Pisco Med Publishing

Research on MRI Whole Body Diffusion Imaging Technology in Medical Clinic

Zhaoyu Ning*

Dexin Pharmaceutical Company, Anhui 241000, China.

Abstract: After the MRI whole-body diffusion imaging technology is applied to medical clinical diagnosis, it is helpful for early diagnosis of the actual condition of the patient, and can effectively improve the detection accuracy and imaging quality. As a medical imaging technology reform, MRI whole-body diffusion imaging can solve the shortcomings of traditional imaging diagnostic methods. Therefore, this article has conducted in-depth research and analysis on MRI whole body diffusion imaging technology in clinical medicine, and briefly explained its principle, T-site evaluation, and clinical application.

Keywords: Clinical Medicine; MRI; Whole Body Diffusion Imaging

1. Introduction

In recent years, due to the gradual improvement of the medical level in China, the MRI system for whole-body diffusion imaging in clinical medicine has made rapid progress, and the application of MRI diffusion weighting has become increasingly widespread. Among them, “magnetic” is a new type of imaging technology that was first developed by Japanese scholars. The imaging images provided by it have a tissue contrast that is different from that of conventional MRI, and it can prompt the patient to breathe freely. Complete the scan of all parts of the body, including the pelvis, abdomen, chest, etc., and can visually display the location and size of the lesion. This article is about the study of MRI whole-body diffusion imaging technology in clinical medicine, and it is described as follows.

2. Principle of whole body diffusion imaging technology

In the process of medical clinical diagnosis of various diseases, the use of magnetic resonance whole-body diffusion imaging technology can effectively detect the water molecules in the patient’s body that are in diffuse motion, and this diffuse motion of water molecules refers to a certain amount of water in the groundwater flow. When the number of solutes indicates that the tracker is migrating and spreading continuously, the influence that it can occupy in the average groundwater beyond the range of its velocity is also increasing. General fluid convection and thermal kinetic energy of particles can cause dispersion, which is the result of both mechanical mixing and molecular diffusion. For water molecules, the use of diffusion imaging has high sensitivity, so in the MRI diffusion weighted imaging technology in medical clinical, when the water molecules remain stationary, the spin echo (SE, spine echo) T2-weighted Two corresponding dispersion-sensitive gradient pulses are added before and after the sequence of 180-degree pulses, and the second gradient pulse can dephase the proton spin generated by the first gradient pulse to refocus, but cannot weaken the signal. The first gradient pulse for water molecules in motion can produce proton spin dephasing, and will move out of the original position, but it will not be focused by the second gradient pulse again, at this time, the detected signal will be weaken to a certain extent. In the process of NMR whole-body diffusion imaging, according to Fick’s law analysis, there is a net molecular motion caused by a concentration gradient, which is called dispersion. The molecular motion caused by thermal effects, pressure gradient ion effects, concentration differences, etc. cannot be effectively identified. Therefore, the dispersion measured in the body can be represented by the apparent diffusion coefficient (ADC). In a very short time, the MRI diffusion weighted imaging

technology can complete an image acquisition, which can minimize the error caused by artificial respiration, and can ensure that the patient can breathe freely in a large range, without interruption, The scan is completed from top to bottom, and the scanned parts involve the pelvis, abdomen, chest, etc., so as to obtain images with high resolution and high signal-to-noise ratio.

3. Evaluation of characteristics of whole body diffusion imaging technology

First, the key to the wide application of MRI diffusion-weighted imaging technology in modern medical clinical testing is that the detection basis of MRI diffusion-weighted imaging technology is the movement of water molecules, which has high sensitivity and good detection results. Through background suppression and black-and-white conversion technology, it can achieve the effect of PET-CT imaging by positron emission computed tomography, which not only has a significant effect on improving the detection rate of patients' lesions, but also can obtain more three-dimensional and intuitive lesion images, and medical staff can formulate scientific and reasonable treatment plans.

Second, the diffusion sensitivity coefficient can be detected in MRI diffusion weighted imaging technology. MRI diffusion weighted imaging technology can be used in stroke, intracranial tumor, demyelinating disease, infectious disease, brain abscess, diffuse axonal injury, and spinal cord disease. It is widely used in diagnosis, and the MRI diffusion-weighted imaging technology is different from other imaging techniques such as conventional MRI, CT images, nuclear medicine images and positron emission computed tomography PET-CT. MRI diffusion-weighted imaging has great advantages, that is, low cost, no radiation hazard, and early diagnosis of tumor diseases, so it is worthy of clinical application.

MRI diffusion whole-body imaging can also measure the apparent diffusion coefficient (ADC value). If the complexity of the tumor is higher, the density of the cells will be higher, the dispersion movement of water molecules will slow down, and the corresponding value will also decrease. This shows that MRI technology plays an important role in the examination and imaging of malignant tumors. In addition, MRI diffusion whole-body imaging can predict the therapeutic effect of tumors. Studies have found that the higher the ADC value of the tumor, the poorer the therapeutic effect of the tumor. At the same time, the lower the ADC value, the better the therapeutic effect of the tumor. Therefore, ADC value is the key to test the effect of tumor treatment. After the tumor is treated, pay attention to the increase of extracellular water, and the tumor ADC value will increase accordingly. The better the treatment effect, the worse the opposite. Therefore, the MRI diffusion whole-body imaging technology can make accurate treatment effects for tumor patients prediction. However, WB-DWI also has certain limitations. The technology is sensitive to changes in the content of fat and water in the bone marrow. Therefore, it is more sensitive to osteolytic lesions. The detection of bone metastasis is not as effective as radionuclide imaging. The image quality of the neck is poor and it is difficult to distinguish between large blood vessels and lymph nodes. WB-DWI works due to the effects of respiration, heartbeat motion artifacts, and air-tissue boundary magnetic sensitivity artifacts, indicating poor thoracic spine metastasis. High signal interference in the gastrointestinal tract leads to false positive and false negative lesions near the abdominal lymph nodes. WB-DWI is limited by the scanning fluid and field of view, and it is difficult to show the lesions of the distal limbs, which may lead to misdiagnosis of the skull and tibial ribs.

Since the MRI diffusion-weighted imaging technology can perform a comprehensive examination of all parts of the body without radiation damage, it can detect various lesions, tumors, and various body indicators, as well as other organ cysts and hemangiomas. So it has been widely cited in major hospitals. Generally speaking, the density of tumor cells is proportional to its complexity. As the dispersion of water molecules gradually slows down, the diffusion coefficient decreases accordingly. Studies have shown that the lower the apparent diffusion coefficient, it indicates that the tumor has not achieved a good therapeutic effect. Therefore, for patients with tumor diseases, the apparent diffusion coefficient can be used to assess the quality of the treatment effect.

4. Clinical application of whole body diffusion imaging technology

4.1 Application of WB-DWI in the detection of bone metastases

The diagnostic criteria of WB-DWI in the detection of bone metastasis are: patients with bone metastasis are already in

advanced stage of malignant tumor, and the puncture effect is not applicable to every patient. The clinical gold standard for the diagnosis of bone transplantation is a comprehensive use of many Imaging data and clinical data, and random follow-up review. Current status of imaging diagnosis of bone metastases: There are many methods for clinical diagnosis of bone graft tumors, mainly X-ray, CT, MR, and BS. These methods have different standards: X-ray sensitivity is relatively low, about The detection rate of the lesion is 30%-50%; CT is highly sensitive to the detection of tumor invasion of bone cortex, is not sensitive to bone marrow lesions, and has difficulty in the diagnosis of osteogenic or osteolytic reaction. MR workers are more sensitive to changes in bone marrow signals, especially in the early stage of bone transplantation, cancer cells generally infiltrate between the bone trabeculae, but no obvious osteogenic or osteolytic lesions occurred. MR workers found the skull and rib metastasis lesions instead of being very clear. The discovery of pelvic lesions is equivalent to radionuclide bone imaging. The imaging of the spine, clavicle-shoulder swelling bone-sternum, upper and lower limbs is better than radionuclide bone imaging.

4.2 WB-DWI for the diagnosis of systemic diseases

In patients with lymphoid tumors and multiple myeloma, there is widespread bone and organ or soft tissue infiltration throughout the body. WB-DWI plays an important role in the evaluation and treatment of the patient's condition. In DW image recognition, the lesions are mostly high-intensity, ADC value There will be a decline, the background will be white and the focus will be black on the computed tomography, which is conducive to the observation of the lesion, so that for patients with unobvious bone puncture, effective auxiliary diagnostic operations can be performed, and it can be effective later If the patient responds well to the treatment, the number of lesions on the DWI image will gradually decrease, the lesion signal will decrease, and the ADC value will increase accordingly.

5. Conclusion

In summary, MRI whole body diffusion imaging technology plays an important role in clinical diagnosis and treatment. As a new type of technology, with its unique diagnosis and treatment advantages and application value, it is of great significance in the clinical field. MRI whole body diffusion imaging technology is not only widely used in the field of clinical diagnosis and treatment, but also has a broad space for development in the future. The use value of this technology far exceeds the value of the technology itself. While bringing good news to patients, it also establishes a good image for the hospital and helps the hospital obtain huge economic benefits.

References

[1] Yang G, Wang M, Zhang M, *et al*. Research on MRI whole body Diffusion imaging technology in medical clinic (in Chinese). Journal of Imaging Research and Medical Applications 2018; 2(20): 76–77.

[2] Diao W. Clinical application of WB-DWI Technology. Journal of Imaging Research and Medical Applications 2018; 2(1): 33–34.

[3] Wu T. Magnetic resonance whole body imaging technology application value of malignant tumor staging. Journal of Liaoning University of Traditional Chinese Medicine 2014; 16(9): 172–174.

[4] Zhu Z, Jiang M. The value of diffusion-weighted magnetic resonance imaging body (WB-DWI) on the preoperative chemotherapy in breast cancer patients. Journal of Chinese Oncology 2016; 22(6): 443–447.

[5] Chen L. Application value of magnetic resonance imaging whole body-diffusion weighted imaging in evaluation of clinical effect of preoperative chemotherapy of patients with breast cancer. China Medicine and Pharmacy 2015; 5(15):165–167.

[6] Wu T, Wang N. Magnetic resonance whole body diffusion imaging of breast cancer patients. Journal of Liaoning University of Traditional Chinese Medicine 2014; 16(8): 196–197.

[7] Li N. Application of magnetic resonance whole body diffusion imaging in systemic tumor screening. China Medical Devices 2012; 27(8): 120–121+127.

[8] Jiao Z, Li C, Chen W. The technique and clinical application of whole-body magnetic resonance diffusion weighted

imaging. Biomedical Engineering and Clinical Medicine 2009; 13(3):262–268.