

# The value of CRP and NLR in differential diagnosis of benign and malignant pulmonary nodules

Hanchi Yu

Xiangdong Hospital Affiliated to Hunan Normal University, Liling412200, China

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**Abstract:** Objective: Evaluate CRP and NLR levels in benign vs. malignant pulmonary nodules for differential diagnosis. Methods: Selected 60 patients with benign nodules and 60 with lung cancer from a Hunan hospital from August 2022 to December 2023. Analyzed CRP and NLR diagnostic value. Results: Significant differences in CRP, NLR levels between groups ( $P < 0.05$ ). Conclusion: CRP and NLR levels are higher in lung cancer patients, indicating diagnostic value in distinguishing benign vs. malignant nodules.

**Keywords:** CRP; NLR; Pulmonary Nodules; Lung Cancer; Differential Diagnosis

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## Introduction

Pulmonary nodules are circular or irregular lesions  $< 3\text{cm}$  in diameter in the lung, with single or multiple occurrences and clear or unclear borders, Imaging manifestations are shadows of increased density<sup>[1]</sup>. Since the outbreak of COVID-19, lung CT exams have become routine, resulting in increased detection of lung nodules. Studies<sup>[2]</sup> show that 90% of nodules detected by LDCT are benign, while 10% are malignant. The increasing detection rate impacts patients' physical and mental health and leads to more unnecessary invasive procedures. Hence, emphasis should be placed on the differential diagnosis of nodules and reducing invasive operations for benign ones.

Chronic inflammation plays a crucial role in cancer occurrence, development, and prognosis<sup>[3]</sup>, involving interactions among immune cells, inflammatory cells, cytokines, and pro-inflammatory factors. Neutrophils, for instance, bind to cytokines to promote carcinogenesis and cancer progression<sup>[4]</sup>. Meta-analyses reveal that elevated NLR levels in malignancies, including lung cancer, correlate with lower patient survival<sup>[5]</sup>. CRP, a pentamer protein secreted by inflammatory cells, significantly increases during injury, infection, and malignancy. This study explores the diagnostic value of CRP and NLR in distinguishing between benign and malignant pulmonary nodules.

## 1. Data and methods

1.1 General data study: Patients who underwent lung CT in a Grade-III hospital in Hunan Province from August 2022 to December 2023 and showed pulmonary nodules were selected. All patients underwent percutaneous pulmonary puncture biopsy, electronic fiberbronchoscopy, or surgical pathological examination. The study included 60 patients with confirmed lung cancer and 60 with benign pulmonary nodules. Gender distribution: 76 males, 44 females. Lung cancer patients: 39 males, 21 females. Benign group: 37 males, 23 females. Average age:  $59.9 \pm 10.422$  years old overall,  $63.51 \pm 7.741$  in lung cancer,  $56.27 \pm 11.459$  in benign. Inclusion criteria: ① CT showed  $\leq 3\text{cm}$  circular/quasi-circular lung lesions; ② Definite pathological diagnosis; ③ No history of infectious disease, blood transfusion; ④ No treatment for small pulmonary nodules. Exclusion criteria: ① Hepatic/renal dysfunction; ② Tumor history; ③ Medical conditions affecting serum FLC & inflammatory markers (e.g., connective tissue diseases, COPD, diabetes, infections); ④ Mental disorders, language barriers, communication issues.

1.2 Methods: Collected clinical data included name, gender, age, blood routine, CRP, imaging, and pathological data. NLR was calculated using blood routine indicators as  $\text{NLR} = \text{neutrophil count} / \text{lymphocyte count}$ .

1.3 Observation indicators: CRP and NLR levels were compared and analyzed between the two groups, and their statistical significance indicated differential diagnosis value.

1.4 SPSS26.0 was used for statistical analysis. Measurement data were normally distributed and expressed as ( $\bar{x} \pm s$ ). Independent sample t test was used for group comparison.  $\chi^2$  test or continuously adjusted  $\chi^2$  test was used for statistical comparison, with  $P \leq 0.05$  considered statistically significant.

**2. Results Comparison of CRP and NLR levels between patient groups found that CRP and NLR levels in the lung cancer group were higher than those in the benign group, and the differences in CRP and NLR levels between the two groups were statistically significant (P<0.05), as shown in Table 1.**

Table 1. Comparison of CRP and NLR Levels between Groups

Subjects	Benign group	Lung cancer group	t	P
CRP	4.87±7.62	29.68±45.39	-4.210	<0.01
NLR	2.94±1.38	4.57±3.18	-3.679	<0.01

**3. Discussion**

CT imaging has led to increased detection of lung nodules, primarily due to the focus on pulmonary malignant tumors. While only 10% of lung nodules detected by LDCT are cancerous, the high incidence and mortality of lung cancer in China remain significant due to population size, age structure, and lifestyle changes. Most patients are diagnosed with advanced disease, limiting treatment options and often leading to unsatisfactory outcomes. This imposes mental pressure on patients and strains the medical system. Hence, emphasizing early detection, diagnosis, and treatment of lung cancer is crucial.

Chronic inflammation is a key factor in cancer occurrence, development, and prognosis<sup>[6]</sup>. Peripheral blood inflammatory markers, including C-reactive protein (CRP) and neutrophil-to-lymphocyte ratio (NLR), reflect inflammation, immunity, and tumor relationships<sup>[7]</sup>. These markers are noninvasive, convenient, economical, and repeatable, aiding early lung cancer diagnosis and prognosis. This study found elevated CRP and NLR levels in lung cancer patients vs. benign group (P < 0.05), consistent with previous research linking CRP to lung cancer risk<sup>[8]</sup>. Indicators for early lung cancer detection significantly improved sensitivity and specificity, making them valuable for diagnosis<sup>[9]</sup>. Li-xia Yuan<sup>[10]</sup> et al. found CRP related to lung cancer classification, staging, and lymph node metastasis, possibly due to weakened immune states promoting tumor progression and affecting prognosis. With the rise of immune therapy, the tumor microenvironment has gained attention. Neutrophils, lymphocytes, and platelets are key components, with neutrophils promoting tumor-related inflammation and restraining lymphocyte activity, while lymphocytes induce cytotoxicity, leading to cell death and inhibiting tumor cell growth and metastasis. Therefore, Higher NLR leads to systemic inflammatory reaction, immune imbalance, and imbalance in cancer and anti-cancer roles<sup>[11]</sup>. Zhu Xuhua et al.<sup>[12]</sup> found that lung cancer patients have significantly elevated NLR levels compared to healthy individuals, indicating its predictive value in lung cancer diagnosis.

In summary, CRP and NLR possess significant clinical application value in the differential diagnosis of pulmonary nodules, making them worthwhile candidates for widespread utilization in clinical practice.

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