatosis	[a]If found on CT, consider further evaluation on ultrasound for specific features of adenomyomatosis. Evaluation and follow-up depend on mass size, other clinical factors
Gallbladder polyp ≤ 6 mm	Benign polyp	No evaluation or follow-up recommendations
Gallbladder polyp 7-9 mm	Benign polyp, adenoma vs small cancer	Follow yearly with ultrasound; surgical consult if polyp grows. [a]If the patient is at higher risk (>50 years old, sessile or single polyp, PSC, Indian ethnicity) initial follow-up ultrasound at 6 months, then yearly.
Gallbladder polyp ≥ 10 mm, mass	Benign polyp, adenoma, vs small cancer	Surgical consult
Pericholecystic fluid	Gallbladder perforation, other collection	Individual assessment
Distended gallbladder (>4 cm in transverse diameter and >9 cm in length)	Fasting, obstruction	If asymptomatic, no evaluation
Ductal dilation > 6 mm[a], if no cholecystectomy or > 10 mm if gallbladder absent	Obstruction, postcholecystectomy	If laboratory results normal, no evaluation; if abnormal ERCP, EUS, MRCP, or CT cholangiography as appropriate
[a]Add 1 mm per decade of life > 60 years		

Abbreviations: ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasound; MRCP, MR cholangiopancreatography; PSC, primary sclerosing cholangitis.
[a]Adaptations by CAR Incidental Working Group 2019.

Symptoms typical for GB carcinoma or an associated mass in the GB were the only predictive factors useful in diagnosing a GB cancer.[65] The Working Group agrees that annual follow-up would not provide significant benefit and thus no follow-up recommendations are given. If GB calcifications are discovered incidentally then a surgical referral is warranted. If follow-up is elected following a discussion between the surgeon and patient, then contrast-enhanced CT remains the most cost-effective modality.

Focal GB Wall Thickening > 3 mm, GB Polyps, or Mass

In 2013, the ACR incidental findings committee concluded that based on the available evidence, no further follow-up should be performed for polyps ≤6 mm, yearly US follow-up should be performed for polyps between 7 to 9 mm, and cholecystectomy should be considered for polyps ≥10 mm.[62] These recommendations were based on 2 studies published in both the radiologic and surgical literature.[67,68] Since 2013, there have been several systematic reviews looking at GB polyps. In 2015, Babu et al published a systematic review demonstrating that 8.5% (199 of 2347) of GB polyps were both malignant AND ≥1 cm, whereas only 1.2% (29 of 2347) of polyps <1 cm in size were found to be malignant, and 0% of polyps less than 5 mm were malignant.[69] A systematic review from the surgical literature in 2016 also found that approximately 8.4% of polyps are malignant, of which 85% were larger than 1 cm.[70] That study found that the prevalence of GB malignancy in polyps <1 cm was around 15%, higher than previously reported, and the probability of malignancy in polyps 4.15 mm or less was nearly zero. They also found that patient age >50 years as well as sessile and solitary polyps were independent risk factors for malignancy. Examining the growth rate of polyps, Shin et al found through multivariate analysis that the growth rate of a polyp was not related to the risk of malignancy,[71] and this is supported by other studies in asymptomatic patients.[72] In 2017, joint European guidelines for the management and follow-up of GB polyps were published, with size and management recommendations similar to the 2013 ACR white paper apart from surveillance of small <6 mm polyps and more aggressive management of polyps of any size in patients at high risk (patient age > 50 years of age, history of primary sclerosing cholangitis [PSC], Indian ethnicity, and sessile polyps).[5]

The CAR Incidental Findings Working Group has, after reviewing all the evidence, decided to continue to endorse the 2013 ACR recommendations until further studies can show that more aggressive follow-up of small GB polyps provides survival benefit, with the caveat that for high-risk patients (patient age >50 years, PSC, Indian ethnicity, sessile, and single polyps) with a polyp measuring 7 to 9 mm, follow-up should be performed at 6 months, 12 months, then yearly if the patient is a surgical candidate. There is still much uncertainty in the natural history of small GB polyps between 7 and 9 mm,

and yearly US surveillance up to 5 years should be sufficient to detect any slow growing GB cancer. In patients at higher risk, more frequent early US assessment should hopefully detect any rapidly growing GB carcinoma. Finally, patients with larger GB polyps >1 cm require a surgical consult for consideration for cholecystectomy given the increased risk of GB carcinoma. For patients with PSC, recent European guidelines recommend surgical consultation for cholecystectomy for any GB polyp, regardless of size given their increased risk of GB carcinoma.[5]

Normal GB wall thickness is up to 3 mm.[73] Adenomyomatosis is a common benign condition characterized by epithelial and smooth muscle proliferation with epithelial invaginations into the GB wall containing bile, mucus, or calculi.[74] It can have variable appearances from diffuse GB wall thickening to focal or segmental wall thickening, most typically the fundus and waist of the GB body, and rarely as a focal mass.[74] It is most reliably diagnosed on US as focal GB wall thickening with associated comet tail artifact from trapped cholesterol crystals within the Rokitansky-Aschoff sinuses.[75,76] On MRI, wall thickening with multiple cystic spaces of high T2 signal is almost uniformly associated with GB adenomyomatosis with a 100% sensitivity, 99% specificity, and 91% positive predictive value.[77,78] Computed tomography poorly assesses adenomyomatosis compared to both US and MRI with accuracy ranging from 62% to 75%.[78] Cystic spaces in the GB wall representing the dilated Rokitansky-Aschoff sinuses are only identified in less than 50% of cases.[79] If incidental GB wall thickening (focal, segmental, or diffuse but without definitive mass) is identified on CT, further characterization with US to assess for comet tail artifact is recommended. Magnetic resonance can be used for indeterminate cases on US.

Biliary Ductal Dilation

Extrahepatic bile ducts normally measure up to 6 mm plus 1 mm for every decade after the age of 60 years and a duct measuring more is considered dilated.[73,80,81] In asymptomatic patients with a remote history of a cholecystectomy, a common bile duct measuring up to 10 mm is considered normal.[82] Currently, it is still acceptable to consider biliary dilation $\geq$ 7 mm in asymptomatic patients and >10 mm in asymptomatic post-cholecystectomy patients with normal alkaline phosphatase (ALP) and bilirubin as unlikely to be clinically significant.[62] This is also supported by a recent study examining incidental biliary dilation on CT in 157 asymptomatic patients with normal liver function tests and no identifiable cause on the CT, in which no malignancy developed during a clinical follow-up interval up to 2 years.[83]

Intrahepatic duct (IHD) dilation on US is defined as an IHD greater than 2 mm or 40% larger than the adjacent portal vein.[73,80] On CT, IHD dilation is more difficult to quantify and can be subjectively defined as visualized intrahepatic ducts outside of the porta hepatis.[80] Mild intrahepatic duct dilation has also been shown to be a common incidental finding after cholecystectomy.[80]

Several proposed mechanisms for asymptomatic biliary dilation after cholecystectomy have been raised, including the hypothesis that the bile ducts were obstructed prior to the cholecystectomy and remained dilated[84] or that the biliary system is compliant and dilates to act as a physiologic reservoir.[80,85] The dilation of the bile ducts with age may be due to sclerosis of the distal common bile duct with compensatory dilation or due to drug effects of calcium channel blockers and nitroglycerin contributing to loss of ductal contractility.[86-88] Furthermore, there is evidence to suggest that chronic opioid use can lead to asymptomatic biliary dilation with normal ALP and bilirubin values due to long-term sphincter of Oddi contraction.[89,90]

If there is high clinical and/or biochemical suspicion for a biliary duct stone or mass causing an obstruction, endoscopic retrograde cholangiopancreatography, endoscopic US, or MR cholangiopancreatography can be performed.[91] If a mass is suspected as the cause for the biliary obstruction or if the obstruction is distal then endoscopic ultrasound or endoscopic retrograde cholangiopancreatography–guided fine needle aspiration is recommended.[62]

Miscellaneous

No recent developments suggest any further workup is necessary for incidental gallstones in the absence of clinical symptoms, associated mass, or biliary duct dilation. Similarly, no emerging evidence is available to suggest a different management approach for dense GB contents, pericholecystic fluid, or a distended GB (>4 cm in transverse diameter or >9 cm in length[62]) since the ACR 2013 white paper.

Emerging Modalities

Dual-energy CT is an increasingly utilized modality that simultaneously measures 2 separate energy spectra allowing for the quantification of the amount of iodine in a lesion. This modality shows some promise in differentiating between benign and malignant incidental liver lesions,[92,93] differentiating liver abscesses from metastases,[94] and finally differentiating between different liver malignancies.[95] Despite future possibilities, dual energy CT is not used widely enough throughout Canada and the literature is not sufficient at this time to warrant inclusion in these guidelines.

Similarly, contrast-enhanced US (CEUS) is a rapidly growing modality for the assessment of liver lesions[96] and is now included in the ACR LI-RADS pathway.[97] Contrast-enhanced US also shows promise in evaluation of GB abnormalities.[98,99] Again, CEUS use is still limited across Canada and it was felt that at this time it would not be included in this document.

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