INPLASY

Incidence and risk factor for malignancy risk among patients with incidental solitary pulmonary nodule: A systematic review and meta-analysis

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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 19 July 2025 and was last updated on 19 July 2025.

INTRODUCTION

Review question / Objective This study aims to investigate the incidence of malignancy and its risk factors in patients with incidental SPNs through meta-analytic approach.

Condition being studied With the widespread application of chest imaging technology in clinical examinations, the detection rate of incidental solitary pulmonary nodules (SPNs) has been increasing year by year, imposing a significant psychological burden on patients. Clarifying the malignancy incidence and associated risk factors of such nodules is crucial for developing appropriate follow-up plans and avoiding overdiagnosis, overtreatment, or missed diagnoses.

METHODS

Search strategy #1 "Solitary Pulmonary Nodule"[Mesh] OR "Solitary Pulmonary Nodule*"[tiab] OR "SPN"[tiab]
#2 (pulmonary OR lung OR chest OR pleura)[tiab] AND "SPN"[tiab]
#3 ((solitary OR coin OR single OR discrete OR indeterminate) NEAR/3 (lung OR pulmonary OR "chest wall" OR pleura) NEAR/3 (lesion* OR lump* OR nodule* OR lobe OR lobes))[tiab]
#4 #1 OR #2 OR #3
#5 "Lung Neoplasms"[Mesh] OR "lung cancer*"[tiab] OR "lung neoplasms*"[tiab]
#6 (Bronchopulmonary carcino* OR "Cancer of Lung" OR "Cancer of the Lung" OR "Lung adenocarcimoma*" OR "Lung Cancer*" OR "Lung carcinoma*" OR "Lung malignan*" OR "Lung Neoplasm*" OR "Lung Tumo*" OR "Pulmonary adenocarcinoma*" OR "Pulmonary Cancer*" OR

"pulmonary carcino*" OR "pulmonary malignan*" OR "Pulmonary Neoplasm*" OR "Pulmonary tumo*")[tiab]
#7 ("Nonsmall Cell Lung Cancer*" OR "Non Small Cell Lung Cancer*" OR "Nonsmall Cell Lung Carcinoma*" OR "Non Small Cell Lung Carcinoma*" OR "NSCLC*")[tiab]
#8 ("Small Cell Lung Carcinoma*" OR "Oat Cell Carcinoma*" OR "Oat Cell Lung Cancer*" OR "SCLC*" OR "Small Cell Lung Cancer*" OR "Small Cell Lung Carcinoma*")[tiab]
#9 ("Pleural Neoplasms"[Mesh] OR "mpm*"[tiab] OR "Pleural cancer*"[tiab] OR "pleural malignan*"[tiab] OR "pleural mesothelioma*"[tiab] OR "Pleural Neoplasm*"[tiab] OR "pleural tumo*"[tiab])
#10 #5 OR #6 OR #7 OR #8 OR #9
#11 #4 OR #10
#12 ("Nodule size*"[tiab] OR diameter*[tiab])
#13 ("Solid*"[tiab] OR "Subsolid*"[tiab] OR "Non-solid*"[tiab] OR "Nonsolid*"[tiab] OR "NSN*"[tiab] OR "Part-solid*"[tiab] OR "Ground-glass*"[tiab] OR "GGO*"[tiab] OR "GGN*"[tiab])
#14 ("Smooth*"[tiab] OR "Lobulat*"[tiab] OR "Spiculat*"[tiab] OR "Border*"[tiab])
#15 ("Calcificat*"[tiab] OR "Pleural indentat*"[tiab] OR "Vessel Convergence*"[tiab] OR "Vascular sign*"[tiab] OR "Air bronchogram*"[tiab] OR "Bronchus sign*"[tiab] OR "Satellite lesion*"[tiab])
#16 ("Nodule locat*"[tiab] OR "Upper lobe*"[tiab] OR "Right lung*"[tiab] OR "Locat*"[tiab])
#17 ("Nodule growth rate*"[tiab] OR "Linear measure*"[tiab] OR "Semiautomated Nodule Volumet*"[tiab] OR "Volume Doubling Time*"[tiab])
#18 ("CT value*"[tiab] OR "Minimum Focal Density*"[tiab])
#19 ("Age"[Mesh] OR "Age factor*"[tiab] OR "Age*"[tiab])
#20 ("Sex"[Mesh] OR "Gender Identity"[Mesh] OR "Sex*"[tiab] OR "Gender*"[tiab] OR "Woman*"[tiab] OR "Women*"[tiab])
#21 ("Race"[Mesh] OR "Race factor*"[tiab] OR "Race*"[tiab] OR "Black man*"[tiab] OR "Black men*"[tiab])
#22 ("Family history*"[tiab] OR "Cancer history*"[tiab] OR "Medical history*"[tiab] OR "Health history*"[tiab])
#23 ("Neoplasm Metastasis"[Mesh] OR "Extrathoracic Malignant Neoplasm*"[tiab] OR "Extrathoracic disease*"[tiab])
#24 ("Pulmonary Disease, Chronic Obstructive"[Mesh] OR "Chronic Obstructive Pulmonary Disease*"[tiab] OR "Chronic Obstructive Lung Disease*"[tiab] OR "COPD*"[tiab] OR "Airflow Obstruction*"[tiab] OR "Emphysema*"[tiab])
#25 ("Idiopathic Pulmonary Fibrosis"[Mesh] OR "Idiopathic Pulmonary Fibros*"[tiab] OR "IPF*"[tiab] OR "Fibro*"[tiab] OR "Interstitial*"[tiab])
#26 ("Asthma"[Mesh] OR "Bronchiectasis"[Mesh] OR "Tuberculosis"[Mesh] OR "Asthma*"[tiab] OR "Bronchiectas*"[tiab] OR "Tuberculos*"[tiab] OR "Koch*"[tiab] OR "Mycobacterium*"[tiab])
#27 ("Smoking"[Mesh] OR "Smok*"[tiab] OR "Onset time*"[tiab] OR "Smoking Frequenc*"[tiab] OR "Cigarette quit*"[tiab] OR "Electronic cigarette*"[tiab] OR "Second-hand smoke*"[tiab] OR "cigarette*"[tiab])
#28 ("Alcohol Drinking"[Mesh] OR "Drinking*"[tiab] OR "Alcohol*"[tiab])
#29 ("Environmental Exposure"[Mesh] OR "Asbestos"[Mesh] OR "Uranium"[Mesh] OR "Radon"[Mesh] OR "Asbestos*"[tiab] OR "Uranium*"[tiab] OR "Radon*"[tiab] OR "Silica*"[tiab] OR "Silicon*"[tiab] OR "Cadmium*"[tiab] OR "Arsenic*"[tiab] OR "Beryllium*"[tiab] OR "Chromium*"[tiab] OR "Vehicle Emissions*"[tiab] OR "Diesel*"[tiab] OR "Nickel*"[tiab] OR "Coal Smke*"[tiab] OR "Soot*"[tiab] OR "Carbon*"[tiab] OR "Exposure*"[tiab])
#30 #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29
#31 "Tomography, X-Ray Computed"[Mesh] OR "Tomography, Spiral Computed"[Mesh] OR "computed tomography"[tiab]
#32 ("CT*"[tiab] OR "computed tomography*"[tiab] OR "computed tomographic scan*"[tiab] OR "computer assisted tomography*"[tiab] OR "computerised axial tomography*"[tiab] OR "computerised tomography*"[tiab] OR "computerized axial tomography*"[tiab] OR "computerized tomography*"[tiab])
#33 #31 OR #32
#34 #11 AND #30 AND #33
#35 "review"[Publication Type] OR "guideline"[Publication Type] OR "letter"[Publication Type] OR "editorial"[Publication Type] OR "comment"[Publication Type] OR "historical article"[Publication Type]
#36 #34 NOT #35
#37 "Animals"[Mesh] NOT "Humans"[Mesh]
#38 #36 NOT #37
#39 "Adult"[Mesh] OR (adult*[tiab] OR young[tiab] OR aged[tiab] OR elder*[tiab] OR older*[tiab] OR "18 years"[tiab] OR "18 yrs"[tiab])
#40 #38 AND #39.

Participant or population Patients with incidental SPNs (≤3 cm, detected via imaging without prior suspicion of malignancy).

Intervention Incidental SPNs confirmed as malignant or pathologically diagnosed as lung cancer.

Comparator Incidental SPNs confirmed as benign.

Study designs to be included Observational studies.

Eligibility criteria Study was included if they met: (1) Participants: patients with incidental SPNs (≤3 cm, detected via imaging without prior suspicion of malignancy); (2) Exposure: incidental SPNs confirmed as malignant or pathologically diagnosed as lung cancer; (3) Comparison: Incidental SPNs confirmed as benign; (4) Outcomes: incidence of malignancy in incidental SPNs and associated risk factors; and (5) Study design: observational studies.

Information sources PubMed, EmBase, Web of Science, and the Cochrane Library.

Main outcome(s) Incidence of malignancy in incidental SPNs and associated risk factors.

Quality assessment / Risk of bias analysis Quality assessment using the Newcastle-Ottawa Scale (NOS), which consists of three domains: selection (4 items), comparability (1 item), and outcome assessment (3items).

Strategy of data synthesis We conducted a random-effects model meta-analysis to estimate the pooled incidence of malignancy in incidental SPNs. To enhance data comparability, all raw data were log-transformed. Restricted maximum likelihood estimation was applied during model fitting to improve parameter accuracy. The effect sizes of factors associated with malignancy in incidental SPNs were expressed as odds ratios (ORs) with 95% confidence intervals (CIs) and pooled using the random-effects model.

Subgroup analysis Subgroup analyses were conducted based on publication year, study design, geographic region (country), and study quality to explore potential sources of variation. Differences between subgroups were compared using interaction t-tests, assuming a normal distribution of the analytical data.

Sensitivity analysis To evaluate the robustness of our findings, we performed sensitivity analyses by iteratively excluding individual studies.

Country(ies) involved China.

Keywords malignancy; incidental solitary pulmonary nodule; incidence; risk factors; systematic review; meta-analysis.

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