

Clinical efficacy of a newly developed free-breathing and high b-value MR diffusion weighted imaging method for the assessment of malignancy of the trunk.

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[Purpose]

DWI with little distortion became possible by employment of Parallel Imaging(PI) in the trunk and free-breathing scanning using 10-15 NEX enabled an increase in signal-to-noise ratio (SNR). The purpose of this paper is to examine the clinical usefulness of a newly developed free-breathing and high b-value DWI with PI for the assessment of neoplastic lesions of the trunk.

[Methods]

Subjects are eight normal volunteers, 36 patients with malignant tumors (lung cancer 1, gastric cancer 5, colon cancer 3, rectal cancer 6, pancreas cancer 4, HCC 4, RCC 4, GB cancer 1, CBD cancer 2, uterus cancer 2, ovarian cancer 1, bladder cancer 1, prostate cancer 2) and 21 patients with metastasis (lung 1, liver 9, lymph node 5, bone 6). The equipment used is 1.5T MRI Vantage and EXCELART (Toshiba, Tokyo). The sequence is Single-Shot EPI Diffusion, b= 0, 500, 1000, TE=100, 27 to 46 cm FOV, 4 to 10 mm slice thickness, 21 to 24 sheets, Matrix 128x128, NEX 10-15, PI Factor 1.6, and Scan Time 4-8min. And two volunteers and two patients (bone metastasis, lymph node metastasis) were examined for whole body scanning by use of a peripheral vascular(PV) coil.

[Result]

- 1) In normal volunteers, spleen, kidney, intestinal tract, prostate, semina vesicle, uterus, and the spinal cord presented a high signal.
- 2) In primary malignancies(Fig 1), except gastric cancer and RCC, very high signal was present in 19 cases and moderate high signal was present in 7 among 27. In five gastric cancer cases, there was only one case presented very high signal. And in four RCC cases, there is no case presented very high signal. ADC in gastric cancer and RCC was $1.563 \pm 0.908 \times 10^{-3}$ mm²/s, while ADC in other malignancies was $0.947 \pm 0.438 \times 10^{-3}$ mm²/s. The ADC in gastric cancer and RCC was significantly higher compared with other malignancy (P value <0.05).
- 3) In metastatic lesions(Figs 1-3), 14 cases presented very high levels among 21 examples (lymph node 4/5, liver 5/9, bone 2/4, lung 1/1).
- 4) Although artifacts due to breathing were mild, the distortion observed around the neck and supraclavicular fossa was somewhat pronounced, and chemical shift artifacts were prominent in some cases. In the coronal section, as compared with the transection image, distortion was extreme, and the display in reverse MIP was useful to demonstrate abnormal lesions.

[Discussions]

The parallel imaging method reduces magnetic susceptibility artifacts, and free-breathing scanning using 10-15 NEX and high b-value enable much higher SNR to be obtained, thus providing much clearer images of neoplastic lesions than the conventional method, without using a contrast medium; thereby improving the clinical usefulness of DWI of the trunk. This new developed DWI is considered to depict tumors, inflammation and lymph nodes non-specifically. Malignant tumors, except gastric cancer and RCC, showed a high signal in primary lesions, lymph node metastasis, liver metastasis, and bone metastasis, and it was very useful in lesion detection. Although artifacts due to breathing are mild, the distortion observed around the neck is somewhat pronounced, and, moreover, the intestines and spine are shown in the images. It is therefore necessary to exercise care in image interpretation. It is possible to display a lesion as it would be seen in PET images by handling the obtained images as volume data and by using the black and white inversion MIP display function. This is useful as a non-contrast-enhanced, low-cost, radiation-free, non-invasive screening method. In addition, it is possible to create fusion images with the addition of normal MR or MDCT images. As such, free-breathing and high b-value DWI by using PI method is very valuable in diagnostic imaging of the trunk. Furthermore, whole body DWI scanning, using a PV coil, proved useful in the assessment of metastatic lesions and in screening of the whole body (Fig 3).

[Conclusion]

Free-breathing and High b-value DWI is very useful in tumor detection, and searches for metastatic foci in the trunk. However, there are also tumors which are poorly depicted, such as gastric cancer and RCC, and correct diagnosis requires cautious evaluation.

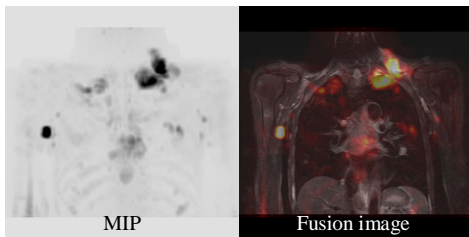


Figure 1: Lung cancer and lymph node metastasis

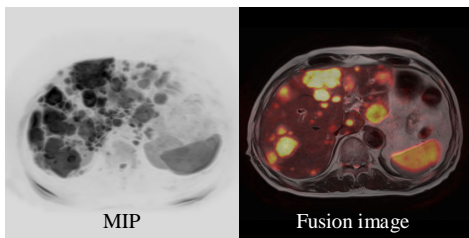


Figure 2: Liver metastasis due to pancreas cancer

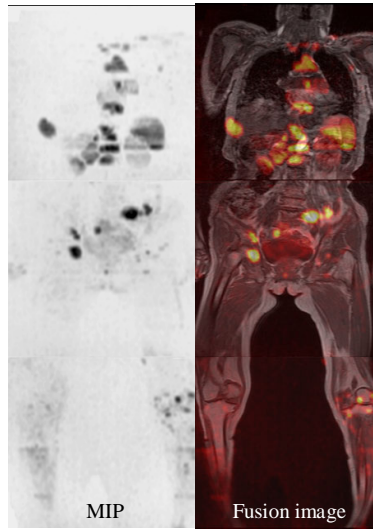


Figure 3: Multiple lymph node metastasis (unknown origin, PV coil)