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Computed tomography manifestations and clinical features of acquired immune deficiency syndrome patients with cervical lymph node tuberculosis

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► ***Original article***

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ABSTRACT

Background: To analyze the computed tomography (CT) findings and clinical features of acquired immune deficiency syndrome (AIDS) patients with cervical lymph node tuberculosis (CLNT). ***Materials and Methods:*** The clinical data of 100 patients diagnosed with CLNT in our hospital from January 2020 to December 2022 were retrospectively analyzed. Based on whether AIDS was combined, 20 cases of CLNT patients with AIDS were included in observation group (OG), and 80 cases of CLNT patients without AIDS were included in control group (CG). CT imaging features and general clinical data were analyzed and compared between groups. ***Results:*** Cervical lymph nodes in the OG showed irregular shape, blurred boundary, and short diameter >3 cm, with statistical difference relative to the CG (P<0.05). The complete necrosis type of cervical lymph node necrosis in the OG presented higher relative to the CG (P<0.05). The OG was more likely to involve lymph nodes in region I and II of the neck (P<0.05). Besides, the lymph node lesions involving ≥3 regions and ≥4 regions, proportion of males and mean age of patients were elevated in the OG (P<0.05). The mean CD4+T lymphocyte count was lower in the OG (P<0.05). The OG also showed higher incidence of clinical symptoms and the proportion of combined clinical symptoms ≥3 relative to the CG (P<0.05). ***Conclusion:*** The CT manifestations of AIDS patients have certain commonality compared with non-AIDS patients, which might provide clues for clinical diagnosis.

INTRODUCTION

Acquired immune deficiency syndrome (AIDS), is a major public health issue leading to 33 million deaths worldwide [1]. As one of the fatal infectious diseases, AIDS is caused by human immunodeficiency virus (HIV), which is mainly spread through sexual contact, mother-to-child transmission and blood transmission [2]. Once the body is infected with the virus, T lymphocytes that assist in immunity can be specifically invaded and destroyed, resulting in damage to the immune function, thus increasing the risk of infection along with malignant tumors, resulting in a series of clinical symptoms and eventually death [3]. Currently, there is no cure for AIDS, and early and accurate diagnosis is critical to improve the clinical outcome of AIDS patients.

Lymph node tuberculosis is an infectious disease with lymph node enlargement as its main clinical manifestation after lymph node infection with tuberculosis bacilli and invasion by toxins [4]. Studies have shown that the incidence of lymph node tuberculosis in China ranks the second in the world, among which the neck is the main site of lymph node tuberculosis, which is often confused with lymphoma or lymphadenitis and other diseases leading to lymph node enlargement [5]. AIDS patients due to the decline of immunity, the incidence of tuberculosis increased significantly, and in the first incidence of cervical lymph node tuberculosis (CLNT) is easy to be misdiagnosed, affecting the treatment effect and patient life quality [6]. Therefore, it is imperative to explore effective diagnostic strategy for the differentiation of cervical lymph node tuberculosis from other diseases.

With the continuous development of computed tomography (CT) technology, CT has been widely used in the diagnosis of cervical lymph node tuberculosis [7]. It is an essential imaging technique with the ability to observe the number, shape, extent of cervical lesions and the compression of the surrounding organs [8]. Additionally, increasing studies have revealed that the CT is a sensitive imaging modality with high quality and repeatability to determine the size, shape, density, as well as location of the mass, and differentiate the cervical lymph node tuberculosis and lymphomas [9, 10]. The lymph node metastasis can be differentiated by multiple features, including the size and necrosis [10-12]. Patients with tuberculosis mainly presented three nodal involvement patterns, including the homogeneous, homogeneous mixed with peripheral

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or multilocular based on CT, while those with lymphoma show similar patterns but the enhancement patterns between tuberculosis and some types of lymphomas are different [9, 13, 14]. At present, there are many studies on the lung CT images of AIDS patients [15], but few studies on the CT images of AIDS patients with CLNT. Therefore, this work analyzed the clinical data as well as CT images of cervical lymph node tuberculosis patients, aiming to compare the differences of CT image findings and clinical characteristics between AIDS and non-AIDS patients with cervical lymph node tuberculosis, which might improve the performance of CT in the diagnosis of cervical lymph node tuberculosis in AIDS patients.

MATERIALS AND METHODS

General data

In this study, a retrospective analysis was conducted to collect clinical data of 100 patients diagnosed with cervical lymph node tuberculosis by biopsy and pathologic examination in our hospital from January 2020 to December 2022. All patients were diagnosed with cervical lymph node tuberculosis for the first time and had not yet received anti-tuberculosis and antiviral therapy. According to whether AIDS was combined, 20 CLNT patients with AIDS were set as observation group (OG), and 80 CLNT patients without AIDS were set as control group (CG). The diagnosis of AIDS patients conformed to the diagnostic criteria in the Chinese AIDS Diagnosis and Treatment Guidelines.

Methods

Patient medical records were consulted and the clinical information of patients was collected as shown in Table 1. Statistical methods were used for the analysis of the clinical features of cervical lymph node tuberculosis patients with or without AIDS.

All patients received 16-slice spiral CT neck scan, and the equipment and instrument were imported Philips 16-slice spiral CT (Philips, Amsterdam, The Netherlands). All patients were treated with elbow venipuncture indignant needle to establish access and injected iohexol injection (Yangzijiang Pharmaceutical Group Co., LTD, Jiangsu, China) into a high-pressure syringe at a concentration of 100 ml: 35 g (iodine) and a speed of 3 ml/s. The scanning parameters were uniformly set as follows: bulb voltage 12 kilovolt (KV), current 220 mA, layer thickness 5 mm, layer spacing 5 mm, mediastinal window position 35 Hounsfield units (HU), and window width 40 HU. After the CT images were obtained, image analysis was carried out by the fixed 3 deputy chief physicians imaging diagnostics physicians respectively. Lymph nodes were partitioned using seven international general partitions, and lymph node image morphology, density, fusion, enhancement, inner edge finish, type of lymph node wall enhancement thickness (According to the thickness of the enhanced scan wall of the lymph node, it was divided into thick-walled type: the thickness of the enhanced ring was greater than 20% of the diameter of the lymph node, thin-walled type: the thickness of the enhanced ring was less than 10% of the diameter of the lymph node and coexisting type: thick-walled and thin-walled) and lymph node necrosis were analyzed. Then the analysis results of three physicians were summarized. For the different image results, the three people discuss and analyze together, and reach a consensus.

Regional criteria for cervical lymph nodes

Diseased lymph nodes were partitioned using seven international general partitions: Region I, submental and submaxillary lymph nodes; Region II, upper jugular vein chain group; Region III, middle group of internal jugular vein chain; Region IV, lower jugular vein chain group; Region V, lymph nodes in posterior cervical triangle; Region VI, central region lymph nodes; Region VII, superior mediastinal lymph nodes.

Statistical analysis

The clinical data and CT image analysis results were successively entered into the computer, and statistical analysis was implemented using SPSS 19.0 statistical software (SPSS Inc., USA). All the results are in normal distribution, and the measurement data were represented by (x±s), and t test was adopted for inter-group comparison. Counting data were exhibited as (n, %), and χ^2 test was adopted for inter-group comparison. The difference was statistically significant with $P<0.05$.

RESULTS

Clinical features of patients with cervical lymph node tuberculosis

In comparison with the CG, the proportion of males in the OG was higher (P=0.004), and the mean age of patients in the OG was older (P=0.007), the mean $CD4^+T$ lymphocyte count in the OG was lower (P<0.001). The incidence of clinical symptoms such as cough, expectoration, fever and fatigue and the proportion of combined clinical symptoms ≥3 was elevated the OG (P<0.05, table 1). Moreover, the CT images showed that the cervical lymph node tuberculosis patient with AIDS presented multiple cervical lesions and wide involvement, and there were multiple circular enhancement, fusion of lesions, and unclear surrounding lipoid space after enhancement (figure 1A). For the cervical lymph node tuberculosis patient without AIDS, the lesions were shown in the left supraclavicular region of the neck, and presented circular enhancement after

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enhancement, and the surrounding lipoid space was clear (figure 1B).

Table 1. Clinical features of CLNT patients with or without AIDS.

Clinical information	Observation group (n=20)	Control group (n=80)	t/χ^2	P
Age (years)	48.83±11.25	40.62±10.96	2.934	0.007
Gender			8.413	0.004
Male	16 (80.00%)	35 (43.75%)		
Female	4 (20.00%)	45 (56.25%)		
$CD4^+$ T lymphocyte count (pcs/μL)	165.85± 35.68	489.36±68.57	28.970	<0.001
Clinical presentations	17 (85.00%)	42 (52.50%)	6.986	0.008
Cough	15 (75.00%)	36 (45.00%)	5.762	0.016
Expectoration	14 (70.00%)	33 (41.25%)	5.309	0.021
Fever	16 (80.00%)	32 (40.00%)	10.260	0.001
Fatigue	17 (85.00%)	35 (43.75%)	10.910	0.001
Night sweats	9 (45.00%)	34 (42.50%)	0.041	0.840
Neck pressure	10 (50.00%)	38 (47.50%)	0.040	0.841
Combined clinical symptoms ≥4 items	16 (80.00%)	32 (40.00%)	10.260	0.001

AIDS, acquired immune deficiency syndrome; CLNT, cervical lymph node tuberculosis; n, number.

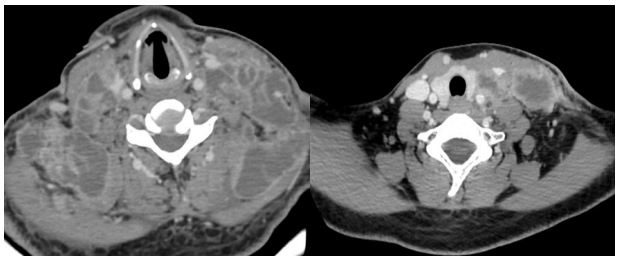

Figure 1. Representative CT images of **(A)** a cervical lymph node tuberculosis patient with AIDS and **(B)** a cervical lymph node tuberculosis patient without AIDS.

CT findings of cervical lymph node tuberculosis

For CLNT patients with or without AIDS, the CT presentations of lymph node tuberculosis were evaluated. In the OG, 14 patients (70%) showed mass with short diameter over 3 cm, and the detection rate was higher compared with the 42.5% patients in the CG (P=0.028); there were 4 patients (20%) with regular form and 4 patients (20%) with clear boundary in the OG, and the detection rate of regular form (P=0.009) and clear boundary (P=0.005) was also lower relative to the CG, respectively. Moreover, table 2 displayed that the detection rate of uniform density (P=0.689), calcification (P=0.423), fusion (P=0.161), and ring-enhancement (P=0.271) were not statistically different between the OG and CG (P>0.05).

CT findings of cervical lymph node necrosis

The CT presentations of cervical lymph node necrosis in AIDS or non-AIDS patients were also assessed. Table 3 displayed that the complete necrosis type of cervical lymph node necrosis in the OG (65%) was higher relative to the CG (37.5%) (P=0.026). However, no difference was discovered in the incomplete necrosis type (P=0.248), coexisting type (P=0.198), and three types of morphology of the inner margin in the necrotic part of the lymph node between groups (P>0.05).

Table 2. CT findings of cervical lymph node tuberculosis in CLNT patients with or without AIDS.

CT presentations	Observation group (n=20)	Control group (n=80)	χ^2	P
Short diameter >3 cm	14 (70.00%)	34 (42.50%)	4.848	0.028
Uniform density	9 (45.00%)	40 (50.00%)	0.160	0.689
Regular form	4 (20.00%)	42 (52.50%)	6.804	0.009
Clear boundary	4 (20.00%)	44 (55.00%)	7.853	0.005
Calcification	11 (55.00%)	36 (45.00%)	0.642	0.423
Fusion	13 (65.00%)	38 (47.50%)	7.961	0.161
Ring-enhancement	12 (60.00%)	37 (46.25%)	1.210	0.271

CT, computed tomography; CLNT, cervical lymph node tuberculosis AIDS, acquired immune deficiency syndrome; n, number.

CT findings of lymph node wall thickness

The lymph node wall thickness of patients in the OG and CG was evaluated. There were 7 thick-walled type cases (35.00%) in the OG, and 26 thick-walled type cases (32.5.00%) in the CG, with no statistical difference between groups (P=0.831). Eight patients (40.00%) in the OG and 36 patients (45.00%) in the CG showed thin-walled type, with no statistical difference (P=0.687). Additionally, 5 patients (25.00%) in the OG and 18 patients (22.50%) in the CG showed coexisting type, while the results were of no statistical difference between groups (P=0.812).

CT findings of cervical lymph node involved regions

As shown in table 5, the OG was more likely to involve lymph nodes in region I (P=0.029), II (P=0.026) and V (P=0.044) of the neck in comparison with the CG, with 10 patients in the OG (50.00%) and 20 patients (25.00%) in the CG involved cervical lymph node in region I, 16 patients in the OG (80.00%) and 42 patients (52.50%) in the CG involved cervical lymph node in region II, and 15 patients in the OG (75.00%) and 40 patients (50.00%) in the CG involved cervical lymph node in region V. Besides, the lymph node lesions involving ≥3 regions (P=0.012) and ≥4 regions (P=0.021) in the OG presented higher than the CG, while the lymph node involved in region III (P=0.623), IV (P=0.644), VI (P=0.799), and VII (P=0.360) were not statistically different between the OG and CG.

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Table 3. CT findings of cervical lymph node necrosis in CLNT patients with or without AIDS.

CT presentations		Observation group (n=20)	Control group (n=80)	χ^2	P
Necrosis types	Complete necrosis type	13 (65.00%)	30 (37.50%)	4.937	0.026
	Incomplete necrosis type	3 (15.00%)	22 (27.50%)	1.333	0.248
	Coexisting type	4 (20.00%)	28 (35.00%)	1.654	0.198
Morphology of the inner margin in the necrotic part of the lymph node	Smooth and complete	6 (30.00%)	29 (36.25%)	0.275	0.600
	Unsmooth and incomplete	8 (40.00%)	37 (46.25%)	0.253	0.615
	Coexisting type	6 (30.00%)	14 (17.50%)	1.563	0.211

AIDS, acquired immune deficiency syndrome; CLNT, cervical lymph node tuberculosis; n, number.

Table 4. CT findings of lymph node wall thickness in CLNT patients with or without AIDS.

Lymph node wall thickness	Observation group (n=20)	Control group (n=80)	χ^2	P
Thick-walled type	7 (35.00%)	26 (32.50%)	0.045	0.831
Thin-walled type	8 (40.00%)	36 (45.00%)	0.162	0.687
Coexisting type	5 (25.00%)	18 (22.50%)	0.056	0.812

CT, computed tomography; CLNT, cervical lymph node tuberculosis; AIDS, acquired immune deficiency syndrome; n, number.

Table 5. CT findings of cervical lymph node involved regions in CLNT patients with or without AIDS.

Cervical lymph node involved regions	Observation group (n=20)	Control group (n=80)	χ^2	P
Region I	10 (50.00%)	20 (25.00%)	4.762	0.029
Region II	16 (80.00%)	42 (52.50%)	4.967	0.026
Region III	5 (25.00%)	16 (20.00%)	0.241	0.623
Region IV	3 (15.00%)	9 (11.25%)	0.213	0.644
Region V	15 (75.00%)	40 (50.00%)	4.040	0.044
Region VI	1 (5.00%)	3 (3.75%)	0.065	0.799
Region VII	10 (50.00%)	31 (38.75%)	0.837	0.360
Involved ≥3 regions	12 (60.00%)	24 (30.00%)	6.250	0.012
Involved ≥4 regions	6 (30.00%)	8 (10.00%)	5.316	0.021

CT, computed tomography; AIDS, acquired immune deficiency syndrome; CLNT, cervical lymph node tuberculosis n, number.

DISCUSSION

AIDS, as a clinically serious disease of the immune system, seriously damages the immune function of the body [16]. As an important part of the immune system of the body, lymph nodes are important targeted by AIDS [17]. Thirty percent of the lymph nodes in the whole body are located in the neck [18], and the cervical lymph nodes are the earliest and most easily involved parts of AIDS [19]. As a highly contagious infectious disease, tuberculosis bacteria can invade the body through the respiratory system and spread to the surrounding areas through the cervical lymph nodes, seriously affecting the health of patients [20].

Studies have shown that the CT findings of patients with tuberculous cervical lymph node enlargement are closely related to the pathological staging of tuberculous lymph nodes, and the proliferation, enhancement, low-density area and annular enhancement and fusion degree of lymph node margin shown by CT at different periods are different [21]. AIDS patients with CLNT are often in the middle and late stages of AIDS, with low body immunity, and invading and spreading tuberculosis bacilli. Thus the disease progress rapidly, and can be manifested as enlarged lymph node fusion, serious necrosis, fuzzy and irregular shape [22]. In this study, the CT results showed that relative to the CG, the detection rate of cervical lymph nodes in the OG with irregular shape, blurred boundary, and short diameter >3 cm was higher (table 2), the complete necrosis type of cervical lymph node necrosis in the OG presented higher (table 3), the OG was more likely to involve lymph nodes in region I and II of the neck, and the lesions involving ≥3 regions and ≥4 regions in the OG presented higher (table 5), which were consistent with the previous findings that lymph node tuberculosis have extensive central necrosis [10]. The reason may be associated with the immune damage by HIV in AIDS patients with cervical lymph node tuberculosis, and once patients are infected with tuberculosis bacteria, the bacteria will rapidly multiply, and spread to the whole body through the lymph node, resulting in more involved lymph node area, more severe necrosis, and increased lymph node short diameter [23].

CLNT is considered as the most common extra-pulmonary tuberculosis [24], and is more common in children and young adults in non-AIDS patients, especially young women [25]. In this study, the proportion of males in the OG was higher, and the mean age of patients in the OG was older relative to the CG (Table 1), which is consistent with the clinical epidemiological characteristics of AIDS [26]. Besides, our study indicated that the mean $CD4^+$T lymphocyte count in the OG presented lower than the CG (table 1). Consistent with our finding, it has been proposed that the $CD4^+$T lymphocyte count in AIDS patients is decreased significantly, and when the number of $CD4^+$T lymphocytes is as low as (300-400)/μL, the probability of tuberculosis infection is increased to more than 50% [27, 28]. The reason may be that AIDS patients with tuberculosis immune system by HIV and

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tuberculosis bacillus double damage, aggravated as an important component of the immune system $CD4^+$T lymphocytes damage, resulting in a decline in the number of $CD4^+$T lymphocytes [29]. Clinical symptoms including cough, fever, expectoration, fatigue can appear in AIDS and tuberculosis patients [30]. In this study, the OG showed higher incidence of these clinical symptoms and the proportion of combined clinical symptoms ≥3 in comparison with the CG (table 1). The reasons may be related to the fact that the number of $CD4^+$T lymphocytes was too low and the body immunity was damaged, leading to the exacerbation of clinical symptoms.

In conclusion, compared with non-AIDS patients, the CT manifestations of AIDS patients have certain commonality. The majority of AIDS patients with cervical lymph node tuberculosis are men over 40 years old with ≥ 3 clinical symptoms. The $CD4^+$T lymphoid count is decreased significantly. CT images shows unclear boundaries, irregular morphology, and complete necrosis involving ≥ 4 regions, which should be paid attention for distinguishing cervical lymph node tuberculosis in AIDS patients in clinical diagnosis.

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***Conflicts of interests*:** The authors declare no conflicts of interest.

***Ethical consideration*:** This study was approved by the Ethics Committee of Chongqing Public Health Medical Treatment Center (approval number: 2024-035-01-KY).

***Author contribution*:** H.W. conceptualized the study. H.W., C.l., and W.S. collected the data. H.W., X.D., and X.L. analyzed the data. H.W. wrote the original manuscript. All authors have reviewed and edited the manuscript and approved the final version of the manuscript.

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