Exploration of CT Diagnostic Value and Imaging Characteristics of Early Peripheral Lung Cancer

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Abstract: This article attempted to analyze the diagnostic value and imaging features of CT (Computed Tomography) in early peripheral lung cancer. 80 randomly selected patients with early peripheral lung cancer admitted between September 2021 and September 2023 were selected as the research subjects for this experiment, and the selected patients were randomly divided into groups. 20 male patients and 20 female patients were assigned to the X-ray and CT groups, ensuring that multiple variables including age, symptoms, other medical history, and clinical data were as close as possible. After that, two methods were used to diagnose the patient, and the diagnostic accuracy of the two methods and the diagnostic accuracy of various imaging features were calculated. The diagnostic accuracy rate of the CT group was 92.50% (P<0.05), while the diagnostic accuracy rate of the X-ray group was 62.50% (P<0.05). In the comparison of diagnostic accuracy rates for spicule sign, tumor lobulation sign, vacuole sign, vascular bundle sign, and pleural indentation sign, the X-ray group was 57.50%, 72.50%, 52.50%, 80.00%, and 67.50%, respectively, while the CT group was 92.50%, 85.00%, 97.50%, 87.50%, and 90.00%, respectively. It can be seen that the performance of the CT group was also better than that of the X-ray group. CT examination is highly necessary in the clinical diagnosis of early peripheral lung cancer. Its diagnostic value and imaging feature analysis ability are excellent, and the diagnostic accuracy is high. Therefore, CT examination can play a significant role in the clinical treatment of early peripheral lung cancer and a series of similar diseases, and is worth promoting.

1. Introduction

Early peripheral lung cancer, as a challenging condition, has been extensively studied. Suzuki K's study involved peripheral lung cancer surgery performed through thin sections of the chest cavity [1]. Bartl A J proposed that the conventional method for lung tumors is targeted radiation therapy [2]. Dziedzic R pointed out that the diagnosis and treatment of early lung cancer remains a clinical challenge [3]. Saji H pointed out that lobectomy is the standard treatment for early non-small cell lung cancer [4]. Egami S believed that Pembrolizumab (an immunotherapy drug) is

the standard treatment for advanced non-small cell lung cancer [5]. The treatment methods for non-small cell lung cancer are also worthy of reference.

The main focus of this article is on the diagnostic value of CT and the analysis of its imaging features, which can serve as an auxiliary treatment tool. Van der Geest K S M pointed out that CT has great diagnostic value for large vasculitis [6]. Sprute K believed that CT imaging is commonly used for lymph node staging of prostate cancer in primary and biochemical relapses [7]. Zheng T X pointed out that multi-slice spiral CT can be used for preoperative diagnosis of peripheral lung cancer [8]. Liu Y C stated that CT imaging features and differential diagnostic efficacy need to be analyzed for inflammatory pseudotumors and peripheral lung cancer [9]. Zhang F hoped to analyze the diagnostic efficacy of multi-slice spiral CT imaging features in patients with peripheral lung cancer by observing them [10]. It can be seen that the diagnostic value of CT and the analysis of imaging features are very valuable patient information for various internal diseases, including peripheral lung cancer.

This article first introduced the characteristics of early peripheral lung cancer, laying the foundation for research on its patients. By designing a comparative experiment between X-ray and CT, and through a series of variable control measures, the diagnostic accuracy of the two methods, as well as the detection of features such as spicule sign, tumor lobulation sign, vacuole sign, vascular bundle sign, and pleural indentation sign, were successfully analyzed and compared, thereby verifying the ability of CT to provide imaging feature information for early peripheral lung cancer.

2. Materials and Methods

2.1 Background Information

Lung cancer is a malignant tumor originating from the living glands of the bronchial mucosa of the lung. The incidence rate and mortality of this disease are growing fastest. Liu Y Y believed that it is a disease that would seriously threaten people's life, health and safety [11]. As a type of lung cancer, early peripheral lung cancer poses a significant threat to life and health. Ren M pointed out that the early symptoms of this type of peripheral lung cancer are not obvious enough, but by the time obvious symptoms appear, the disease has entered a difficult to treat late stage [12].

Table 1: Characteristics of peripheral lung cancer

Characteristic	Particulars
Position	Peripheral lung cancer usually occurs at the edge or peripheral tissues of the lungs, and compared to central lung cancer, it is located in a more peripheral location of the lungs.
Growth rate	Some peripheral lung cancers may grow slower, which means they may not have obvious symptoms in the early stages, but some may also have a faster growth rate.
Symptom	Patients may experience symptoms such as difficulty breathing, chest pain, coughing, expectoration, or hemoptysis when the tumor is large or spreads to surrounding tissues.

Table 1 lists the characteristics of multiple peripheral lung cancers. Firstly, the location is relatively unique. Peripheral lung cancer usually occurs at the edge or peripheral tissues of the lung, and compared to central lung cancer, it is located in a more peripheral location of the lung. Next is the growth rate. Some peripheral lung cancers may grow slower, as mentioned earlier, which means they may not have obvious symptoms in the early stages, but some may also have a faster growth rate. Its symptoms also have some characteristics, and patients may experience symptoms when the

tumor is large or spreads to surrounding tissues, such as difficulty breathing, chest pain, cough, phlegm or hemoptysis. It can be said that many characteristics, combined with their early undetectable characteristics, make treating this condition more challenging.

2.2 General Information

Randomly 80 patients with early peripheral lung cancer admitted to a certain hospital from September 2021 to September 2023 were selected as the research subjects for this experiment, and 40 male and 40 female patients were ensured when selecting these 80 study subjects. In order to compare with CT diagnosis, this article continued to divide these study subjects equally into the X-ray group and the CT group, with 20 male and 20 female patients in each group. The differences between these two medical imaging technologies were presented in this article as follows.

Table 2: Differences between X-ray and CT

Differences	X ray	CT
Resolution ratio	Usually two-dimensional	Usually with higher resolution, generating 3D images
Information depth	Mainly used for observing bones	CT display of soft tissue and bones
Exposure dose	Low exposure dose	High exposure dose
Surgical guidance	Less anatomical details	Provided more anatomical details

Table 2 shows some differences between X-ray and CT. Firstly, CT usually has higher resolution and can provide more detailed images, as it can generate three-dimensional images, while X-ray is usually two-dimensional. Mou J believed that CT provides more anatomical information and can better display soft tissue and bones, while X-ray is mainly used to observe bones [13]. Then, CT usually requires more X-ray exposure, which may expose the patient to more radiation, with a higher exposure dose compared to X-ray. Finally, compared to X-ray, CT can be used for navigation and guidance of surgical processes, as it provides more anatomical details.

Among the two groups, one was the X-ray group, consisting of 20 male and 20 female patients, ranging in age from 35 to 70 years old, with an average age of (51.76 ±3.78) years old. There were 18 cases with lesions smaller than 1cm, 12 cases with lesions between 1-2cm in size, and 10 cases with lesions larger than 2cm. The other group was the CT group, with an age range of 33-71 years and an average age of (52.15 ±4.01) years. There were 15 cases with lesions smaller than 1cm, 14 cases with lesions between 1-2cm in size, and 11 cases with lesions larger than 2cm. Due to differences in specific personal information among multiple patients, after controlling for variables, there may still be some differences in the information data of the two groups of members, but they are already relatively small. The other conditions of these two groups of members were basically the same, such as no other major symptoms (no history of allergies, no other malignant tumors, no psychiatric diseases, etc.) at admission, no obvious complications, complete clinical data, and both signed informed consent forms, voluntarily cooperating with this study. In summary, all data and information of the two groups of patients were basically similar (P>0.5), indicating comparability.

2.3 Method

Currently, it is necessary to conduct separate diagnostic work for both groups of patients. The first is the X-ray group. Medical staff should first take X-rays of the patient, and during this process, the patient's chest needs to be kept close to the fluorescent screen at all times, in order to cooperate with the use of a fixed rate device. Doctors would review the generated X-ray images to evaluate

the status of bones, tissues, or organs to diagnose problems. Moreover, doctors would record the results of X-ray examinations and combine them with the patient's medical records and other medical information to ensure accurate diagnosis.

In the other group (CT group), the patient first needs to undergo breath holding training under the guidance of a professional, because during the CT examination, it is necessary to ensure that the patient completes the breath holding in a calm breathing state during the examination. Moreover, during the scan, medical staff would also wear appropriate radiation protective clothing for the patient. Throughout the entire CT scan process, medical staff would detect the patient's status to ensure any necessary adjustments or interventions. Finally, after the scan is completed, the CT image would be diagnosed.

After completing the initial diagnosis of the two groups of images, the same professionals would perform 3D reconstruction of the images, and then the same professionals would review the reconstructed images. Finally, all different opinions would be jointly negotiated to ensure consistency in the review.

2.4 Observation of Indicators

After completing the reconstruction of the film, it is necessary to analyze many features under these two imaging diagnoses. Li Z Q analyzed features such as spicule sign, tumor lobulation sign, vacuole sign, vascular bundle sign, and pleural indentation sign in his research [14].

2.5 Statistical Methods

SPSS 20.0 software was used for statistical comparison of measurement and counting data entry. After inputting the data, P test and χ^2 test were conducted respectively, and P<0.05 indicates significant differences between the two groups of data results.

3. Comparison of Test Results

In order to present statistical results, this article presented the diagnostic accuracy of X-ray and CT diagnosis methods and the diagnostic accuracy of imaging features.

$$\text{Diagnostic accordance rate} = \frac{\text{Number of correctly diagnosed cases}}{\text{Total number of cases}} \times 100\% \qquad (1)$$

Table 3: Diagnostic coincidence rate of X-ray and CT diagnosis

Group	Number of cases	Number of compliance cases	Diagnostic accordance rate
X ray	40	25	62.50%
CT	40	37	92.50%
X^2			4.963
P			<0.05

Table 3 shows the diagnostic accuracy of X-ray and CT. It can be seen that out of the 40 patients in the X-ray group, 25 were successfully diagnosed, with a diagnostic accuracy rate of 62.50%. Among the 40 patients in the CT group, 37 were successfully diagnosed, with a diagnostic accuracy rate of 92.50%. That is to say, the diagnostic accuracy of the CT group was much higher than that of the X-ray group.

Table 4 shows the diagnostic accuracy of imaging features for X-ray and CT diagnosis. From it, it can be seen that the diagnostic accuracy of spicule sign, tumor lobulation sign, vacuole sign,

vascular bundle sign, and pleural indentation sign was 57.50%, 72.50%, 52.50%, 80.00%, and 67.50% in the X-ray group, while 92.50%, 85.00%, 97.50%, 87.50%, and 90.00% in the CT group, respectively. That is to say, the CT group performed better than the X-ray group in terms of diagnostic accuracy in all five imaging features. Huang LP proposed that these features can serve as important imaging data for clinical diagnosis and differentiation, and combining them with signs and medical history can improve diagnostic efficiency [15].

Table 4: Diagnostic coincidence rate of imaging features in X-ray and CT diagnosis

Group	Spiculation	Tumor lobulation sign	Vacuole sign	Vessel convergence	Pleural indentation
X ray	57.50%	72.50%	52.50%	80.00%	67.50%
CT	92.50%	85.00%	97.50%	87.50%	90.00%
X^2	3.513	3.687	3.542	4.023	3.867
P	<0.05	<0.05	<0.05	<0.05	<0.05

4. Conclusions

Early peripheral lung cancer is a difficult and complex disease, and a series of treatments for it are extremely difficult. In order to assist in its treatment, this article proposed a method of using CT examination for diagnostic value and imaging feature analysis. Li J believed that CT and MRI (Magnetic Resonance Imaging) findings can be used for misdiagnosis analysis [16]. In addition to CT examination, similar medical detection methods related to imaging can also be used for auxiliary treatment of diseases. Emmett L stated that MRI can provide diagnostic added value for the diagnosis of prostate cancer [17]. Zhao Y H pointed out that MRI can also analyze the accuracy and imaging features of pediatric medulloblastoma [18]. As a product of CT examination, the role of imaging feature data cannot be ignored. Morris M J believes that imaging examinations targeting patients are helpful for treatment [19]. Dahdouh E believed that the imaging sign data of clinical samples is of great help for treatment [20]. This further reflects the importance of CT examination.

However, there are still some shortcomings in this article, namely: the sample size is limited, with only 80 patients, which may not be representative; although the differences in the situation between patients have been minimized by the experimental group as much as possible, objective differences still exist, which can lead to imaging issues in the experiment. This article would consider the above two points in detail in future research to make the research experiment more accurate and informative. In summary, it is necessary to conduct CT examination for early peripheral lung cancer and related similar diseases, in order to analyze the diagnostic value and imaging characteristics. It can be said that this method is worth promoting and can make it easier to detect and treat the symptoms of more early peripheral lung cancer patients.

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