ANALYSIS ON THE APPLICATION VALUE AND SAFETY OF CT-GUIDED PERCUTANEOUSLY TRANSTHORACIC LUNG BIOPSY IN THE DIAGNOSIS OF PULMONARY MALIGNANCY

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ABSTRACT

Objective: *The purpose of the study was to investigate the clinical application value and safety of CT-guided percutaneously transthoracic lung biopsy (CT-GPLB) in the diagnosis of pulmonary malignancies in patients.*

Methods: *A total of 120 patients who underwent CT-GPLB and were diagnosed with pulmonary malignancies in our hospital from January 2019 to January 2020 were selected as study subjects. The relationship between CT-GPLB sensitivity and complication rate (CR), patients' age, lesion size as well as puncture depth was analyzed, and the results of pathological distribution of puncture were summarized.*

Results: *There were 118 patients diagnosed with pulmonary malignancies by CT-GPLB, with the sensitivity of 98.3 %; the patients (≤30 years old and >70 years old) had the sensitivity of 100.0 %, the patients (>30 years old and ≤50 years old) had the sensitivity of 97.1 %, and the patients (>50 years old and ≤70 years old) had the sensitivity of 98.2 %; the patients with the lesion size (>5 cm and ≤7 cm, and >7 cm) had the sensitivity of 100.0%, the patients with the lesion size (≤2 cm) had the sensitivity of 96.0 %, and the patients with the lesion size (>2 cm and ≤5 cm) had the sensitivity of 97.1 %; the patients with the puncture depth (>7 cm and ≤9 cm, and >9 cm) had the sensitivity of 100.0%, the patients with the puncture depth (≤ 4 cm) had the sensitivity of 98.5%, and the patients with the puncture depth (>4 cm and ≤7 cm) had the sensitivity of 96.9%, with no significant differences (P<0.05); the occurrence rate of pneumothorax and hemoptysis in patients was 14.2% and 18.3%, respectively, and the patients had no symptoms after treatment, with no death; lesion size and puncture depth were both the key factors affecting patients' CR.*

Conclusion: *CT-GPLB, with high safety and feasibility, has high application value in the diagnosis of pulmonary malignancies, and there is a close relationship between CR and lesion size as well as puncture depth.*

Keywords: *CT, percutaneous lung puncture, biopsy, lung, malignancy.*

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Introduction

Lung cancer in early stage, with good stealthiness, can not be easily detected, and in consequence, when diagnosed, most patients have already been in critical conditions in the advanced stage of the disease, with 5-year mortality rate of over 85 %; therefore, improving the early detection rate of lung cancer in patients is of great significance to ensure their physical health. At present, CT-GPLB has become one of the most commonly used biopsy modalities in clinical treatment, which combines the twin features from pathology and imageology, with significant advantages of microtrauma and less pain, greatly increasing the detection rate of lung malignancy in patients.

Some scholars have stated that the death rate caused by disease in lung cancer patients can be reduced by 20 % after they are treated with CT-GPLB, indicating that CT-GPLB has extremely

high application value in lung cancer detection[1-3]. However, in clinical practise, some patients may suffer from pneumothorax, hemoptysis and other complications after receiving CT-GPLB.

Academia has not developed a unified perception about the incidence of CT-GPLB complications so far, and there are some differences in research conclusions drawn by different scholars, speculating that CT-GPLB safety may be determined by many factors[4-7].

Based on this, in order to explore the application value and safety of CT-GPLB in the diagnosis of pulmonary malignancies in patients, a total of 120 patients who underwent CT-GPLB and were diagnosed with pulmonary malignancies in our hospital from January 2019 to January 2020 were selected, and the study results are summarized as follows.

Materials and methods

General information

A total of 120 patients who underwent CT-GPLB and were diagnosed with pulmonary malignancies in our hospital from January 2019 to January 2020 were selected as the study subjects, including 65 males and 55 females, aging from 44 to 74 years old, with the average age of (58.4±6.5) years old. Among them, there were 105 patients with peripheral lesions and 15 patients with central lesions, with the lesion length between 1.5 cm and 15.0 cm. This study was approved by the hospital.

Inclusion criteria:

• Patients and their family members were informed of the purpose and process of the study and signed the informed consent;

• Patients were diagnosed with pulmonary malignancies;

• Patients were diagnosed with puncturable lesions (diameter ≥5 mm) in their lungs by chest CT examination;

• Patients' electrocardiographic examination results met the criteria for CT-GPLB.

Exclusion criteria:

• Patients had coagulation dysfunction, or other abnormal routine test results such as positive HIV test results, etc.;

• Patients had mental disorders or could not communicate with others;

• Patients had other organic diseases;

• Patients could not take the potential risks of CT-GPLB complications;

• Patients had the contraindications to CT-GPLB, or could not cooperate with the study.

Methods

The specific steps of CT-GPLB were as follows:

• Before surgery, the patients should receive chest CT (ScintCareCT16; State Food and Drug Administration approval No. 20153301584 for medical devices) scan examination, so as to determine the positional relationship between lesion size and adjacent vessels in patients, and meanwhile the preparation for puncture biopsy should be ready;

• Patients' suitable positions were selected according to the CT results. Subsequently, the positioning scale was placed on patients' body surface, and the CT scanning was performed again to determine and record puncture positions and angle.

• After a sterile surgical drape was spread on a surgical table, the infiltration anaesthesia with 2 % lidocaine solution (Tongfang Pharmaceutical Group Co., Ltd.; State Food and Drug Administration approval number: H20063466) in pleura was performed, and then the puncture was carried out according to a prepared puncture protocol;

• As CT scanning was performed, 3-6 needles were punctured into the lesions by a biopsy gun after confirming that the puncture needles were inside the lesions[8-11];

• The punctured tissue specimens were fixed with formalin (Zhongshan Kangnaixin Biological Medical Science and Technology Co., Ltd.; Guangfong Food and Drug Administration approval number 20150039) and sent for examination;

• After the puncture biopsy finished, CT scanning was conducted once again to observe whether the patients had complications, then the nursing staff should inform the patients of relevant post-surgery notes and ask them to stay in bed for 4 h;

• After the 4-h rest, the patients underwent a review to check whether they developed pneumothorax or bleeding, while those with adverse symptoms would be treated with recuperation, oral administration of hemostatic drugs and others to observe whether their symptoms disappeared.

Observation indexes

• The relationship between CT-GPLB sensitivity and patients' age was analyzed in the way that all the patients were divided into four groups, group (≤30 years old), group (>30 years old and ≤50 years old), group (>50 years old and ≤70 years old) and group

(>70 years old), and the sensitivity was compared among the different groups;

• The relationship between CT-GPLB sensitivity and patients' lesion size was analyzed in the way that all the patients were divided into four groups, group (lesion size ≤2 cm), group (lesion size >2 cm and ≤5 cm), group (lesion size >5 cm and ≤7 cm), and group (lesion size >7 cm), and the sensitivity was compared among different groups[12-15];

• The relationship between CT-GPLB sensitivity and puncture depth was analyzed in the way that all the patients were divided into four groups, group (puncture depth ≤ 4 cm), group (puncture depth >4 cm and ≤7 cm), group (puncture depth >7 cm and ≤9 cm), and group (puncture depth > 9 cm), and the sensitivity was compared among different groups;

• The relationship between CR and patients' age, lesion size as well as puncture depth was analyzed in the way that all the patients were divided into two groups according to the boundaries of age (50 years old), lesion size (2 cm) and puncture depth (4 cm);

• The results of pathological distribution of puncture were summarized.

Statistical treatment

The selected data processing software for this study was SPSS20.0, and the enumeration data were tested by X^2 test. The differences had statistical significance when P<0.05.

Results

Relationship between CT-GPLB sensitivity and patients' age

The patients (≤30 years old and >70 years old) had the sensitivity of 100.0 %, the patients (>30 years old and ≤50 years old) had the sensitivity of 97.1 %, and the patients (>50 years old and ≤70 years old) had the sensitivity of 98.2 %, with no significant differences (P<0.05), as shown in Figure 1 and Table 1.

Relationship between CT-GPLB sensitivity and patients' lesion size

The patients with the lesion size (>5 cm and ≤7 cm, and >7 cm) had the sensitivity of 100.0%, the patients with the lesion size (≤2 cm) had the sensitivity of 96.0 %, and the patients with the lesion size (>2 cm and ≤5 cm) had the sensitivity of 97.1 %, with no significant differences (P<0.05), as shown in Figure 2 and Table 2.

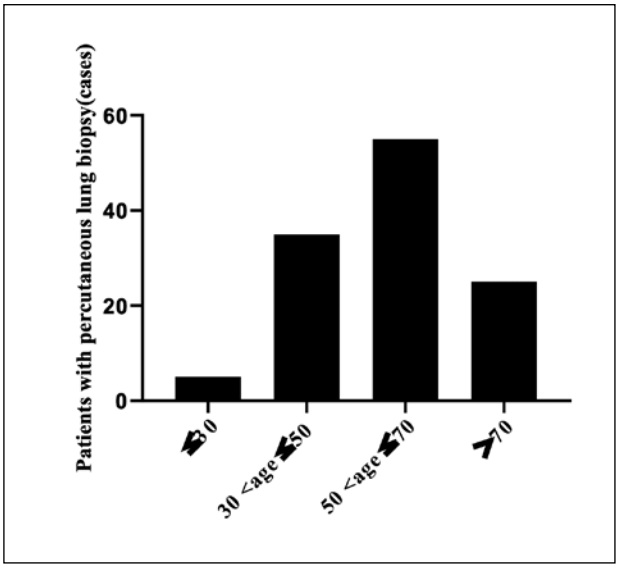

Figure 1: Patients' age distribution.
Note: The abscissa represented the age (≤ 30 years) (5 cases), age (>30 years old and ≤50 years old) (35 cases), age (>50 years old and ≤70 years old) (55 cases), and age (>70 years old) (25 cases), while the ordinate represented the number of patients.

Age	Cases	Positive	Negative	Sensitivity
≤30 years old	5	5	0	100.0%
30 years old <age ≤50 years old	35	34	1	97.1%
50 years old <age ≤70 years old	55	54	1	98.2%
>70 years old	25	25	0	100.0%

Table 1: Relationship between CT-GPLB sensitivity and patients' age.

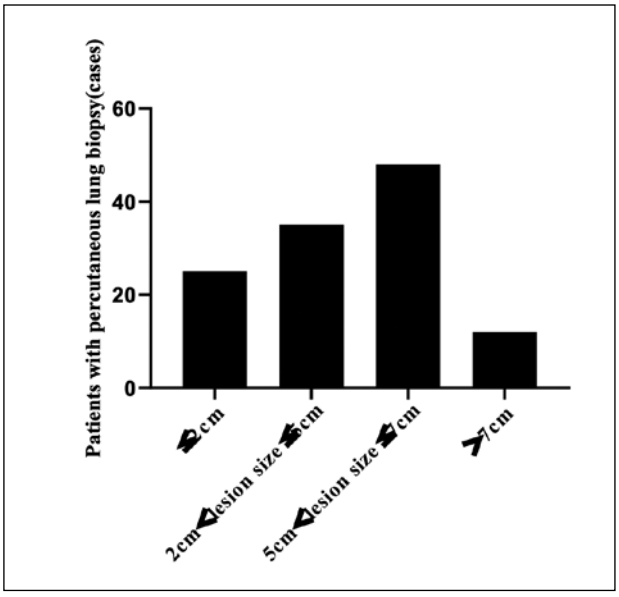

Figure 2: Distribution of the lesion size in patients.
Note: The abscissa represented the lesion size (≤ 2 cm) (25 cases), lesion size (>2 cm and ≤5 cm) (35 cases), lesion size (>5 cm and ≤7 cm) (48 cases), and lesion size (>7 cm) (12 cases), while the ordinate represented the number of patients.

Lesion size	Cases	Positive	Negative	Sensitivity
≤2 cm	25	24	1	96.0%
2 cm <lesion size ≤5 cm	35	34	1	97.1%
5 cm <lesion size ≤7 cm	48	48	0	100.0%
>7 cm	12	12	0	100.0%

Table 2: Relationship between CT-GPLB sensitivity and patients' lesion size.

Relationship between CT-GPLB sensitivity and puncture depth

The patients with the puncture depth (>7 cm and ≤9 cm, and >9 cm) had the sensitivity of 100.0%, the patients with the puncture depth (≤4 cm) had the sensitivity of 98.5%, and the patients with the puncture depth (>4 cm and ≤7 cm) had the sensitivity of 96.9%, with no significant differences (P<0.05), as shown in Figure 3 and Table 3.

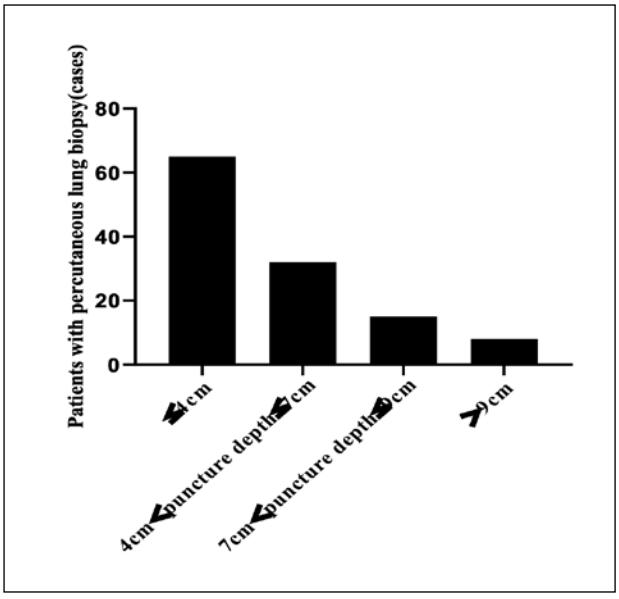

Figure 3: Distribution of the puncture depth in patients.
Note: The abscissa represented the puncture depth (≤4 cm) (65 cases), puncture depth (>4 cm and ≤7 cm) (32 cases), puncture depth (>7 cm and ≤9 cm) (15 cases), and puncture depth (>9 cm) (8 cases), while the ordinate represented the number of patients.

Puncture depth	Cases	Positive	Negative	Sensitivity
≤4 cm	65	64	1	98.5%
4 cm <puncture depth ≤7 cm	32	31	1	96.9%
7 cm <puncture depth ≤9 cm	15	15	0	100.0%
>9 cm	8	8	0	100.0%

Table 3: Relationship between CT-GPLB sensitivity and puncture depth.

Relationship between CR and patients' age, lesion size and puncture depth

The occurrence rate of pneumothorax and hemoptysis in patients was 14.2% and 18.3%, respectively, and the patients had no symptoms after treatment, with no death; lesion size and puncture depth were the key factors affecting the CR of patients, as shown in Table 4.

Factors	Cases	Pneumothorax			Hemoptysis		
		Cases	X^2	P	Cases	X^2	P
Age (years old)			0.137	0.711		1.781	0.182
≤50	40	5			10		
>50	80	12			12		
Lesion size (cm)			17.331	0.000		36.618	0.000
≤2cm	25	10			15		
>2cm	95	7			7		
Puncture depth (cm)			4.889	0.027		10.725	0.001
≤4cm	65	5			5		
>4cm	55	12			17		

Table 4: Relationship between CR and patients' age, lesion size and puncture depth.

Summarized results of pathological distribution of puncture

Among 120 patients with pulmonary malignancies studied, there were 118 patients diagnosed with pulmonary malignancies by CT-GPLB, with the sensitivity of 98.3 %, as shown in Figure 4.

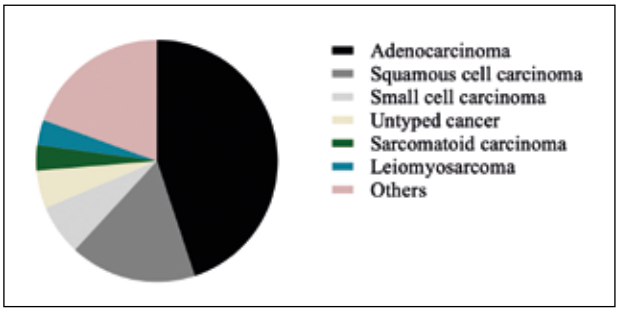

Figure 4: Summarized results of pathological distribution of puncture.
Note: The black area represented adenocarcinoma (53 cases), the dark gray area represented squamous cell carcinoma (20 cases), the light gray area represented small cell carcinoma (8 cases), the yellow area represented untyped cancer (6 cases), the green area represented sarcomatoid carcinoma (4 cases), the blue area represented leiomyosarcoma (4 cases) and the pink area represented others (23 cases).

Discussion

Percutancous lung biopsy is one of the least restrictive and invasive as well as most economical biopsy modalities applied in clinical treatment, and through CT scanning, patients' lesions can be clearly presented, which effectively provides good imaging guidance for lung puncture. Besides, this biopsy modality performed by experienced operating physicians can successfully reduce the damage caused by the puncture and easily obtain the pathological tissue specimens, providing references for the diagnosis of pulmonary tumors in patients[16-19].

In this study, there were 118 patients diagnosed with pulmonary malignancies by CT-GPLB, with the sensitivity of 98.3 %, and the results showed that patients' age, lesion size and puncture depth could greatly affect the CT-GPLB sensitivity to some extent, but the differences among each group had little statistical significance, indicating that this modality has a wide range of application for patients, with less clinical limitations. Moreover, our study revealed that the patients with the lesion size (≤2 cm) had the sensitivity of 96.0 %, and the patients with the lesion size (>2 cm and ≤5 cm) had the sensitivity of 97.1 %, demonstrating that the sensitivity shows an upward trend as the lesions become larger in patients, for small lesion size will affect the precision of puncture; therefore, physicians should pay more attention to the angle and depth of the puncture during surgery to avoid puncturing into necrotic tissues.

In our study, it was concluded that the occurrence rate of pneumothorax and hemoptysis in patients was 14.2% and 18.3%, respectively, and the patients had no symptoms after treatment, with no death, confirming that CT-GPLB has high safety, and the patients who have received this surgery have low incidence of suffering from complications, which is in line with the results of general studies in academia[20-22]. The analysis on the CT-GPLB complications showed that lesion size and puncture depth were both crucial factors affecting patients' CR, so the optimal puncture route should be chosen to avoid multiple punctures and reduce the CR. Scholar Mehmet has pointed out in his study that, the incidence of pneumothorax and hemoptysis is 14.1 % (31/220) and 18.2 % (40/220) in patients undergoing CT-GPLB, and their symptoms disappear after treatment[23], which is consistent with the results obtained in our study, indicating that CT-GPLB can reduce CR, with high safety. In conclusion, CT-GPLB has high clinical application value in diagnosis of pulmonary malignancies in patients, with high safety, which is worthy of application and promotion in clinical practice.

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