

The Clinical Application Value of CTA and CMR in Diagnosis and Evaluation of Coronary Heart Disease

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Abstract: Coronary heart disease (CHD) is one of the most common heart diseases in clinic. Clinical diagnosis relies on coronary angiography (CAG) as the main diagnostic tool. However, CAG is an invasive diagnostic method with contraindications and adverse reactions, and the diagnosis of coronary heart disease can not effectively detect the adhesion plaque after coronary arteriosclerosis. The limitations are large and often bring unnecessary trouble to patients. There are also some difficulties in treatment. It can not effectively evaluate the clinical stages of coronary heart disease and have a certain impact on the patient's body, etc., which will promote the continuous innovation of new diagnostic technology and equipment. The rapid development of CT Multi-slice Spiral CT (MSCT) and Magnetic Resonance Imaging (MRI) technology. CT Angiography (CTA) and Cardiovascular Magnetic Resonance (CT Cardiovascular).CMR the continuous emergence of technology has provided new ideas and methods for the clinical diagnosis of coronary heart disease. This article will rely on the technology of coronary CT angiography and magnetic resonance angiography to analyze the diagnosis and treatment of coronary heart disease under the two technologies. I hope this chapter can help clinical diagnosis and treatment of coronary heart disease.

Key words: Scoronary heart disease, CTA, CMR, curative effect evaluation.

1. Introduction

Clinically, coronary heart disease is one of the diseases with high fatality rate. In order to improve the survival rate and quality of life of patients, the improvement of the diagnostic rate of coronary heart disease is an important foundation. Only by correct diagnosis, finding out the cause of disease and arranging the treatment plan reasonably can we effectively protect the patient's survival. After entering the opening of the left and right coronary artery, the contrast agent is injected into the coronary artery to make the coronary artery imaging. This method is commonly used in clinic. However, the difficult operation, high cost, and invasive diagnostic method have limited its application and development. Coronary artery CT angiography and magnetic resonance angiography all through the device, contrast agent, post-processing technology, such as artificial control, so that the patient's heart, coronary artery and so on have a better examination, clearer the patient's condition [1]. Under the application of technology, for clinicians to have a better grasp of the patient's coronary blood flow. Thus, a series of data such as cardiac physiological structure, function and myocardial movement are obtained, which provides data support for clinical therapeutic effect evaluation, and is emerging as a new imaging diagnostic technology in clinical practice.

2. Coronary Atherosclerotic Heart Disease

2.1. Overview

Among the ten major death diseases reported by WHO, coronary heart disease (12.9%), known as coronary heart disease (CHD), is called coronary heart disease (CHD). It is caused by coronary artery ischemia. It is also known as ischemic heart disease (IHD). It is more common in women over 40 years old, with more males than females. It is customary to equate CHD to coronary atherosclerotic heart disease. Coronary atherosclerotic heart disease is mainly caused by myocardial ischemia. Myocardial ischemia may be a narrow >50% and complex lesion caused by coronary artery insufficiency and plaque. Myocardial oxygen consumption increases, such as sudden increase in blood pressure, fatigue, emotional excitement, cardiac hypertrophy and other myocardial supply is relatively insufficient. Coronary heart disease is difficult to cure, with the location and degree of lesions and vascular stenosis development speed, organ damage and so on, the prognosis also has different situations.

2.2. Main Clinical Manifestations

Angina pectoris (angina pectoris) refers to the clinical syndrome caused by acute coronary artery insufficiency and / or sudden increase in myocardial oxygen consumption, resulting in rapid, temporary ischemia and hypoxia. It is characterized by paroxysmal precordial pain or oppression, which can radiate the left upper limb for a few minutes. Angina is caused by nitroglycerin or rest. Angina is caused by the acidic products of myocardial ischemia and hypoxia, which stimulates nerve terminal pain. It is divided into stable angina pectoris: the nature, intensity, location, frequency and inducement of angina pectoris do not change significantly within 1 to 3 months; coronary stenosis >75%; Unstable angina pectoris: in 3 months, the frequency, degree, duration, and inducement of pain often change, progressive deterioration. It often causes plaque and thrombus, and convulsion. Variant angina pectoris: often occurs when resting or waking up, often due to arterial spasm.

Myocardial infarction (MI) myocardial infarction refers to the rapid reduction or interruption of coronary blood supply, and the corresponding myocardial ischemia resulting in myocardial necrosis. There are severe and persistent sternal pain in the clinic. Rest and nitric acid preparations can not be relieved. The clinical reasons are mostly caused by bleeding in coronary atherosclerotic plaques. It causes coronary artery spasm. It is divided into subendocardial myocardial infarction (infarction) which only involves the heart part of the inner wall of the ventricular wall and the transmural myocardial infarction. It is also known as regional myocardial infarction, with large lesions, the largest diameter is more than 2.5cm, and involves the 2/3 of the full wall of the ventricular wall or the ventricular wall.

Myocardial fibrosis (myocardial fibrosis) is characterized by myocardial fibrosis. It is the result of persistent and / or repeated aggravation of ischemia and hypoxia caused by moderate or severe coronary artery stenosis.

Sudden coronary death (SCD) SCD is the most common type of sudden cardiac death. It is mainly due to the fact that the patient has coronary atherosclerosis, thrombosis or bleeding within the plaque. If there is alcohol, fatigue, smoking, strenuous exercise and quarrels, sudden death will occur.

In addition to the above symptoms, physical activity or emotional agitation can cause sudden pain in the precordial area, mostly for angina pectoris or squeezing pain. It can also be characterized by oppression, pain from the sternum or the precordial area, from the top to the left shoulder and arm, even to the little finger and ring finger. Taking breaks or taking nitroglycerin can effectively relieve pain. If the pain is aggravating and the frequency is fast and the duration is longer, seek medical advice promptly and avoid the best treatment time.

3. Coronary CT Angiography and Cardiovascular Magnetic Resonance Imaging

3.1. Coronary Artery CT Angiography

The technology is mainly used in clinical diseases such as arteriosclerosis, aortic aneurysm and aortic dissection. By means of checking the obstruction or abnormal auxiliary diagnostic measures of blood vessels, the data of scanning and imaging can be analyzed and stored by means of X-ray, detector and scanning device. Finally, the image is put on the computer or TV screen through the reorganization of the image software. By means of rotation, translation and fixation, the imaging technology is constantly improved, and the images are obtained by multi-dimensional photography. On this basis, the contrast agent is injected to make the angiography more obvious. The angiographic images can be obtained by scanning and reconstructing the computer system. It has good clinical diagnostic value for patients with heart diseases or aortic diseases [2].

3.2. Cardiovascular Magnetic Resonance Imaging

Cardiovascular magnetic resonance imaging (CMRI) is used to reconstruct the blood vessels using the signals generated by the hydrogen nuclei in the magnetic field. The blood vessels are observed by contrasting the difference in the signal conduction between the blood vessels and the rest tissues. 1.0T and 1.5T High magnetic field intensity is more conducive to spatial resolution. Commonly used technologies include non-enhanced MRA, such as time flies, MRA and phase contrast MRA, and contrast enhancement of paramagnetic contrast agents to shorten the time of blood vessel t1 contrast enhancement MRA. In clinical the use of the above method effectively avoids the damage of radiation, isotope effects and contrast agents to the human body [3].

4. Evaluation of Coronary Heart Disease under CTA and CMR

4.1. Coronary Artery Stenosis

The patients were diagnosed differently by CTA and CMR. The coronary artery stenosis was divided into 5 segments: the right coronary artery, left coronary artery, left main artery, left anterior descending branch and left circumflex artery. The doctors analyzed and evaluated the imaging findings, and evaluated the severity of coronary artery stenosis, whether the image was seriously ghosting, whether the blood vessel boundary was clear or not. With the most severe stenosis as the standard, 50% of the lumen stenosis was used to evaluate multiple stenosis. CTA showed significant coronary artery stenosis in image quality rating, severe imaging contrast, blurred edge, 50% of segment stenosis was mild stenosis, 30% stenosis was moderate stenosis, and 10% stenosis was mixed stenosis. 10% of them were specific stenosis. There were several cases of CTA showing severe stenosis and MRA showing mild stenosis. The image quality of the CMR showed clearly in the image quality assessment. There were mild contrast radiography, clear edge. 65%, mild stenosis, 25% stenosis, moderate stenosis, 5% stenosis as mixed stenosis, 5% as specific stenosis, and double diagnosis of the detected stenosis by CTA and CMR. Its specificity, coronary artery stenosis sensitivity and accuracy are all higher. CTA and CMR have good diagnostic value for the diagnosis of coronary artery stenosis.

4.2. Image Quality Assessment

Maximum intensity projection, multidimensional reconstruction and volume reconstruction were performed on CTA and CMR images of patients. The coronary artery was reconstructed by counting. The length, diameter, thickness and degree of stenosis of the main branches of the coronary artery were measured and recorded. The image was used to observe whether the image was seriously ghosting, whether the blood vessel boundary was clear or not, and the ratio of tissue to specific degree was evaluated.

The measurement error of CTA and CMR for the diameter and length of coronary artery was <2mm, CMR. Image quality evaluation of the right coronary artery, left coronary artery, left main artery, left anterior descending branch, and left circumflex branch were evaluated to be below 10%, $P < 0.05$. The quality of CTA images in the quality evaluation was high [4].

4.3. Identification of Patch Damage

After plaque formation, plaques may form thin cap fibro-atheroma (FA) and cause severe coronary artery disease. Reasonable measures to reverse plaque damage can effectively improve the efficiency of clinical treatment. CTA is more accurate in locating plaque. There is a close relationship between the CT value and the positive remodeling of blood vessels. In image analysis, we can see that CTA has a high incidence of positive remodeling of blood vessels and a significant decrease in CT value. Its specificity, positive rate and negative rate have also reached 95%, 93% and 86%. MRA respectively. We can see that the incidence of CTA positive remodeling is lower than that of CTA. The CT value was slightly higher. The specificity, positive rate and negative rate are 82%, 88% and 75% respectively. It can be seen that CTA plays an important role in the identification of vulnerable plaques. However, there are also defects in CTA application. The absorption and attenuation of scanning machine and method and contrast agent in the coronary artery cavity will affect the stability of CT value measurement.

For mild attenuation plaques, there are no specific quantitative criteria. They are also affected by image quality, image visualization, vessel diameter, lumen thickness, calcification area and dimensional resolution. There are great differences between the data for the breakage of plaque and the diameter measurement due to objective reasons. After repeated technical improvement and standard specification, CTA will have a more significant accuracy in diagnosing the damage of the patch.

4.4. Intraluminal Density Attenuation Gradient: The Mainly Index of Coronary Blood Flow

After calculating the linear regression coefficient between the density attenuation value and the length of the coronary artery opening, we can get the CTA image after tag evaluation. We will find that the average tag of the stenosis degree will be affected by the type of coronary artery stenosis. Functional stenosis or specific stenosis will be smaller than that of tag with mild stenosis and other general narrow tag. The specificity is 80%~82%, the negative rate is between 60% and 70%. After CMR image analysis, after the tag numerical analysis, the difference in specificity of coronary artery stenosis degree is not CTA high, the average tag value is relatively large, it is difficult to distinguish the type. The positive rate of CMR combined with tag is 64%, specificity is 68%, and the negative rate is 50%. It can be seen that CTA has a good diagnostic standard for the stenosis degree [5].

5. Four Treatment and Prevention of Coronary Heart Disease

5.1. Interventional Therapy

Chronic total occlusion of coronary artery (CTO) is the most serious type of coronary heart disease in clinic. It is more difficult to treat, and has the characteristics of high disability rate, high mortality and poor prognosis. Percutaneous coronary intervention (PTCA) can be applied to the stenosis of the coronary artery through the peripheral artery to the coronary artery. The balloon can expand the narrow cages, improve the blood flow, and place the stent in the dilated stenosis to prevent stenosis. It can be combined with thrombus aspiration. It is suitable for patients with unstable angina pectoris, unstable angina pectoris and myocardial infarction. Acute myocardial infarction is the first choice in the acute stage.

5.2. Chinese Medicine Treatment

Heart yang deficiency: we should treat the *Pinellia ternata*, tangerine peel, *Arisaema amarum* and

Amomum villosum by the method of aromatic turbidity, warming and transforming phlegm.

Heart Yin deficiency is the main treatment method of Supplementing Qi and nourishing yin. The main prescription is *Radix heterophylla*, *Radix Paeoniae Alba*, *Ophiopogon japonicus* and *Dendrobium*, which are commonly used for nourishing yin and nourishing yin.

In addition, the treatment of *Huoxue Tongmai* is the treatment principle. The treatment methods include Invigorating Qi, activating blood circulation, activating blood circulation and dredging pulse, and *Wen Shenyang*: according to the different conditions of patients, they can give targeted treatment, such as dry mouth, redness of tongue, less fur, and consider Yin deficiency Cure.

5.3. Other Treatments

General treatment: changes in lifestyle: smoking cessation, alcohol restriction, low fat and low salt diet, proper physical exercise, weight control, etc.

Drug therapy: standardized drug therapy can effectively reduce the mortality rate of patients with coronary heart disease and the occurrence of ischemic events, and improve the clinical symptoms. The main drugs are nitrates, antithrombotic drugs, beta blockers, calcium channel blockers, and renal cord vascular tight Zhang Su system inhibitors.

6. Prevention of Coronary Heart Disease

The prevention of coronary heart disease is also very important. We should change our habits and habits, develop the habit of keeping early hours, do not stay up late; on the diet side, we should also have a balanced diet, not picky eaters, eat more vegetables and fruits, supplement vitamins, and give up smoking and drinking. The food should be low salt, low fat and low sugar, and control diet. In addition, we should also do the necessary physical exercise, and can jog or fast walk and other more documentary sports. To improve the body's resistance, control the weight and body function of various indicators, for some dangerous diseases, such as hypertension, diabetes, hyperlipidemia and so on should be actively treated, so as to control the development of atherosclerosis to the maximum extent.

Once the symptoms of angina pectoris occur, rest immediately, and sublingual nitroglycerin at the same time, usually after rest or nitroglycerin, usually can relieve angina within one or two minutes. It can also contain or take Chinese medicine compound *Danshen* dripping pills or *Kyushin* Pills, but it will take a longer time to relieve angina. If nitroglycerin is contained for five minutes, it will not relieve. Nitroglycerin can be reconstituted. If it is the first angina, no matter whether the drug can be alleviated, it is necessary to go to the hospital as soon as possible, because the first angina pectoris, the risk of myocardial infarction, to minimize the pain of patients.

7. Concluding Remarks

Coronary atherosclerotic heart disease causes serious consequences of myocardial ischemia and hypoxia due to atherosclerosis. Coronary heart disease, myocardial infarction, asymptomatic myocardial ischemic type, heart failure, arrhythmia and sudden death are classified as clinical classifications. Coronary heart disease is one of the most important diseases affecting Chinese residents. If there is no earlier diagnosis and treatment, the quality of life of patients will often be reduced. Coronary angiography as a clinical diagnostic standard of "gold standard" has gradually disappeared in clinical diagnosis in recent years due to the discovery of its diagnostic rate and invasive diagnostic mode. Coronary CT angiography and cardiovascular magnetic resonance imaging have been applied continuously because of its non-invasive and high diagnostic rate. The two were to judge the diagnosis effect in four aspects: coronary artery stenosis, image quality assessment, plaque damage identification and lumen density attenuation gradient. It can be seen that CTA has a good diagnostic effect for coronary heart disease. However, due to its insufficiency, the

clinical repetition rate is low, and it is still necessary to improve and perfect CMR. Because of the continuous development of imaging, it can have good prospects for development. The theory and application of 4D - MRA will be a great innovation for clinical diagnosis, which can promote the rapid development of medical and health services in China.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Ren Bin-Hua conducted data collection and analysis, and wrote the first draft of the paper. Xiao Changjiang verified the data and revised the paper several times.

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Ren Binhua was born in Changsha, Hunan province, China on March 15, 1991. In 2013, she obtained a bachelor's degree from Mudanjiang Medical College, Mudanjiang City, Heilongjiang Province, China. During the school period, she mainly studied medical imaging and basic clinical direction. Since she graduated from 2013, she has been working in the Affiliated Hospital of Hunan Academy of Traditional Chinese Medicine in the department of Radiology. She has been interested in the relationship between angiography and clinical application, and has been working on it for several years.