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# Comparison of Uniportal and Multiportal Robotic-Assisted Thoracoscopic Surgery for Non-Small Cell Lung Cancer: A Systematic Review and Meta-Analysis

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**ADMINISTRATIVE INFORMATION**

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**Review Stage at time of this submission -** Preliminary searches.

**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 5 July 2026 and was last updated on 5 July 2026.

## INTRODUCTION

**Review question / Objective** To systematically evaluate the efficacy disparities between uniportal robotic-assisted thoracoscopic surgery (URATS) and multiportal robotic-assisted thoracoscopic surgery (MRATS) in the management of non-small cell lung cancer (NSCLC), and to compare the superiority and inferiority of the two surgical modalities in terms of perioperative outcomes and long-term prognosis.

**Condition being studied** Lung cancer ranks as the second most incident and the leading cause of cancer-related mortality globally, with non-small cell lung cancer (NSCLC) accounting for approximately 85% of all lung cancer cases. For patients with early-stage NSCLC, lobectomy combined with lymph node dissection remains the standard surgical treatment. With the continuous evolution of minimally invasive surgical techniques, robotic-assisted thoracoscopic surgery (RATS) has emerged as a pivotal direction in the surgical management of NSCLC. Compared with conventional video-assisted thoracic surgery (VATS), RATS offers advantages such as three-dimensional high-definition visualization, tremor filtration, and dexterous, precise surgical instruments, which can reduce surgical complexity and enhance operational accuracy. Multiportal robotic-assisted thoracoscopic surgery (MRATS) was the standard approach during the early phase of RATS development, but it requires the creation of multiple ports on the chest wall, resulting in relatively greater trauma. In 2021, Gonzalez-Rivas first reported uniportal robotic-assisted thoracoscopic surgery (URATS) using the Da Vinci robotic system, which completes the entire surgical procedure through a single incision, promising further reduction in trauma and acceleration of postoperative recovery. However,

there is currently a paucity of systematic evaluations regarding the efficacy differences between URATS and MRATS in the treatment of NSCLC.

## METHODS

**Participant or population** The study population consisted of patients with histopathologically or radiologically confirmed non-small cell lung cancer (NSCLC) who underwent Da Vinci robotic-assisted thoracoscopic surgery (including lobectomy or segmentectomy). No restrictions were imposed on patient age, gender, tumor stage, or preoperative neoadjuvant therapy status.

**Intervention** The exposure variable was the surgical approach. Patients were stratified into two groups based on the number of operative ports:
1. **Uniportal Robotic-Assisted Thoracoscopic Surgery (URATS) Group**: Robotic arms were inserted through a single intercostal incision to perform pulmonary resection and lymph node dissection.
2. **Multiportal Robotic-Assisted Thoracoscopic Surgery (MRATS) Group**: Robotic arms were inserted through 2–4 intercostal incisions to complete the surgical procedure.

**Comparator** Direct efficacy comparison between the URATS group and the MRATS group, with effect sizes defined as the differences in various outcome measures between the two groups.

**Study designs to be included** Only cohort studies, including prospective cohort studies and retrospective cohort studies, were eligible. Studies were restricted to those published in English.

**Eligibility criteria** Literature screening and data extraction were independently conducted by two researchers, with cross-verification. Discrepancies were resolved through consensus or adjudication by a third reviewer.
Inclusion Criteria
1. Study design: Cohort study (prospective or retrospective);
2. Study population: Patients with confirmed NSCLC who underwent robotic-assisted thoracoscopic surgery;
3. Intervention: Direct comparison between the URATS and MRATS groups;
4. Outcome measures: Reporting of at least one of the following outcomes—1-year postoperative all-cause mortality, perioperative complications (e.g., infection, pulmonary air leak, hemothorax), operative time, intraoperative blood loss, chest tube drainage duration, length of hospital stay, number of lymph nodes dissected;
5. Availability of full-text data with complete information.
Exclusion Criteria
1. Studies without direct comparison between URATS and MRATS;
2. Reviews, meta-analyses, case reports, conference abstracts, letters, commentaries, and other non-original research;
3. Basic research (e.g., animal experiments, cell experiments);
4. Studies with unavailable full text or insufficient raw data;
5. Duplicate publications;
6. Non-English literature.

**Information sources** Four electronic databases—PubMed, The Cochrane Library, Web of Science, and Embase—were systematically searched from their respective inception dates up to March 2026. Search terms included *robotic-assisted thoracic surgery, uniportal robotic-assisted thoracic surgery, multiportal robotic-assisted thoracic surgery, non-small cell lung cancer, URATS, MRATS, Da Vinci robot, lobectomy, segmentectomy*, and other relevant terms, with a combination of MeSH terms (or corresponding subject headings in each database) and free-text keywords. Additionally, manual searches were conducted on relevant clinical trial registration platforms and the reference lists of included studies to supplement potentially missed data.

**Main outcome(s)** The primary outcome was 1-year postoperative all-cause mortality. Secondary outcomes included perioperative complications (infection, pulmonary air leak, hemothorax), operative time, intraoperative blood loss, chest tube drainage duration, length of hospital stay, and number of lymph nodes dissected.

**Quality assessment / Risk of bias analysis** Two reviewers independently assessed the quality of included cohort studies using the Newcastle-Ottawa Scale (NOS). The NOS evaluates three domains:
1. Selection of study population (4 items, maximum 4 points);
2. Comparability between groups (1 item, maximum 2 points);
3. Outcome assessment (3 items, maximum 3 points).
The total score ranges from 0 to 9, with studies classified as high quality (≥7 points), moderate quality (4–6 points), or low quality (<4 points). Discrepancies were resolved via discussion or

third-party adjudication. The overall quality of each study was ultimately graded.

**Strategy of data synthesis** Data analysis was performed using Stata 17.0 software. For dichotomous variables, the odds ratio (OR) was used as the effect measure; for continuous variables, the weighted mean difference (WMD) or standardized mean difference (SMD) was applied. All effect measures were reported with 95% confidence intervals (95% CI), and statistical significance was set at $P < 0.05$. Heterogeneity was assessed using the chi-square test ($\alpha = 0.1$) and $I^2$ statistic: - If $I^2$ 0.05 (low heterogeneity), a fixed-effects model was used for meta-analysis; - If $I^2 \geq 50\%$ or $P \leq 0.05$ (significant heterogeneity), a random-effects model was employed, and subgroup analysis and sensitivity analysis were conducted to explore sources of heterogeneity.
Publication bias was evaluated using funnel plots and Egger's test ($\alpha = 0.05$).

**Subgroup analysis** When high heterogeneity was observed ($I^2 \geq 50\%$), subgroup analyses were conducted based on study characteristics to explore potential sources of heterogeneity.

**Sensitivity analysis** A leave-one-out sensitivity analysis was performed: each included study was sequentially excluded, and the meta-analysis was re-run to observe changes in the pooled effect size, thereby assessing the robustness and reliability of the results. A significant change in the pooled effect size after excluding a specific study indicated that the study had a substantial impact on the overall findings.

**Country(ies) involved** Department of Cardiovascular Surgery, First Hospital of Lanzhou University, 730000, Lanzhou, Gansu, China.

**Keywords** Uniportal robotic-assisted thoracoscopic surgery; Multiportal robotic-assisted thoracoscopic surgery; Non-small cell lung cancer; Robotic-assisted surgery; Systematic review; Meta-analysis.

**Contributions of each author**
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