ARTICLE
Application of Multimodal MRI in Cerebral Infarction

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1. Introduction

Acute cerebral infarction is mainly due to stenosis or occlusion of cerebral blood supply arteries, resulting in insufficient blood supply to the brain. The causes of stenosis or occlusion of blood vessels mainly include atherosclerosis, dissection, vasculitis, moyamoya disease, and reversible cerebral vasoconstriction syndrome. Wait [1]. At present, the application of magnetic resonance technology in the diagnosis of cerebral infarction is very mature, but for the judgment of the etiology of cerebral infarction, such as the condition of the blood vessel wall and the state of cerebral blood flow perfusion, conventional magnetic resonance scanning technology cannot meet the requirements. Therefore, multimodal MRI has become a hot spot in imaging research.

2. High-resolution Magnetic Resonance Vascular Wall Imaging Technology (HR-VWI)

In the Asian population, the proportion of acute cerebral infarction caused by intracranial atherosclerosis accounts for 50%-60% [2], so atherosclerosis is an important risk factor for acute cerebral infarction. In view of the intracranial atherosclerotic blood vessel wall, high-resolution magnetic resonance vascular wall imaging technology has gradually played an increasingly important role. This technology mainly includes bright blood and black blood technology. Bright blood technology is TOF MRA, which uses inflow enhancement. The effect is to make the blood flow bright and high signal, and the tube wall lesion is relatively low signal, increasing the contrast between the two; the main acquisition sequence of the black blood technology includes spin echo, spatial pre-saturation, dou-
ble inversion recovery pre-pulse, motion sensitivity Drive balanced pre-pulses, variable delay precession, customized excitation, etc. to fully inhibit intraluminal blood flow and extravascular cerebrospinal fluid signals, highlighting intravascular lumen lesions. In addition, there are special sequences for the identification of plaque components, such as MPRAGE, SNAP, etc., which have a very high specificity for plaque bleeding. In identifying the cause of acute cerebral infarction, atherosclerotic plaque is a factor that must be considered. The basic principle of selecting an imaging scheme is to obtain sufficient information images with the shortest imaging time.

3. Magnetic Resonance Three-dimensional Arterial Spin Labeling Imaging Technology (3D-ASL)

3D-ASL uses hydrogen ions in the arterial blood as an endogenous tracer and uses its differential measurement imaging to detect changes in global cerebral blood flow after ischemia in the brain[3]. 3D-ASL can monitor the time required for reperfusion after ischemia and the progress of cerebral blood perfusion, and can also evaluate the therapeutic effect of embolism[4]. Many scholars have conducted 3D-ASL research on patients with acute cerebral infarction and found that ASL can better show the range and perfusion characteristics of the infarct area, and ASL has a higher sensitivity to the high signal of the edge of high or low perfusion area of cerebral infarction[5]. The 3D-ASL technology has a shorter scanning time, no need for contrast injection, overcomes the magnetically sensitive artifacts caused by echo imaging, and has a higher signal-to-noise ratio. It can clearly show the local lesion perfusion status of patients with cerebral infarction, and combined with the CBF value can be more objective Show ischemic infarction of brain tissue.

4. Magnetic Resonance Perfusion Weighted Imaging Technology (PWI)

Magnetic resonance perfusion weighted imaging (PWI) is very sensitive to changes in microcirculation tissue perfusion and can accurately reflect the microcirculation state of brain tissue[6]. Mean transit time (MTT), cerebral blood volume (CBV) and cerebral blood flow (CBF) can accurately reflect the hemodynamic status of the ischemic area in real time, and some scholars have confirmed that intracranial artery stenosis can be manifested at an early stage Because of the decrease of CBV and the increase of MTT, PWI is highly sensitive to predict cerebral infarction[7]. The combination of PWI and ASL can quantitatively identify the focal area of cerebral infarction, and some studies have found that ASL patients with acute cerebral infarction show that the infarct hypoperfusion is closer to the PWI peak time threshold (Tmax)[8]. The Tmax of the brain tissue area that exceeds the threshold is the PWI lesion area. Therefore, PWI can provide a basis for the early diagnosis and treatment options of cerebral infarction.

5. Magnetic Resonance Diffusion Weighted Imaging Technology (DWI)

With the gradual development of magnetic resonance technology, DWI technology has also become an important inspection method. The main principle of DWI is that the diffusion of water molecules in brain tissue is limited during cerebral ischemic infarction. The imaging mainly depends on the movement of water molecules, not the proton spin density. It is a kind of imaging and diffusion measurement that can be done on the living body. Technology[9]. The diffusion sensitivity of water molecules in the tissue is positively correlated with the b value. When the b value is reduced, the imaging focuses on the weighted image, and when the b value is increased, the imaging focuses on the diffusion image. In the actual application process, the image signal to noise ratio and the image should not be affected due to the inappropriate b value. Detection of lesions[9]. For intracranial atherosclerotic plaques that cause cerebral infarction, DWI can quantitatively identify the internal components of the plaque, especially the lipid necrosis core and the fibrous cap. The lipid core presents a diffusion-limited feature on DWI, that is, high signal. The INH necrosis core and the fibrous cap. The lipid core presents a diffusion-limited feature on DWI, that is, high signal. The diffusion-limited feature on DWI, that is, high signal. The

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