

Imaging Effect and Accuracy Analysis of 64-Slice Spiral CT in the Diagnosis of Coronary Artery Stenosis

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Abstract: *Objective:* To analyze the imaging effect and accuracy of 64-slice spiral CT in the diagnosis of coronary artery stenosis. *Methods:* 30 patients with suspected coronary heart disease admitted to our hospital from March 2022 to March 2023 were selected. All patients underwent both 64-slice spiral CT and digital subtraction angiography (DSA). DSA is considered the gold standard for diagnosis, so it was used to analyze the diagnostic performance of 64-slice spiral CT. *Results:* (1) The diagnostic results of digital subtraction angiography and 64-slice spiral CT was analyzed and compared with each other. The 64-slice spiral CT had an accuracy of 96.67% (29/30), a sensitivity 96.55% (28/29), and a specificity of 100.00% (1/1) in diagnosing coronary artery stenosis. (2) There was no significant difference between 64-slice spiral CT and digital subtraction angiography in the positive detection rate of anterior descending artery lesion, the positive detection rate of left main lesion, the positive detection rate of left circumflex artery lesion and the positive detection rate of right coronary artery lesion ($P > 0.05$). (3) There was no significant difference between 64-slice spiral CT examination and DSA examination in identifying mild stenosis, moderate stenosis, and severe stenosis of coronary arteries ($P > 0.05$). *Conclusion:* 64-slice spiral CT examination can accurately determine the degree of occlusion of coronary arteries, which allows for the accurate diagnosis of coronary artery stenosis.

Keywords: 64-slice spiral CT angiography; Coronary artery stenosis; Diagnostic performance

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1. Introduction

Coronary heart disease is a common disease primarily characterized by coronary artery stenosis. Once coronary artery stenosis occurs, myocardial cells will not receive sufficient blood supply, leading to myocardial ischemia and hypoxia, which are also the basic pathological change of various clinical symptoms of coronary heart disease^[1,2]. Coronary artery stenosis is closely related to underlying diseases such as hypertension, diabetes, and hyperlipidemia. The main cause of coronary artery stenosis is coronary artery atherosclerosis. Thrombus, fat, calcium carbonate, and connective tissue accumulate on the coronary artery walls due to an unhealthy lifestyle or diet, leading to the development of coronary artery atherosclerosis. This process causes

the arterial walls to thicken and harden, resulting in the narrowing of the lumen, which is referred to as coronary artery stenosis^[1,2]. At present, the gold standard for detecting the degree of coronary artery stenosis is digital subtraction angiography (DSA). However, there are certain limitations to its application, as coronary digital subtraction angiography exhibits a high rate of displaying sclerotic plaques, which can cause missed diagnoses. Consequently, the quest for a safer, non-invasive, and cost-effective method to assess coronary artery stenosis remains a focal point among scholars. With the continuous development and progress of imaging technology, multi-slice spiral CT (MSCT) has been widely used in clinical diagnosis of coronary artery disease. Among them, the 64-slice spiral CT technology marks a huge progress in medical technology, and it plays an increasingly important role in the diagnosis of coronary artery disease and the prediction of the risk of coronary heart disease^[3,4]. The advantage of this technique lies in its high spatial resolution and signal-to-noise ratio. It can determine the degree of stenosis of the lumen and identify the tissue components of the plaque, and it is also highly sensitive. In this study, 30 patients with suspected coronary heart disease admitted to our hospital between March 2022 and March 2023 were selected. The purpose of this study is to further analyze the application value of 64-slice spiral CT coronary angiography in clinical diagnosis of coronary artery stenosis.

2. Materials and methods

2.1. General information

A total of 30 patients admitted from March 2022 to March 2023 were included in the study, all of whom were suspected coronary heart disease. This included 16 male patients and 14 female patients, aged 45–73 years old, with an average 59.28 ± 6.12 years old. In terms of underlying diseases, 10 patients had type 2 diabetes, 12 patients had hypertension, and 15 patients had hyperlipidemia. This study was approved by the ethics committee of our hospital. Inclusion criteria: (i) Patients who voluntarily cooperate to complete the relevant inspection items of this study and sign the consent form; (ii) Patients who present with chest tightness, chest pain, and myocardial ischemia when they are admitted to the hospital, and they are suspected to be coronary heart disease at the first diagnosis; (iii) Patients without mental illness or dementia, with good compliance and cooperation. Exclusion criteria: (i) Patients with severely impaired liver and kidney function; (ii) Patients with immune system diseases; (iii) Patients with blood system diseases.

2.2. Methods

All patients underwent an 64-slice spiral CT coronary angiography examination: the patients were required to refrain from drinking for at least 13 hours and undergo an electrocardiogram examination to ensure that their heart rate could be stabilized at about 70 beats per minute. If the patient's heart rate exceeded the specified standard, Betoprolol was administered. The patients were asked to perform inhalation and breath-holding exercises ease the examination process and avoid respiratory artifacts. The equipment used during the examination was Philips Incisive 64-slice spiral CT Scanner. The patients laid in a supine position, and the electrodes were placed on their bodies. To make sure that ECG signal could be generated, the patients were instructed to hold their breath, and a routine plain scan of the coronary artery was performed. The scanning procedure initiated at the tracheal carina and extended to the lower diaphragm boundary, with the following scan parameters: screw pitch (0.2-0.24), tube voltage (120kV), and tube current (100mA). Following the plain scan, an enhanced scan was conducted after injecting a non-ionic contrast medium (iohexol, concentration: 350mg/mL) through the median vein at the elbow, with a dose of 60-70mL administered at a rate of 3–4mL/s. The concentration of the contrast agent in the aortic root was moderated, and automatic trigger technology was employed. The scanning parameters for enhancement were set as follows: slice thickness (0.75mm) and

FOV (200mm). After scanning, the data obtained were uploaded to the post-processing workstation, and post-processing inspection was carried out. After undergoing the aforementioned procedures, the patients then underwent a DSA examination. During the examination, the standard operating procedures and specifications were strictly followed. The obtained images were reviewed by two experienced radiologists, and a consensus was reached. In cases where there was a lack of agreement, a unified conclusion was achieved through collective discussion.

2.3. Observation indicators

2.3.1. Analysis of 64-slice spiral CT examination results

The diagnostic efficacy of 64-slice spiral CT was analyzed using DSA as the gold standard, which includes accuracy, sensitivity, and specificity, calculated using the equations below.

$$\text{Accuracy} = \frac{(\text{number of true positive cases} + \text{number of true negative cases})}{30} \times 100.00\%$$

$$\text{Specificity} = \frac{\text{number of true negative cases}}{(\text{number of true negative cases} + \text{number of false positive cases})} \times 100.00\%$$

2.3.2. Detection rate

The positive detection rate of anterior descending artery lesion, the left main artery lesion, the left circumflex artery lesion, and the right coronary artery lesion of 64-slice spiral CT were compared against the DSA results.

2.3.3. Accuracy for different degrees of occlusion

Lumen stenosis of not more than 50% is considered mild stenosis, stenosis of more than 50% but not more than 75% is considered moderate stenosis, and stenosis more than 75% is considered severe stenosis.

2.4. Statistical analysis

The research data was processed with SPSS 24.0, and the enumeration data were described as n (%). A χ^2 was performed to compare the data of both groups, and $P < 0.05$, indicates statistical significance.

3. Results

3.1. Analysis of 64-slice spiral CT examination results

Using coronary angiography as the diagnostic gold standard, the accuracy of 64-slice spiral CT in diagnosing coronary artery stenosis was 96.67% (29/30), the sensitivity was 96.55% (28/29), and the specificity was 100.00% (1 /1), as shown in **Table 1**.

Table 1. Analysis of 64-slice spiral CT examination results

CT scan	DSA		Total
	Positive	Negative	
Positive	28	0	28
Negative	1	1	2
Total	29	1	30

3.2. Comparison of detection rate between 64-slice spiral CT and DSA

There was no significant difference in the positive detection rate between the two inspection methods ($P > 0.05$), as shown in **Table 2**.

Table 2. Comparison of detection rates between 64-slice spiral CT and coronary angiography

Examination method	No	Anterior descending artery disease	Left main disease	Left circumflex artery disease	Right coronary artery disease
64-slice spiral CT	28	18 (64.29)	8 (28.57)	1 (3.57)	1 (3.57)
DSA	29	18 (62.07)	8 (27.59)	2 (6.90)	1 (3.45)
χ^2		0.010	0.045	0.001	0.482
P		0.919	0.832	0.975	0.487

3.3. Comparison of the accuracy between 64-slice spiral CT and DSA for different degrees of occlusion

There was no significant difference in the degree of coronary artery occlusion between the two inspection methods ($P > 0.05$), as shown in **Table 3**.

Table 3. Comparison of 64-slice spiral CT and coronary angiography for the detection accuracy of different degrees of occlusion (n [%])

Examination method	No	Mild	Moderate	Severe
64-slice spiral CT	28	16 (57.14)	10 (35.71)	2 (7.14)
Coronary angiography	29	17 (58.62)	10 (34.48)	2 (6.90)
χ^2		0.024	0.032	0.232
P		0.876	0.857	0.629

4. Discussion

There is a close correlation between the occurrence of coronary heart disease and coronary artery stenosis. Patients with coronary heart disease often experience coronary artery stenosis. The exacerbation of myocardial ischemia can even cause sudden death [5,6]. Therefore, early detection and treatment of coronary artery stenosis is of great significance to improve the prognosis and quality of life of patients.

In the past, DSA was usually used clinically to determine the location and degree of coronary artery stenosis. However, this inspection method is invasive, which can cause damage to the body to a certain extent, and it is expensive, which is a concern for some patients. With the advancement of CT, 64-slice spiral CT coronary angiography has played an increasingly important role in the diagnosis of cardiac lesions, especially in determining the degree of coronary artery stenosis [7,8]. Moreover, this examination method is non-invasive, so it is well-accepted by patients. The 64-slice spiral CT enables rapid scanning of coronary arteries from various angles and planes, facilitating timely lesion detection and assessment of lesion severity. This study's findings demonstrated that the accuracy of 64-slice spiral CT for diagnosing coronary artery stenosis was 96.67%, with a specificity of 100.00% and a sensitivity of 96.55%. Moreover, no significant difference was found in either the positive detection rate of lesions or the detection rate of coronary stenosis ($P > 0.05$) between the CT method and DSA. This further confirmed the 64-slice spiral CT is highly useful for the diagnosis of coronary artery stenosis.

However, the image quality of 64-slice spiral CT is affected by some factors, such as scan delay, the

patient's heart rate or respiratory rate, reconstruction technique, scan parameter settings, reconstruction algorithm, etc^[9,0]. Improper handling of any of the factors above can affect the quality of the resulting image. Moreover, the quality of the image is also related to the CT equipment. The better and more advanced the CT equipment itself, the higher the spatial and temporal resolution of the image. Multi-slice spiral CT is the result of the continuous development of CT technology. The 64-slice spiral CT has both high spatial resolution and time resolution.

The application of this technology has achieved isotropy, leading to a significant improvement in image quality. The equal-width detector in the 64-slice spiral CT machine can rotate 360° in 0.4 seconds, substantially reducing scanning time, with the shortest duration being 8–10 seconds. In this way, the impact of scan parameters, reconstruction techniques, and patient respiratory rate on CT image quality can be significantly reduced^[11,12].

5. Conclusion

In summary, 64-slice spiral CT coronary angiography can be used in the clinical diagnosis of coronary artery stenosis. This technique is non-invasive, moderately priced, and accurate, making it a highly feasible method.

Disclosure statement

The authors declare no conflict of interest.

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