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Imaging Approach to Liver Mass
Part 1: Incidental Finding Without Underlying Liver Disease

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Imaging modalities commonly used for detection of liver mass include US, CT, and MRI. Radionuclide scan is less popular secondary to its relatively poor resolution and unavailability. Diagnostic angiogram is usually used in conjunction with interventional purpose. PET is a problem solving tool and currently useful in cancer staging.

Of the three common imaging modalities, US is usually the first to detect liver mass because of its availability and reasonable cost. Even though US is fairly sensitive for detection of liver mass, its specificity is relatively low. Both low-echoic and high-echoic masses have a long differential list of diseases. Therefore, liver mass detected by US is often characterized further by either CT or MRI[1,2]. MRI is the best imaging modality to characterize liver mass and should be the imaging of choice. If MRI is not available, CT is also an option, particularly MDCT with ability to perform dynamic contrast study.

Imaging approach to liver mass will depend upon three common clinical scenarios, as following;

1. Incidental finding without underlying liver disease
2. Liver mass with underlying chronic liver disease
3. Liver mass with underlying malignancy

Only scenario 1 and 2 will be discussed since scenario 3 (liver mass with underlying malignancy) is quite straight forward, of which most liver mass detected would represent metastasis. In this article, MRI will be emphasized as the imaging modality of choice for characterizing liver masses.

Incidental finding without underlying liver disease

Liver masses detected incidentally are sometimes referred to as "incidentalomas". Differential diagnosis of common liver incidentalomas is as following[3];

1. Focal fatty sparing
2. Focal fatty liver
3. Hemangioma
4. Focal nodular hyperplasia (FNH)
5. Hepatic adenoma

Focal fatty sparing (FFS) (Figure 1)

FFS usually shows low-echoic at US (Figure 1A). However, this finding is not specific and other liver masses may show similar findings. MRI is the best tool to characterize the lesion, because of its accurate ability to identify fat by using fat-sensitive technique pulse sequences (Figure 1B-C). After intravenous gadolinium, FFS shows enhancement similar to the adjacent liver parenchyma (Figure 1D)

Focal fatty liver (FFL) (Figure 2)

FFL usually shows high-echoic at US (Figure 2A). However, many liver lesions share similar finding and there is a need to further characterize the lesion, and MRI is the best imaging tool. Opposed-phase pulse sequence is very sensitive to intracellular fat and shows signal drop comparing to the in-phase pulse sequence (Figure 2 B-D). After intravenous gadolinium, enhancement of FFL is similar to the adjacent normal liver, confirming that the lesion is not a true mass (Figure 2 E).

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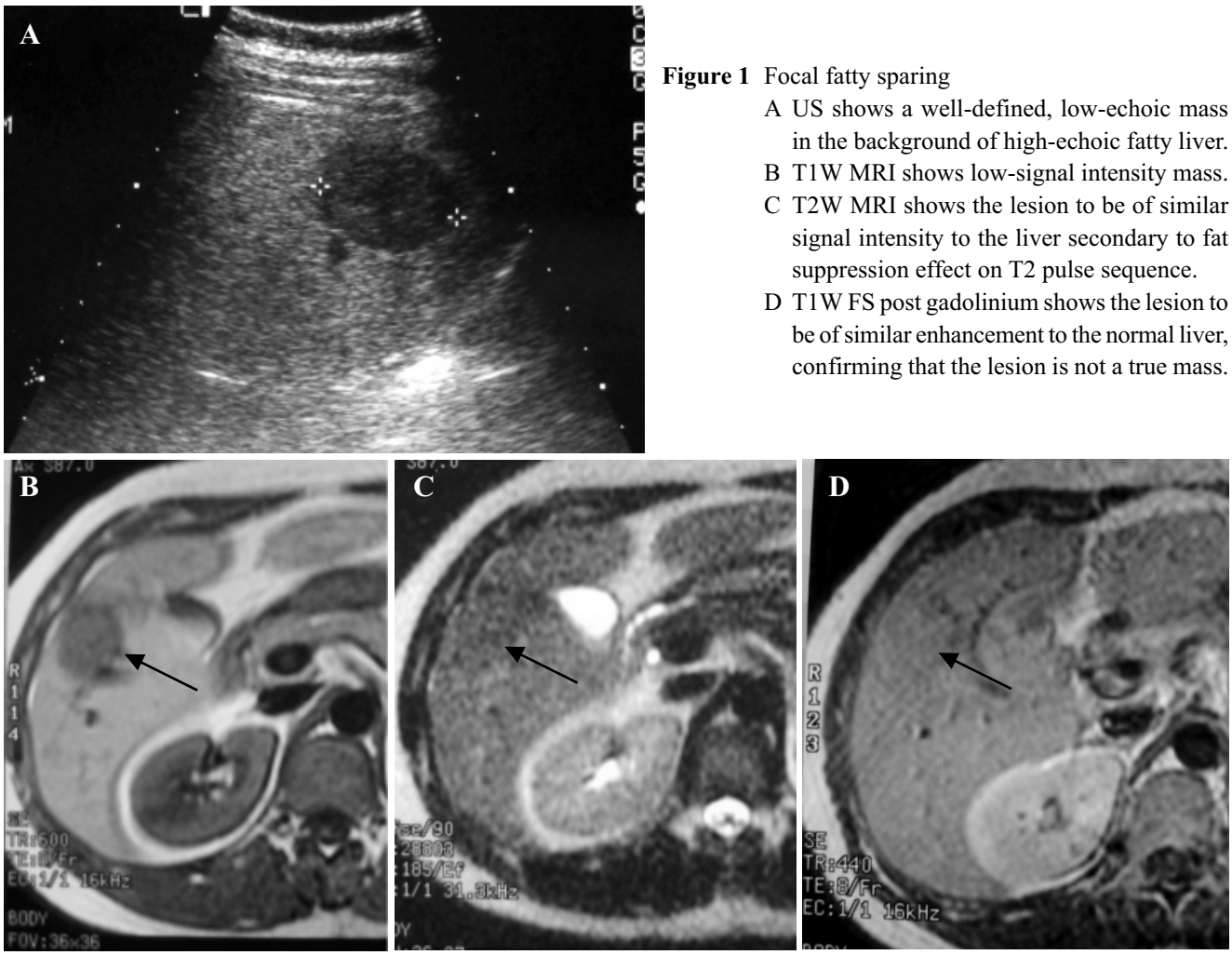

Figure 1 Focal fatty sparing
A US shows a well-defined, low-echoic mass in the background of high-echoic fatty liver.
B T1W MRI shows low-signal intensity mass.
C T2W MRI shows the lesion to be of similar signal intensity to the liver secondary to fat suppression effect on T2 pulse sequence.
D T1W FS post gadolinium shows the lesion to be of similar enhancement to the normal liver, confirming that the lesion is not a true mass.

Hemangioma (Figure 3)

Hemangioma is the most common benign tumor of the liver. Incidental detection of hemangioma is usually from US and increasingly from screening CT colonography (Figure 3 A). Definite diagnosis is usually from MRI showing low signal intensity at T1W and very bright signal intensity at T2W[4] (Figure 3 B-C). After gadolinium, there is peripheral nodular enhancement, central filling-in, and persistent enhancement throughout delayed phase (Figure 3 D-F).

Focal nodular hyperplasia (Figure 4)

Focal nodular hyperplasia (FNH) is the second most common benign liver tumor. US is usually the first imaging modality to pick up the lesion (Figure 4 A), and MRI is often used to further characterize the mass[5]. Characteristic MRI finding includes low- or iso-signal intensity at T1W, and slightly high- or iso-signal intensity at T2W with bright central scar (Figure 4 B-C). After gadolinium, the lesion shows homogeneous enhancement at arterial phase, wash-out at portal venous phase, and enhancement of central scar at delayed phase (Figure 4 D-F).

Hepatic adenoma (Figure 5)

Hepatic adenoma is the 3rd most common benign liver tumor that is usually found in a woman with the history of taking oral contraceptive pills. US is non-specific and could be either hypo- or hyper-echoic (Figure 5A). MRI shows similar signal intensity to the normal liver at both T1W and T2W (Figure 5B). After gadolinium, the tumor shows homogeneous enhancement at arterial phase and rapid wash-out at portal venous phase. This finding is similar to FNH, albeit, no central scar.

It is important to distinguish FNH from hepatic adenoma because FNH has no malignant potential and could be left alone. Hepatic adenoma has a small chance of developing into adenocarcinoma and is well

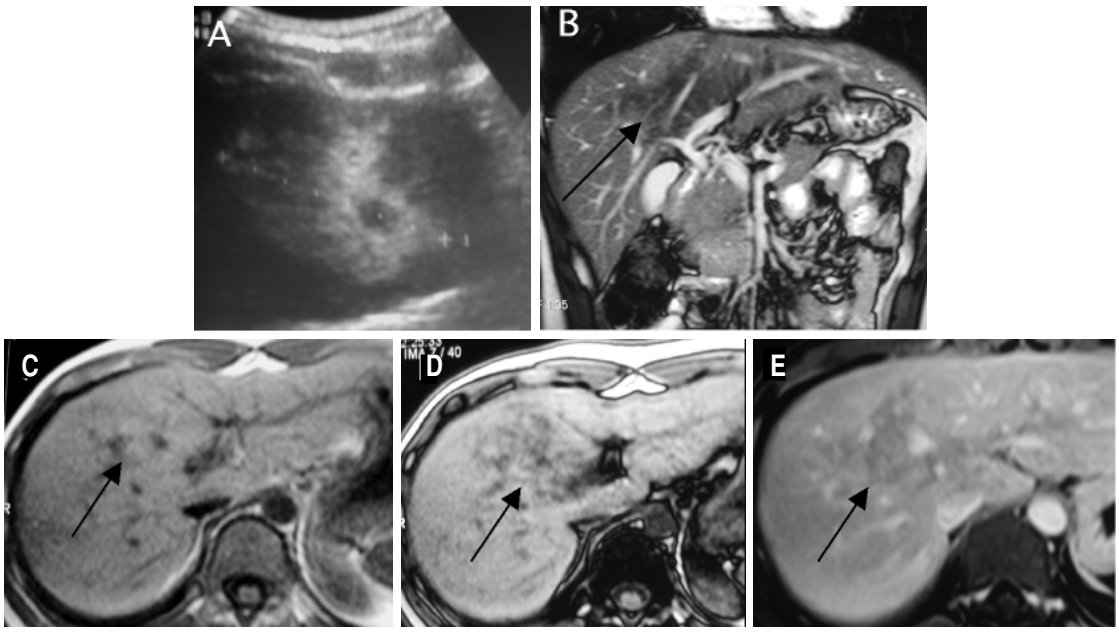

Figure 2 Focal fatty liver

A US shows infiltrative high-echoic lesion with angulated margin.

B FIESTA opposed-phase coronal MRI shows infiltrative lesion to be of low signal intensity with vessels coursing through the lesion, characteristic of fatty infiltration.

C T1W in-phase MRI shows no obvious abnormality.

D T1W opposed-phase MRI shows infiltrative area of signal drop corresponding to finding at US, characteristic of fatty infiltration.

E T1W FS post gadolinium shows enhancement of the lesion to be similar to the normal liver, confirming that the lesion is not a true mass.

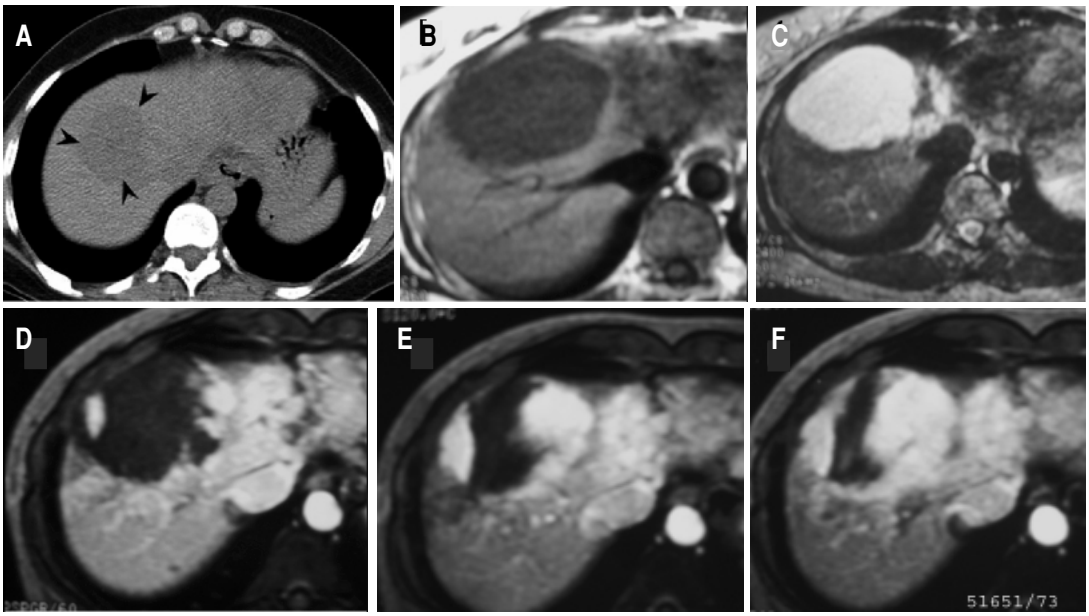

Figure 3 Hemangioma

A Plain CT from CT colonography screening shows a large low-density mass that needs to further characterize.

B T1W MRI shows low signal intensity mass at anterior segment of right lobe liver.

C T2W MRI shows the mass to be of high signal intensity, similar to the CSF.

D-F T1W dynamic gadolinium shows peripheral nodular enhancement, central filling-in, and persistent enhancement throughout delayed phase, consistent with a hemangioma.

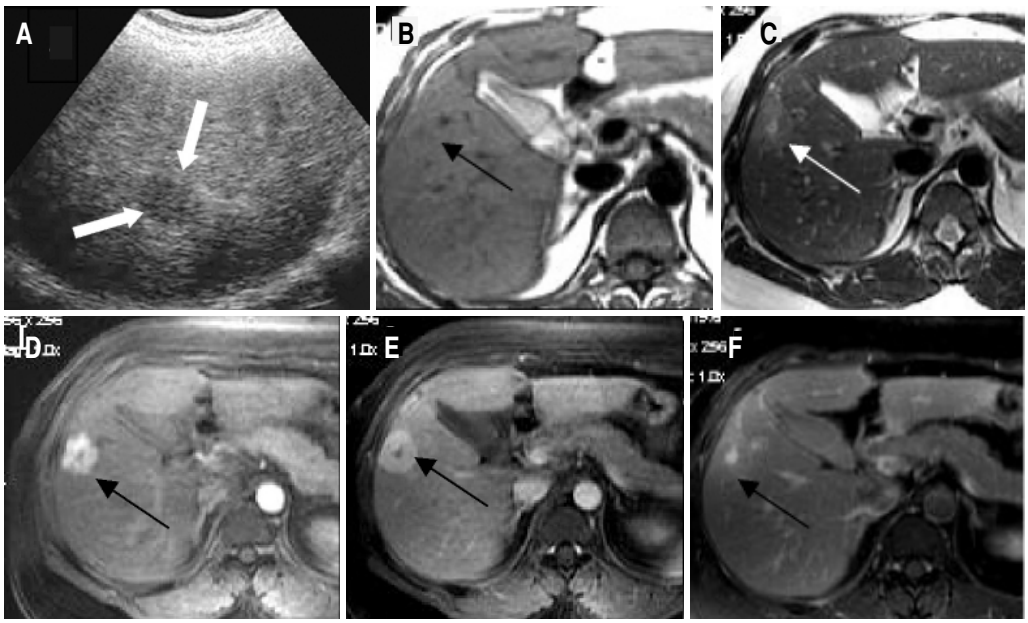

Figure 4 Focal nodular hyperplasia (FNH)

A US check-up shows a low-echoic, non-specific mass.

B T1W MRI shows the lesion to be of similar signal intensity to the normal liver.

C T2W MRI shows the lesion to be of slightly high signal intensity with a bright central scar.

D-F T1W post gadolinium shows the mass to be of homogeneous enhancement at arterial phase with some degree of washout at portal venous phase and with enhancement of the central scar at delayed phase, characteristic of FNH.

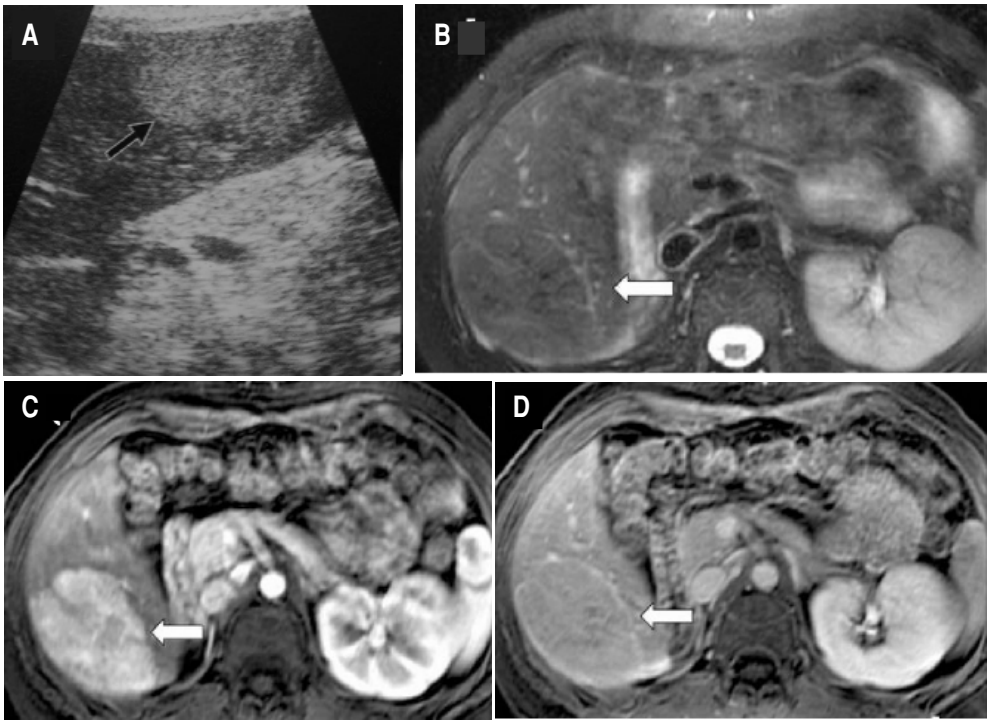

Figure 5 Hepatic adenoma

A US check-up shows a high-echoic mass.

B T2W MRI shows the mass to be similar signal intensity to the normal liver.

C-D T1W post gadolinium shows the mass to be of homogeneous enhancement at arterial phase and rapid wash-out at portal venous phase.

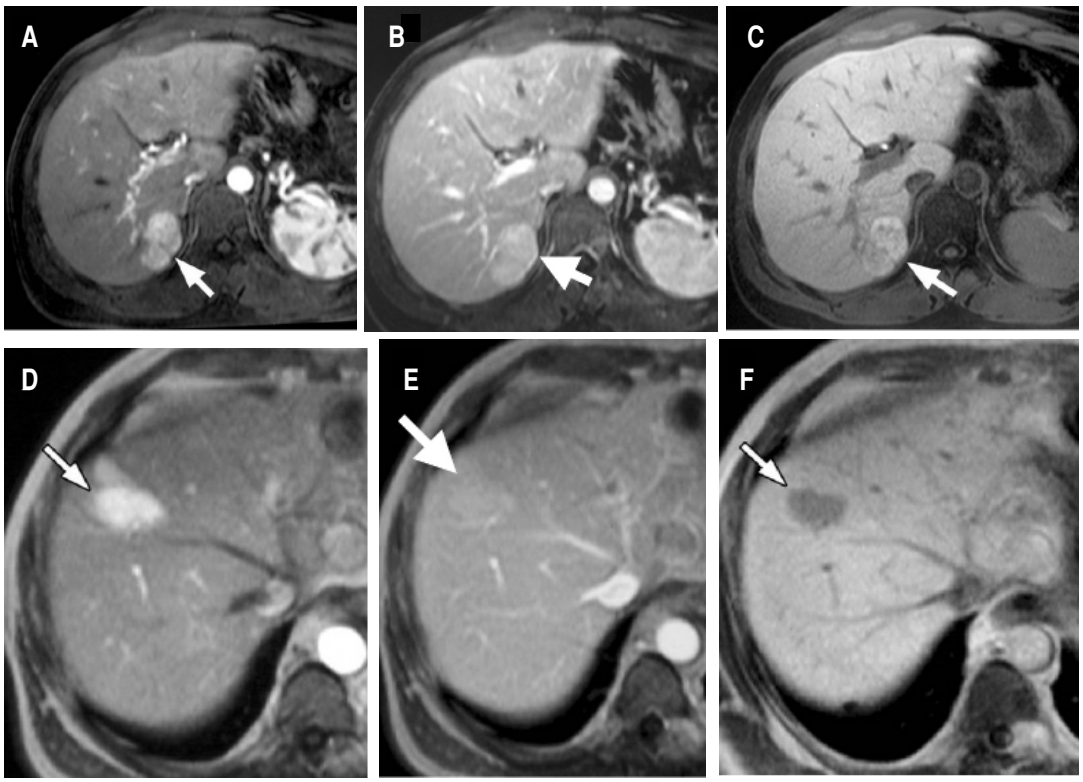

Figure 6 Differentiation of FNH and hepatic adenoma by hepatobiliary (HB) specific contrast agent
A-C T1W post HB specific contrast agent in FHN shows homogeneous enhancement at arterial phase, rapid wash-out at portal venous phase and increased uptake in delayed 30 min phase.
D-F T1W post HB specific contrast agent in hepatic adenoma shows homogeneous enhancement at arterial phase, rapid wash-out at portal venous phase, but no uptake in delayed 30 min phase.

known for bleeding[6]. Therefore, many surgeons prefer to remove hepatic adenoma to follow-up. Hepatobiliary specific contrast agent is able to distinguish these two entities (Figure 6). FNH shows delayed uptake of this contrast because it contains hepatocytes as well as functioning biliary system. Hepatic adenoma, on the other hands, shows no uptake in spite of containing hepatocytes. This is because hepatic adenoma has no functioning biliary system, therefore, inhibiting the uptake of contrast by hepatocytes[7].

CONCLUSION

1. It is important to have a good clinical history in order to analyze liver mass based upon imaging findings.

2. One of the common clinical scenarios is incidental finding without underlying liver disease (incidentalomas).

3. Five common incidentalomas include focal fatty sparing, focal fatty liver, hemangioma, FNH and hepatic adenoma.

4. MRI is usually the best imaging modality to characterize these lesions.

REFERENCES

1. Buetow PC, Pantongrag-Brown L, Buck JL, *et al*. Focal nodular hyperplasia of the liver: radiologic-pathologic correlation. RadioGraphics 1996;16:369-88.
2. Pantongrag-Brown L. Imaging of focal liver masses. Thai J Gastroenterol 2004;5:130-6.
3. Pantongrag-Brown L. Hepatic incidentalomas: imaging perspective. Medical Time CME 2003;2:33,45-50.
4. Pantongrag-Brown L. Multiple faces of liver hemangiomas. Thai J Gastroenterol 2007;8:91-8.
5. Pantongrag-Brown L. Multiple faces of focal nodular hyperplasia. Thai J Gastroenterol 2007;8:139-43.
6. Pantongrag-Brown L. Bleeding hepatic tumors. Thai J Gastroenterol 2004;5:189-92.
7. Grazioli L, Morana G, Kirchin MA, *et al*. Accurate differentiation of focal nodular hyperplasia from hepatic adenoma at gadobenate dimeglumine-enhanced MR imaging: prospective study. Radiology 2005;236:166-77.