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Prognostic impact of quantitative CT-defined emphysema in lung cancer

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 June 2024 and was last updated on 30 June 2024.

INTRODUCTION

Review question / Objective To identify the prognostic impact of quantitative CT-defined emphysema in lung cancer patients based on current evidence.

Condition being studied Patients with primary lung cancer were divided into different groups according to the percentage of LAA in the chest CT images. The long-term survival and incidence rates of treatment-related adverse events were compared between the groups.

METHODS

Search strategy The Web of Science, PubMed, EMBASE and Cochrane Library databases were searched from database inception up to May 21, 2024 with following key words: emphysema, lung, pulmonary, tumor, cancer, carcinoma, neoplasm, CT and computed tomography. A combination of subject terms and free words was used. The detailed search strategy in the PubMed was as follows: (emphysema) AND (lung OR pulmonary) AND (tumor OR cancer OR carcinoma OR neoplasm) AND (CT OR computed tomography).

Participant or population Patients were diagnoses with primary lung cancer pathologically.

Intervention The presence and severity of emphysema were quantitatively assessed by percentage of LAA in the CT images before anti-tumor treatment. Besides, patients were divided into different groups according to the percentage of LAA in the chest CT images.

Comparator At least one of the primary or secondary outcomes was compared between

groups. In this meta-analysis, primary outcome was the long-term survival, including the overall survival (OS), disease-free survival (DFS), cancer-specific survival (CSS) and progression-free survival (PFS). Secondary outcomes were treatment-related adverse events, including the 30-day mortality, 90-day mortality, postoperative complication, postoperative pulmonary complication (PPC), cardiopulmonary complication (CPC), respiratory complication, prolonged air leak (PAL), pneumonia, atrial fibrillation, prolonged ventilation, arrhythmia, atelectasis, prolonged postoperative stage (PPS), bronchopleural fistula, empyema, acute respiratory distress syndrome (ARDS), acute lung injury (ALI), acute exacerbation of interstitial pneumonia (AEIP), tracheostomy, pyothorax, prolonged oxygen therapy (POT), radiation pneumonitis and immune related pneumonia (IRP).

Study designs to be included Cohort studies.

Eligibility criteria Studies which met following criteria were included: 1) patients were diagnosed with primary lung cancer pathologically; 2) the presence and severity of emphysema were quantitatively assessed by percentage of LAA in the CT images before anti-tumor treatment; 3) patients were divided into different groups according to the percentage of LAA in the chest CT images; 4) at least one of the primary or secondary outcomes was compared between groups; 5) the hazard ratios (HRs) or odds ratios (ORs) with 95% confidence intervals (CIs) were reported or enough data were provided to calculate them; 6) full texts were available; 7) when the data were severely overlapped or duplicated, only the latest or most comprehensive studies were included.

Information sources The Web of Science, PubMed, EMBASE and Cochrane Library databases were searched from database inception up to May 21, 2024. Furthermore, all references in included studies and relevant review publications were also evaluated for feasibility.

Main outcome(s) Primary outcome was the long-term survival, including the overall survival (OS), disease-free survival (DFS), cancer-specific survival (CSS) and progression-free survival (PFS).

Additional outcome(s) Secondary outcomes were treatment-related adverse events, including the 30-day mortality, 90-day mortality, postoperative complication, postoperative pulmonary complication (PPC), cardiopulmonary complication (CPC), respiratory complication, prolonged air leak (PAL), pneumonia, atrial fibrillation, prolonged ventilation, arrhythmia, atelectasis, prolonged postoperative stage (PPS), bronchopleural fistula, empyema, acute respiratory distress syndrome (ARDS), acute lung injury (ALI), acute exacerbation of interstitial pneumonia (AEIP), tracheostomy, pyothorax, prolonged oxygen therapy (POT), radiation pneumonitis and immune relatedpneumonia(IRP).

Quality assessment / Risk of bias analysis All included studies were cohort studies. Therefore, the Newcastle–Ottawa scale (NOS) tool was applied for quality assessment, and studies with a NOS score of six or higher were defined as high-quality studies.

Strategy of data synthesis All statistical analyses were performed by the STATA (version 15.0, StataCorp LLC, College Station, Texas, USA) software. The heterogeneity among included studies was evaluated by the I2 statistics and Q test. If significant heterogeneity was observed, presenting as I2>50% and/or P<0.1, the random-effects model was used; otherwise, the fixed-effects model was used [2]. The HRs and ORs with 95% CIs were combined to evaluate the association between quantitative CT-defined emphysema and long-term survival and treatment-related adverse events, respectively. If HRs with 95% CIs were not reported in papers, then they would be calculated from the Kaplan-Meier survival curves [3]. When calculating the OR, if the occurrence rate of a certain groups is 0%, the Add-One method was used. This involved adding one to the number of occurrences in each group to avoid division by zero, ensuring the feasibility and stability of the calculation. Additionally, we removed indicators that the total number of occurrences was only one to avoid significant bias. If data with a critical value of LAA%=0% and LAA%>0% were both reported, then the data with a critical value of LAA%>0% was preferentially included in the overall calculation. Similarly, if both whole-lung and lobe-specific cutoff values were applied, the data grouped by the lobe-specific cutoff values were preferentially included.

Subgroup analysis Subgroup analysis stratified by the threshold of emphysema ratio (LAA%=0%, LAA%>0%, LAA%≤5% and LAA%>5%), pathological type (NSCLC, SCLC and lung cancer), treatment (surgery, chemotherapy, ICIs and mixed therapies) and type of emphysema ratio (overall and lobar emphysema ratios) were also performed.

Sensitivity analysis Sensitivity analysis was conducted to clarify the source of heterogeneity and evaluate the stability of pooledresults.

Language restriction Multiple counties such as the Japan, Spain, USA, Turkey, Republic of Korea, China and South Korea.

Country(ies) involved China (West China Hospital, Sichuan University).

Keywords Emphysema; lung cancer; computed tomography; prognosis; meta-analysis.

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