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Review Article

Analysis on value of CT and MRI clinical application in diagnosis of middle-aged patients with multiple cerebral infarction

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Abstract: Objective: To compare the application of MRI and CT imageological examination in diagnosis of middle-aged patients with multiple cerebral infarction. Methods: 218 cases of patients with multiple cerebral infarction were selected for CT and MRI examinations, and the clinical value of CT and MRI examinations in diagnosis and imaging of middle-aged patients with multiple cerebral infarction was compared and analyzed. Results: For the 218 cases of patients, the total detection rate of CT examination was 56.88% and that of MRI examination was 95.87%, indicating a statistically significant difference (x^2=6.795, P=0.008). For the 85 patients in the group of less than 24 h, the detection rate of CT examination was 37.65% and that of MRI examination was 94.12%, and the comparative analysis between two groups suggested a statistically significant difference (x^2=6.357, P=0.006); for the 70 cases in the group of 24~72 h, the detection rate of CT examination was 48.57%, and that of MRI examination was 97.14%, suggesting a statistically significant difference (x^2=5.315, P=0.026); for the 63 cases in the group of greater than 72 h, the detection rate of CT and MRI examinations showed no statistically significant difference (P>0.05). This showed that the cerebral infarction detection rate of MRI examination was significantly higher than that of CT examination in the group of less than 24 h and the group of 24~72 h, while the difference in the cerebral infarction detection rate was not significant in the group of greater than 72 h. The number of lesions detected by MRI examination was significantly higher than that by CT examination (P<0.01); the capability of MRI examination to detect small lesions of cerebral infarction was significantly stronger than that of CT examination (P<0.05). Conclusion: MRI has significant advantages in diagnosis of middle-aged patients with multiple cerebral infarction when compared to CT.

Keywords: Middle-aged patients with multiple cerebral infarction, MRI, CT, X-ray computer

Introduction

Multiple cerebral infarction (MCI) is also known as multiple encephalomalacia. In addition to commonly occurring paralysis and sensory disability and language barrier, the manifestation may also involve dementia [1]. MRI and CT imageological techniques play an important role in the examination of brain diseases. 218 cases of patients with multiple cerebral infarction admitted to our hospital from January 2012 to January 2014 were collected as research subjects so as to analyze the performance differences of CT and MRI imageological indexes in middle-aged patients with multiple cerebral infarction.

Materials and methods

General information

These 218 cases of patients were included in this study with the informed consent of patients and their families as well as the approval of hospital Ethics Committee. These patients composed 148 males and 70 females aged from 41 to 59 with a mean age of (51.12±10.26) years. Given the language barrier, limb hemiplegia, motor and sensory dysfunction and other symptoms on admission, the included patients were initially diagnosed as multiple cerebral infarction. Then, these patients underwent conventional CT and MRI examinations, and the examination results were recorded.

Table 1. Detection rate of cerebral infarction regarding different times in two groups (%)

CT	MRI		Total
	Have	None	
Have	123	1	124
None	86	8	94
Total	209**	9*	218

Note: Compared with CT, *refers to $P<0.05$ and **to $P<0.01$.

Examination

The CT examination adopted 16-slice spiral CT scanner (GE, USA) with the settings including scan matrix of 512×512, slice thickness of 10 mm, and scan delay time of 48~56 s with a mean of 53 s; the target areas were scanned using 5 mm and 2 mm slices, where the collimation was set at 0.75 mm and table-advancing rate at 2.8 mm/r.

NOVA1.5T superconducting magnetic resonance imaging system (Siemens) was used for MRI examination to perform T1WI/T2WI imaging scan at positions of SAGI, TRNS and CORO.

Image analysis

The CT and MRI scanning images were analyzed by two experienced radiologists in our hospital, and the operators had no knowledge about the clinical data of CT- and MRI-scanned patients in advance. We referred to the report by *Paciaroni, et al.* for lesion diameter, area and other standards [2]. In the CT and MRI examinations, the size and number of cerebral infarction lesions, examination duration, and time interval between established lesions and cerebral infarction were recorded in details and finally summarized for statistical analysis.

Statistical analysis

Statistical method: For the overall detection results data after collating, please refer to **Table 1**.

Inspection result of multiple cerebral infarctions (MCI) in elderly patients by two inspection methods.

Firstly, carry out analysis on the total detection rate for CT group and MRI group, since the data are categorical data, if is desired to compare whether there is a difference with respect to detection of multiple cerebral infarctions (MCI) in elderly patients between CT and MRI, it should select the chi-square test of four matched tables to conduct comparison, and the specific steps are that: (1) establish test-hypothesis and define the inspection level; if H_0: $\pi_1=\pi_2$, then there is no difference in the detection result of MCI in elderly patients for the two methods; and if H_1: $\pi_1\neq\pi_2$, then there is a difference in the detection result of MCI in elderly patients for the two methods; (2) calculate test statistics, there is a theoretical frequency $1<T_{22}=3.8<5$ in the study, and it should employ the calibration formula for the chi-square test of four matched tables to perform tests; and (3) determine the value *P* and make statistical inference, check the chi-square boundary value table, according to the level of $\alpha=0.05$, $P<0.05$ indicates that the difference has statistical significance. For the above statistical inference, it adopts statistical software SPSS15.0 data package to carry out analysis.

Similarly, conduct grouping according to the onset time of cerebral infarction: <24 h, 24~72 h and >72 h, carry out analysis in accordance with the above-mentioned methods, and compare the detection results obtained by the two methods.

Results

Detection rate at different visiting times

According to the interval between onset and visiting time, the patients with cerebral infarction were divided into three groups, i.e., the group of less than 24 h, the group of 24~72 h and the group of greater than 72 h, for further comparison. The results showed that the total detection rate of CT examination in these 218 cases of patients was 56.88% and that of MRI examination was 95.87%, indicating a statistically significant difference ($x^2=6.795$, $P=0.008$). For the 85 patients in the group of less than 24 h, the detection rate of CT examination was 37.65% and that of MRI examination was 94.12%, and the comparative analysis between two groups suggested a statistically significant difference ($x^2=6.357$, $P=0.006$); for the 70 cases in the group of 24~72 h, the detection rate of CT examination was 48.57%, and that of MRI examination was 97.14%, suggesting a sta-

Table 2. Comparison of different examination indicators in two groups regarding cerebral infarction

Item	Lesion number (n)	Lesion size (mm^2)	Examination duration (min)	Onset -examination interval (day)
CT	1.9±0.5	11.3±2.5	18.9±2.6	1.9±0.1
MRI	2.4±0.9**	8.6±1.8*	10.6±1.5*	0.9±0.2*

Note: Compared with CT, *refers to $P<0.05$ and **to $P<0.01$.

Table 3. Abnormity detection of at different cerebral infarction sites

Item	Frontal lobe	Temporal lobe	Parietal lobe	Basal ganglia	Paraventricular area	Thalamus	Cerebellum
CT	43	15	32	91	44	36	20
MRI	86*	17	46*	113*	48	46*	27

Note: Compared with CT, *refers to $P<0.05$.

tistically significant difference ($x^2=5.315$, $P=0.026$); for the 63 cases in the group of greater than 72 h, the detection rate of CT and MRI examinations showed no statistically significant difference ($P>0.05$). This showed that the cerebral infarction detection rate of MRI examination was significantly higher than that of CT examination in the group of less than 24 h and the group of 24~72 h [3], while the difference in the cerebral infarction detection rate was not significant in the group of greater than 72 h (**Table 1**).

Comparison of different examination indicators

The results showed that the number of lesions detected by MRI examination was significantly higher than that by CT examination ($P<0.01$); the capability of MRI examination to detect small lesions of cerebral infarction was significantly stronger than that of CT examination ($P<0.05$) [4]; the examination duration of MRI examination was significantly shorter than that of CT examination ($P<0.05$); the cerebral infarction onset-examination interval completed by MRI was significantly shorter than that by CT ($P<0.05$, **Table 2**).

Detection rate in different infarction sites

According to different cerebral infarction sites, these patients were divided into seven groups including frontal lobe group, temporal lobe group, parietal lobe group, basal ganglia group, paraventricular area group, thalamus group and cerebellum group to compare the abnormity detection of CT and MRI examinations at different cerebral infarction sites. The results showed that the abnormity detection of MRI examination at all of seven different sites including frontal lobe, temporal lobe, parietal lobe, basal ganglia, paraventricular area, thalamus and cerebellum was higher than that by CT examination. The infarction detection rate of MRI examination at frontal lobe, parietal lobe, basal ganglia, thalamus was significantly higher than that of CT examination (P<0.05), while there was no significant difference in the detection rate at temporal lobe, paraventricular area and cerebellum area between two examination methods (P>0.05) (**Table 3**).

Discussion

Despite of enhanced living standards and advanced diagnostic techniques, the incidence and mortality of cerebral infarction in middle-aged population increases with time. Although general diagnosis could be established for most of middle-aged patients with multiple cerebral infarction based on their causative factors as well as neurological symptoms and signs, some symptoms are not very typical and can be easily confused with other diseases. In general, the clinical diagnosis of cerebral infarction mainly depends on patient's signs and clinical manifestations [5]; according to the specific conditions of neurological deficit-related symptoms (e.g. consciousness disorder, anaesthesia, hemiplegia, aphasia, etc.), the location of patients cerebral infarction is deduced roughly, thus providing a basis for initial diagnosis [6-8].

Therefore, it is of great importance to utilize effective means to accurately identify conditions and guide clinicians to select appropriate treatment plans. CT and MRI imaging techniques are used to distinguish pathological tissues from normal tissues, and both of them have their own advantages [9-11]. In recent years, they have been widely applied in clinical practice, especially in brain examination.

Through provide an important reference for the accurate judgment of position, size and number of acute cerebral infarction, both CT and MRI are required in determining the status of cerebral infarction [12-14].

The results of the study showed that according to the different intervals between onset and visiting time, the total detection rate of CT examination in these patients was 56.88% and that MRI examination was 95.87%, indicating a statistically significant difference. For patients from the group of less than 24 h and the group of 24~72 h, detection rate of MRI examination was significantly higher than that of CT examination, and the comparative analysis between two groups suggested a statistically significant difference. The number of lesions detected by MRI examination was significantly higher than that by CT examination ($P<0.01$); the capability of MRI examination to detect small lesions of cerebral infarction was significantly stronger than that of CT examination ($P<0.05$); the examination duration of MRI examination was significantly shorter than that of CT examination ($P<0.05$); the cerebral infarction onset-examination interval completed by MRI was significantly shorter than that by CT ($P<0.05$). The abnormity detection of MRI examination at all of seven different parts including frontal lobe, temporal lobe, parietal lobe, basal ganglia, paraventricular area, thalamus and cerebellum was higher than that by CT examination.

The infarction detection rate of MRI examination at frontal lobe, parietal lobe, basal ganglia, thalamus was significantly higher than that of CT examination ($P<0.05$), while there was no significant difference in the detection rate at temporal lobe, paraventricular area and cerebellum area between two examination methods ($P>0.05$).

In conclusion, compared to CT, MRI has significant advantages in diagnosis of elderly patients with multiple cerebral infarction and is featured with higher detection rate and stronger capability to detect small lesions of cerebral infarction than CT examination. Considering the higher costs of MRI examination than CT examination, the most clinically suitable detection method may be determined based on the actual situation of patients and the reasonable assessment on their condition.

Disclosure of conflict of interest

None.

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