

Possible imaging diagnosis

Case 335

3. Gall bladder cancer

[Progress]

He was scheduled gall bladder cystectomy under laparoscopic surgery.

[Discussion]

MRI diffusion weighted imaging (DWI) is MRI sequence to find out a lesion with disorder of water molecule mobility. Water molecule mobility can be visualized when you let fall a drop of ink to water tank. Ink diffuses in water in tank freely at random. Both of an Ink drop and water in tank compose of water molecules. In a living body, water molecules in living body moves freely at every moment. Water molecules diffuse cell inside and outside. It is considered that water molecules diffuse more freely cell inside than cell outside because cell own organelles inside which make water molecules repress to move. At present, MRI DWI reflect water molecules mobility cell outside rather than cell inside under limitation of MRI repetition imaging time (1). Infarction under occlusion of arterial blood flow and abscess cause to repress mobility of water molecules, indicating that these lesions visualize as high signal intensity, compared to their surroundings.

The size of single tumor size varies from 10 μm or greater (up to 20 μm). Meanwhile, the sizes of red blood cell, lymphocyte, neutrophil and macrophage are 7 μm , 10 μm , 15 μm , and 20 μm , respectively. It is known water molecule diffusion disorder is most in malignant lymphoma probably because malignant lymphoma is smallest in size and accumulate densely with least extracellular water molecules (2).

In T2 weighted imaging, 90 degree pulse and 180 degree pulse are given to get strong signal of hydrogen atom. In Diffusion weighted imaging, motion probing gradient was given in reverse direction before and after 180 degree pulse, leading to make signal intensity less weak in areas with water molecules diffuse more potency, while to make signal intensity remain in areas with water molecules diffuse disorder. This phenomenon is well expressed in Figure in ADC curve with longitudinal line of signal intensity (logarithm unit) and transverse line of strength of motion probing gradient (MPG). ADC is calculated as slope between logarithm signal intensity before MPG and after MPG. Namely, water molecules diffuse greater, ADC values become greater, whereas water molecules diffuse less, ADC values become less (1, 3).

Based on my experiences, ADC values of 1.5 or greater indicate CSF or edema, ADC 1.2 or less than 1.5 indicate edema or benign tumor, ADC 0.6 or less than 1.1 indicate malignant tumor, ADC 0.6 or less indicate abscess and epidermal cyst. Virtually, both Diffusion weighted imaging (DWI) and ADC image are interpreted simultaneously: when a lesion on diffusion disorder is visualized high signal intensity whose lesion is expressed low on ADC image. ADC image is formed coloring 16 degrees of grey: 0 black, 16 white. The middle grey is given to mother organ. Therefore, ADC values 0.9 to 1.1 whose values are usually experienced in cancer; coloring is different based on background organ. For example, metastatic carcinoma or glioblastoma whose ADC values are around 0.9 to 1.0 are bright grey in brain parenchyma whose ADC values are around 0.7 to 0.8. Prostatic carcinoma with ADC values of 0.6 to 1.1 are demonstrated high signal intensity in prostate gland whose ADC values are around 1.2 to 1.4. ADC values of gall bladder cancer are reported to be around 1.06. while xanthogranulomatous cystitis, around 1.637 (4, 5). In our case with gall bladder mural thickness, ADC values 0.85, indicative of water molecules diffusion disorder of gall bladder cancer.

[Summary]

We presented a seventy-five-year-old man with gradual mural thickening of gall bladder in the follow up study. He took abdomen MRI for further investigation which showed mural thickening that Diffusion WI showed it high signal intensity and MRI ADC values were 0.85, indicative of water molecules diffusion disorder. It is borne in mind that signal intensity of the lesion on MRI Diffusion WI is dependent on ADC values of its mother organ: ADC values of 0.9 to 1.1 on metastatic brain tumor under those of 0.7 to 0.8 on brain parenchyma, are iso- or low-signal intensity while ADC values of 0.6 to 1.1 of prostate cancer under those of 1.3 to 1.4 of prostate gland were high signal intensity. Gall bladder mural thickness in our case was depicted high signal intensity under ADC values of 1.164 – 1.427 of liver parenchyma.

[References]

- 1.Miho Kita Futyu Hospital, Osaka Japan personal communication
- 2.Shashni, B, et al. Size-Based Differentiation of Cancer and Normal Cells by a Particle Size Analyzer Assisted by a Cell-Recognition PC Software. *Biological and Pharmaceutical*. 2018;41: 487-503
- 3.Camila Lopes Vendrami et al. *RadioGraphics*Vol. 41, No. 1 Gastrointestinal Imaging Free Access. Gallbladder Carcinoma and Its Differential Diagnosis at MRI: What Radiologists Should Know
- 4.Kang TW,et al. Differentiating xanthogranulomatous cholecystitis from wall-thickening type of gallbladder cancer: added value of diffusion-weighted MRI *Clin Radiol*. 2013;10:992-1001.
- 5.Ogawa T, et al. High b-value diffusion-weighted magnetic resonance imaging for gallbladder lesions: differentiation between benignity and malignancy. *Clin Radiol*. 2013;10:992-1001.

[back](#)

2024.5.10