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Review Article

Efficacy of single- and double-hole thoracoscopic lobectomy for treatment of non-small cell lung cancer: a meta-analysis

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Abstract: Objectives: To compare the effectiveness of single-port and double-port thoracoscopic lobectomy in the treatment of non-small cell lung cancer (NSCLC) using meta-analysis. Methods: We systematically searched Pubmed, Embase, and Cochrane Library databases to collect literature on single-hole and double-hole thoracoscopic lobectomy for NSCLC with the end date of August 2022. Keywords included "thoracoscopy", "lobectomy", and "non-small cell lung cancer". Two authors independently conducted literature screening, data extraction, and quality evaluation. The quality evaluation tools were the Cochrane bias risk assessment tool and the Newcastle-Ottawa scale. Meta-analysis was performed using RevMan5.3 software. The odds ratio (OR), weighted mean difference (WMD), and 95% CI were calculated using a fixed-effects model or random-effect model as appropriate. Results: Ten studies were included. These included two randomized controlled studies and eight cohort studies. 1800 sick persons were included in the survey. Among them, 976 sick people underwent single-hole thoracoscopic lobectomy (single-hole group), and 904 had double-hole thoracoscopic lobectomy (double-hole group). The results of the meta-analysis are as follows. The intraoperative bleeding volume [WMD = -13.75, 95% CI (-18.47, -9.03), $P < 0.001$], postoperative 24 h VAS score [WMD = -0.60, 95% CI (-0.75, -0.46), $P < 0.001$], and postoperative hospital stay time [WMD = -0.33, 95% CI (-0.54, -0.11), $P = 0.0003$] in the single-hole group was less than that in the double-hole group. The amount of dissected lymph nodes in the double-hole group was more than that in the single-hole group [WMD = 0.50, 95% CI (0.21, 0.80), $P = 0.0007$]. In both groups, operative time [WMD = 1.00, 95% CI (-9.62, 11.62), $P = 0.85$], intraoperative conversion rate [OR = 1.07, 95% CI (0.55, 2.08), $P = 0.85$], postoperative drainage time [WMD = -0.18, 95% CI (-0.52, -0.17), $P = 0.32$], and postoperative complications rate [OR = 0.89, 95% CI (0.65, 1.22), $P = 0.46$] had no statistical significance. Conclusion: Single-hole thoracoscopic lobectomy has advantages in reducing intraoperative bleeding volume, alleviating early postoperative pain, and shortening postoperative hospital stay time. Double-hole thoracoscopic lobectomy has advantages in lymph node dissection. Both methods are equally safe and feasible for NSCLC.

Keywords: Thoracoscope, lobectomy, NSCLC, application effect, meta-analysis

Introduction

Non-small cell lung cancer (NSCLC), as the most common histologic type, accounts for more than 80% of lung carcinomas. It is characterized by high morbidity and mortality rates. Surgery is the preferred treatment for early NSCLC [1]. The National Comprehensive Cancer Network (NCCN) NSCLC Clinical Practice Guidelines [2] suggest that anatomical lobectomy plus lymph node dissection is the standard surgical procedure for early NSCLC open surgery. With the popularization of thoracoscopic technology, thoracoscopic lobectomy has gradually become a mainstream operation due to its characteristics of less trauma, better safety, and faster recovery. Conventional thoracoscopic lobectomy has different surgical approaches, such as four-hole, three-hole, and double-hole. There is no consensus on their reliability. With the development of minimally invasive techniques, single-port thoracoscopic lobectomy is proposed, which reduces the operating hole to make the operation less traumatic.

In recent years, studies have compared the efficacy of these two types of surgery for NSCLC. Some studies [3, 4] believed that single-hole thoracoscopy required only one incision, which increased the difficulty of surgery. Whether it

Table 1. Retrieval strategy

Database	Search strategy
Pubmed	#1 “Thoracoscopes” [MeSH Terms] OR “Thoracoscopes” [All Fields]
	#2 “Pneumonectomy” [MeSH Terms] OR “Pneumonectomy” [All Fields]
	#3 “Carcinoma, Non-Small-Cell Lung” [MeSH Terms] OR (“Carcinoma” [All Fields] AND “Non-Small-Cell Lung” [All Fields]) OR “Non-Small-Cell Lung” [All Fields]
	#4 #1 and #2 and #3
Embase	#1 ‘Thoracoscopes’/exp OR Thoracoscopes
	#2 ‘Pneumonectomy’/exp OR Pneumonectomy
	#3 ‘Non-Small-Cell Lung’/exp OR Non-Small-Cell Lung
	#4 #1 and #2 and #3
Cochrane Library	#1 Thoracoscopes: ti,ab,kw (Word variations have been searched)
	#2 Pneumonectomy: ti,ab,kw (Word variations have been searched)
	#3 Non-Small-Cell Lung: ti,ab,kw (Word variations have been searched)
	#4 #1 and #2 and #3

can achieve the same radical effect as double-hole thoracoscopic surgery and whether this will increase postoperative complications remains to be seen. Other studies [5, 6] believe that single-hole thoracoscopy reduces the trauma and invasiveness to the chest wall, it can effectively relieve postoperative pain, reduce the occurrence of complications, and shorten the period of hospitalization. At present, there is no consistent conclusion on the therapeutic effects and advantages of these two surgical methods. To accurately and objectively appraise the treatment outcome of single- and double-port thoracoscopic lobectomy for NSCLC, we compared the perioperative clinical indexes of the two surgical methods by a meta-analysis to offer a reference for clinical treatment.

Methods

Literature screen

We systematically searched Pubmed, Embase, and Cochrane Library databases to collect literature on single-hole and double-hole thoracoscopic lobectomy for NSCLC with the end date of August 2022. Keywords such as “thoracoscopy”, “lobectomy”, and “non-small cell lung cancer” were systematically searched. The search strategy of subject words + free words were adopted, and the search strategy was adjusted according to the database. The specific search strategy is shown in **Table 1**. The literature was selected independently by two authors. First, the title and abstract of the literature were preliminarily browsed. After excluding unrelated literature, the full text of the abstract was further read according to the inclusion and exclusion criteria to determine whether to include or not. After the screening, cross-check was performed, and the disagreements were resolved through third-party consultation.

Eligibility criteria

Inclusion criteria: (1) Study type: randomized controlled trials or cohort studies. (2) Research object: primary NSCLC was diagnosed, and a thoracoscopic lobectomy was performed; 18 ≤ Age < 80 years old. (3) Intervention measures: observation group received a single-hole thoracoscopic lobectomy. The control group underwent double-port thoracoscopic lobectomy. (4) Outcome indicators: primary indicators were operation time, intraoperative blood loss, intraoperative conversion rate, amount of dissected lymph nodes, and incidence of postoperative complications. The literature included in the systematic review must contain a primary outcome indicator. Exclusion criteria: (1) The surgical form is sub-lobectomy, that is, wedge resection or segmental resection of the lung. (2) No relevant outcome indicators or incompletely reported literature are needed for this study. (3) Personal experience, expert opinions, and animal experiments as the primary form of literature. (4) Literature whose full text cannot be obtained, or data cannot be extracted. (5) Repeated published literature. (6) Review/systematic review/meta-analysis.

Data collection

Two authors extracted data independently according to a unified data extraction table. The contents include (1) Basic information: title, first author, publication year, country/region and research type. (2) Research contents: baseline data, interventions, grouping, outcome indicators and results. (3) Research characteristics: design scheme, inclusion and exclusion criteria, and measures to prevent bias. Cross-check was also conducted after data extraction, and the disagreements were resolved through third-party negotiation.

The primary outcome indicators included operation time, intraoperative blood loss, intraoperative conversion rate, amount of dissected lymph nodes, and postoperative complication rate. The secondary outcomes included postoperative 24 h VAS score, postoperative drainage time, and postoperative hospital stay.

Assessment of risk of bias

The included literature was evaluated independently by two authors using the Cochrane bias risk assessment tool and Newcastle-Ottawa Scale (NOS). The Cochrane tool was applied to assess the risk of bias in selection, implementation, measurement, follow-up, reporting, and other areas. There were seven items in total, which were judged by "low risk", "uncertainty", and "high risk". The results were represented using RevMan's Risk of a bias graph. NOS was evaluated from three modules: population selection, comparability and exposure/results with a total of eight items. The rating adopted the semi-quantification principle of the star system. Except the comparability module, which can be evaluated up to 2 stars, the remaining are up to 1 star, with a total score of 9 stars. A total score ≥ 6 was classified as high-quality literature. Cross-check after the quality evaluation was completed, any disagreement was resolved through third-party negotiation.

Statistical analysis

RevMan5.3 software was used for statistical analysis, and the statistical analysis results of the combined effect size were expressed by forest map. Weighted mean difference (WMD) and odds ratio (OR) were used as effect analysis statistics for quantitative and qualitative data, respectively, and 95% CI of each effect was provided. Statistical heterogeneity between aggregated data was assessed using I^2 statistics. $P > 0.1$ and $I^2 < 50\%$ indicates that the heterogeneity is acceptable, and the fixed effect model is used for Meta-analysis; $P < 0.1$ and $I^2 > 50\%$ suggests a high heterogeneity, and the random effect model is selected. If heterogeneity could not be eliminated, the source of heterogeneity was analyzed from both methodological and clinical aspects, and subgroup or sensitivity analysis was selected. A funnel plot was used to check whether there was publication bias. If the funnel plot was asymmetric, bias might be present. All tests were two-tailed, and $P < 0.05$ was considered significant.

Results

Literature characteristics

After preliminary screening, 183 articles were obtained. Most studies (n = 145) were excluded due to literature title and type. After the brows of abstracts, 17 studies were included. Among them, seven studies were further excluded due to inappropriate inclusion criteria in 4 studies, no results of interest in 1 study, and no full text in 2 studies. Finally, 10 studies were included in the meta-analysis. Among them, there were two randomized controlled studies [7, 8], one prospective cohort study [9], and seven retrospective cohort studies [10-16]. **Figure 1** shows the PRISMA flowchart. The characteristics of the included studies are summarized in **Table 2**. All selected studies were published between 2016 and 2021. These studies reported the efficacy of single-port and double-port thoracoscopic treatment of NSCLC, with sample sizes ranging from 21 to 200 in each group.

All the included literature provided complete indicator data, and none selectively reported the results. In the two included randomized controlled studies, one study reported correct random grouping method, and the other did not mention the grouping method in detail; Both groups did not fully describe the grouping concealment and blind procedure, and other biases were unclear (**Figure 2**). All of the remaining cohort studies scored ≥ 6 points, indicating high literature quality (**Table 3**).

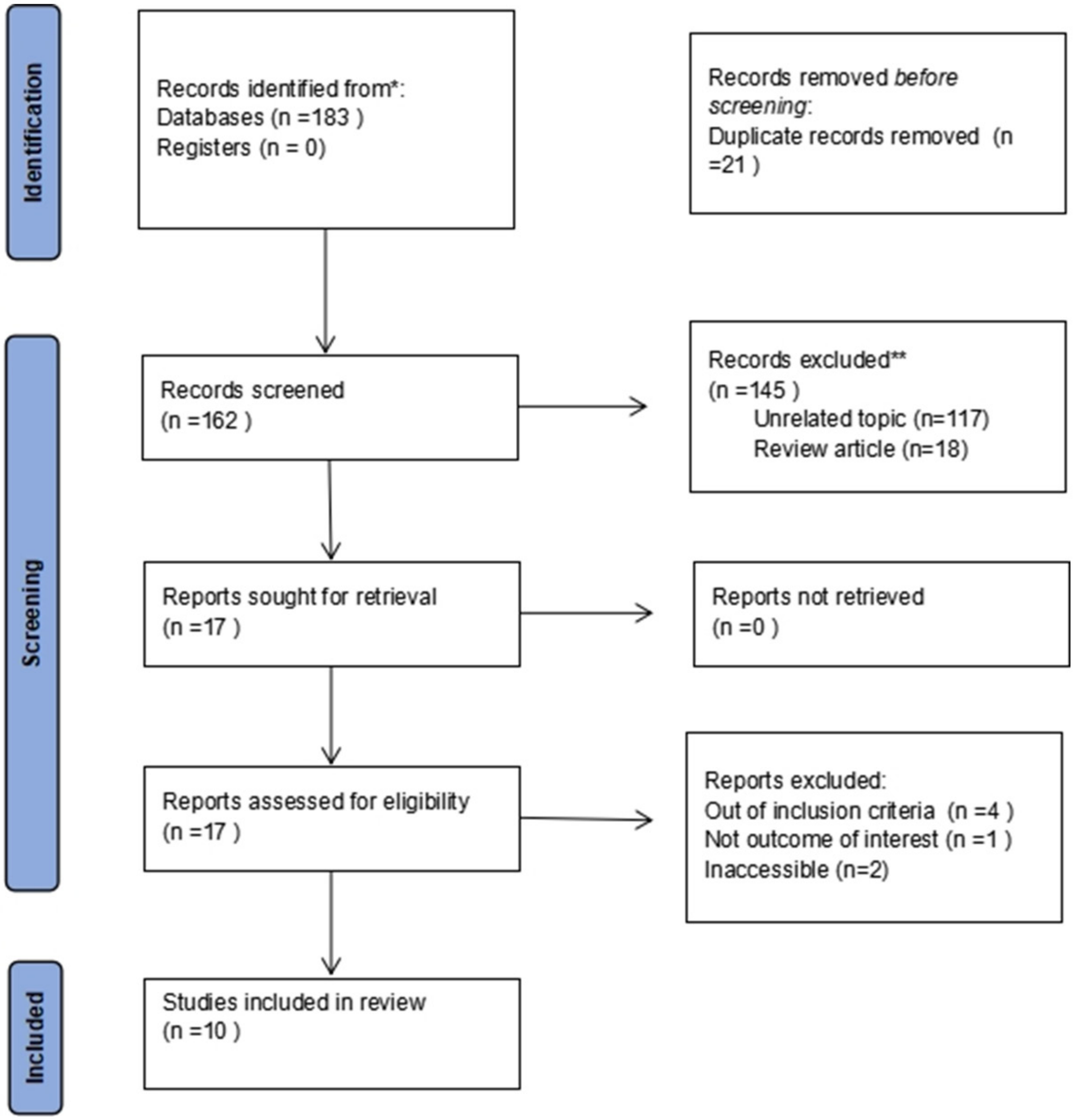

Figure 1. PRISMA flowchart.

Analysis of operation time of two approaches

Operation time was reported in nine studies involving 1552 patients. There were 810 patients in the single-hole group and 742 patients in the double-hole group. There was heterogeneity among studies (I^2 = 88 %, P < 0.001), so REM was used for combined analysis. The consequence displayed no notable difference in operation time between two approaches [WMD = 1.00, 95% CI (-9.62, 11.62), P = 0.85], as shown in **Figure 3**.

Analysis of intraoperative bleeding volume of two approaches

Intraoperative bleeding volume was reported in seven studies, which included a total of 1148 patients. There were 557 patients in the single-hole group and 591 patients in the double-hole group. The heterogeneity among all studies was acceptable (I^2 = 43%, P = 0.10), so the FEM was selected for the combined analysis. The consequence displayed that the intraoperative bleeding volume in the single-hole group was notably

Table 2. Basic information of the literature included in the study

Study	Year	Group		Gender (M/F)		Age		Clinical stage	Outcome
		Single-hole	Double-hole	Single-hole	Double-hole	Single-hole	Double-hole		
Lin 2016 [7]	2013.10-2014.4	21	46	13/8	29/17	59±7.3	62±6.2	-	① ② ⑥ ⑦
Ye 2019 [8]	2010.1-2012-8	58	58	33/25	32/26	64.16±11.38	63.86±9.83	Ia~Ib	① ② ④ ⑤ ⑥ ⑦ ⑧
Liu 2019 [9]	2015.8-2016.9	166	162	89/77	88/74	63.4 (22, 84)	62.5 (45, 82)	I~IIIa	③ ⑧
Bai 2016 [10]	2015.10-2016.5	109	67	48/61	35/32	55.79±15.58	60.32±13.09	I~II	① ② ⑤ ⑥ ⑦
Dai 2016 [11]	2013.1-2015.6	63	63	40/23	46/17	58.68±9.24	57.11±12.22	I~IIIa	① ② ④ ⑤ ⑥ ⑦ ⑧
Han 2017 [12]	2006.1-2015.6	167	58	-	-	-	-	I~IIIb	① ③ ④ ⑥
Hu 2021 [13]	2014.10-2017.10	200	200	112/88	109/91	67.00 (55.00, 77.00)	66.00 (56.00, 72.00)	I~IIIa	① ② ③ ④ ⑤ ⑦ ⑧
Sun 2017 [14]	2014.10-2015.11	86	93	42/44	48/55	62.3±7.6	61.8±7.4	-	① ④ ⑥ ⑦ ⑧
Wang 2017 [15]	2015.1-2015.12	73	86	31/42	45/41	57.12±6.43	54.36±7.6	I~IIIa	① ② ④ ⑥ ⑦ ⑧
Xu 2020 [16]	2018.5-2019.3	55	87	18/37	46/41	60.75±9.82	59.82±11.06	I~IIIb	① ② ④ ⑤ ⑥ ⑦ ⑧

Note: ① operation time; ② intraoperative bleeding volume; ③ intraoperative conversion rate; ④ amount of lymph nodes dissected; ⑤ visual simulation pain score of 24 h after operation; ⑥ postoperative drainage time; ⑦ postoperative hospital stay time; ⑧ postoperative complication rate.

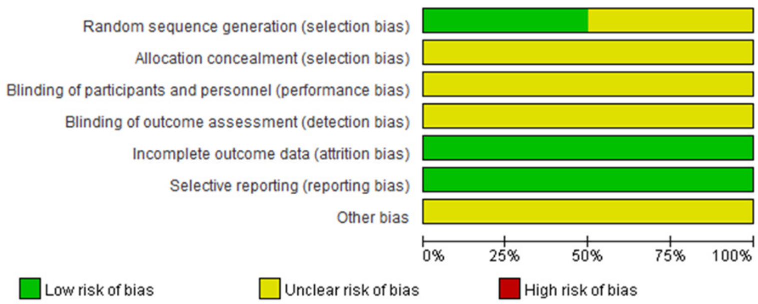

Figure 2. Risk of bias graph.

less than that in the double-hole group [WMD = -13.75, 95% CI (-18.47, -9.03), P < 0.001], as shown in **Figure 4**.

Analysis of intraoperative conversion rate of both approaches

The Intraoperative conversion rate was reported in three studies, which included 953 patients. There were 533 patients in the single-hole group and 420 patients in the double-hole group. The heterogeneity among all studies was acceptable (I^2 = 0%, P = 0.87), so the FEM was selected for the combined analysis. The consequence showed no significant difference in intraoperative conversion rate between the two approaches [OR = 1.07, 95% CI (0.55, 2.08), P = 0.85], as shown in **Figure 5**.

Analysis of dissected lymph nodes of both approaches

The amount of dissected lymph nodes was reported in seven studies, which included a total of 1347 patients. There were 702 patients in the single-hole group and 645 patients in the double-hole group. The heterogeneity among all studies was acceptable (I^2 = 37%, P = 0.14), so the FEM was selected for the combined analysis. The consequence displayed that the amount of dissected lymph nodes in the double-hole group was higher than that in the single-hole group [WMD = 0.50, 95% CI (0.21, 0.80), P = 0.0007], as shown in **Figure 6**.

Analysis of postoperative 24 h VAS score of both approaches

Postoperative 24 h VAS score was reported in 5 studies, which included 960 patients. There were 485 patients in the single-hole group and 475 patients in the double-hole group. There was heterogeneity among studies (I^2 = 73%, P = 0.006), so the REM was used for combined analysis. Results showed that the postoperative 24 h VAS score in the single-hole group was lower than that in the double-hole group [WMD = -0.60, 95% CI (-0.75, -0.46), P < 0.001], as shown in **Figure 7**.

Analysis of postoperative drainage time of two approaches

Postoperative drainage time was reported in eight studies, which included 1152 patients. There were 610 patients in the single-hole group and 542 patients in the double-hole group. There was heterogeneity among studies (I^2 = 64%, P = 0.006), so the REM was used for combined analysis. Results showed no notable difference in postoperative drainage time between the two groups [WMD = -0.18, 95% CI (-0.52, -0.17), P = 0.32], as shown in **Figure 8**.

Analysis of postoperative hospital stay of both approaches

Postoperative hospital stay time was reported in eight studies, which included 1327 patients. There were 643 patients in the single-hole group and 684 patients in the double-hole group. The heterogeneity among all studies was acceptable (I^2 = 37%, P = 0.13), so the FEM was selected for the combined analysis. Results showed that postoperative hospital stay time in the single-hole group was less than that in the double-hole group [WMD = -0.33, 95% CI (-0.54, -0.11), P = 0.0003], as shown in **Figure 9**.

Analysis of postoperative complication rate of two approaches

The postoperative complication rate was reported in seven studies, which included 1450 patients. There were 701 patients in the single-hole group and 749 patients in the double-hole group. The heterogeneity among all studies was acceptable (I^2 = 0%, P = 0.49), so the FEM was selected for the combined analysis. Results showed no notable difference in postoperative complication rate between the two groups [OR = 0.89, 95% CI (0.65, 1.22), P = 0.46], as shown in **Figure 10**.

Table 3. Quality evaluation of the Cohort study

Study	Selection				Comparability control for important factor	Exposure			Scores
	Adequate definition of cases	Representativeness of the cases	Selection of controls	Definition of controls		Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Responserate	
Bai 2016	*	*	*	*	*	*	-	-	6
Dai 2016	*	*	*	*	**	*	-	-	7
Han 2017	*	*	*	*	*	*	*	*	8
Hu 2021	*	*	*	*	**	*	-	-	7
Liu 2019	*	*	*	*	*	*	*	-	7
Sun 2017	*	*	*	*	*	*			6
Wang 2017	*	*	*	*	*	*	-	-	6
Xu 2020	*	*	*	*	*	*	-	-	6

Note: * Represents a score of 1; ** Represents scores of 2.

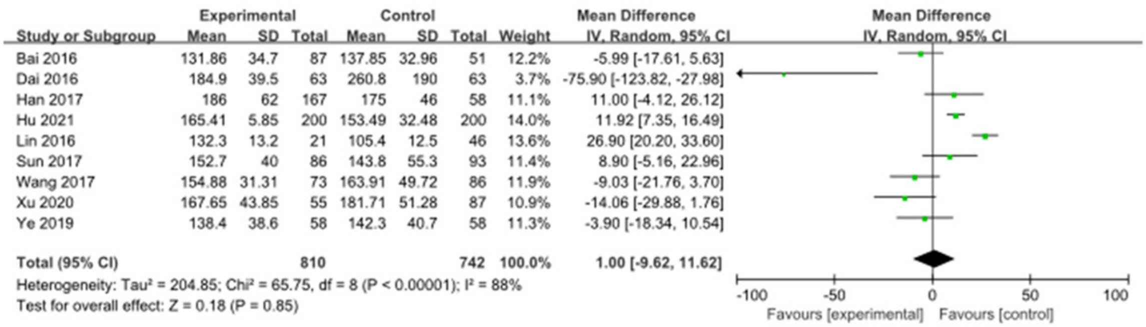

Figure 3. Forest plot for meta-analysis of operation time.

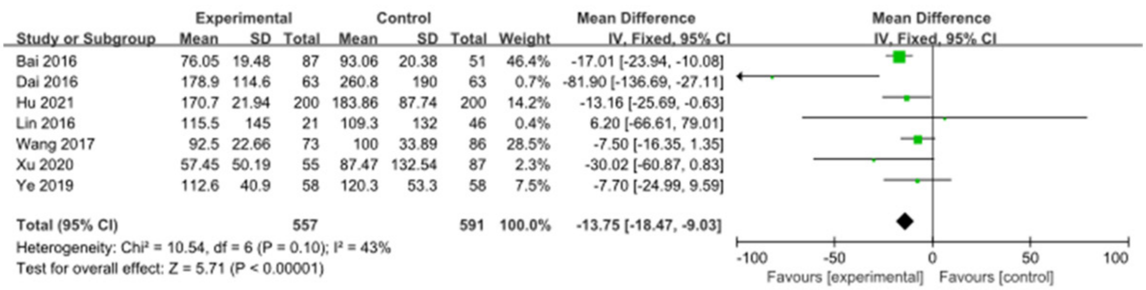

Figure 4. Forest plot for meta-analysis of intraoperative bleeding volume.

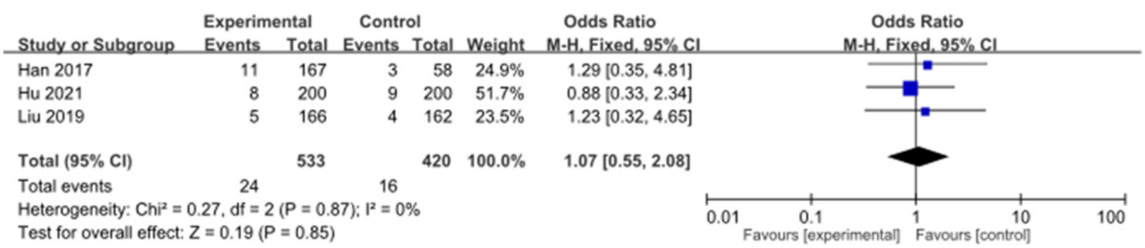

Figure 5. Forest plot for meta-analysis of intraoperative conversion rate.

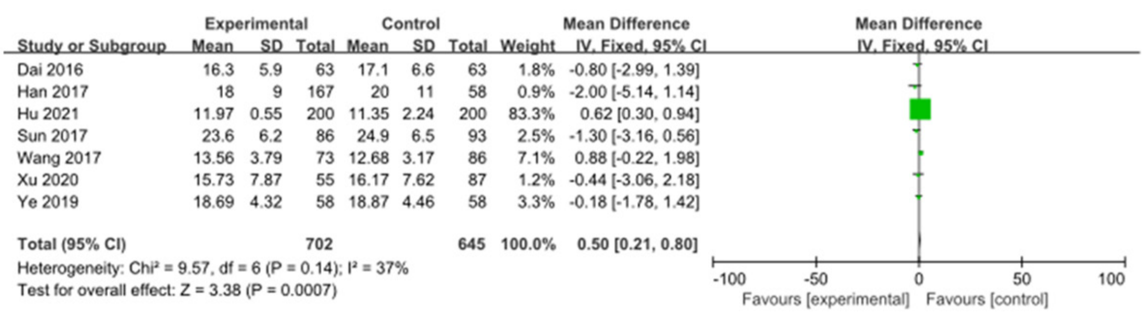

Figure 6. Forest plot for meta-analysis of number of dissected lymph nodes.

Reporting bias assessment

We drew a funnel plot based on the incidence of postoperative complications (**Figure 11**). All the literature were located in the 95% confidence interval, and the left and right sides were asymmetric. Considering that many retrospective cohort studies were included, and there were unpublished negative results, there might be a specific publication bias.

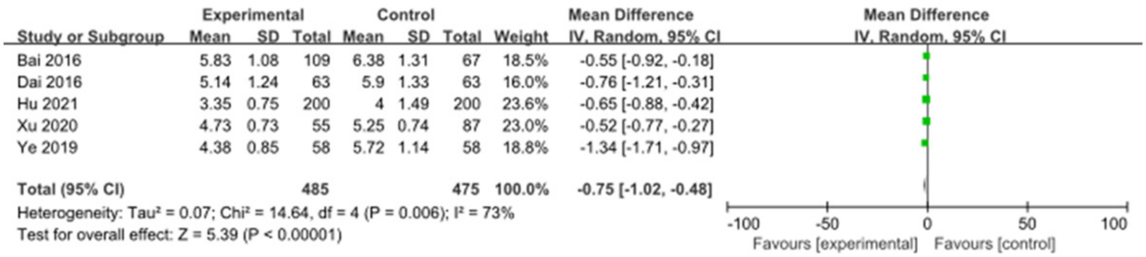

Figure 7. Forest plot for meta-analysis of postoperative 24 h VAS score.

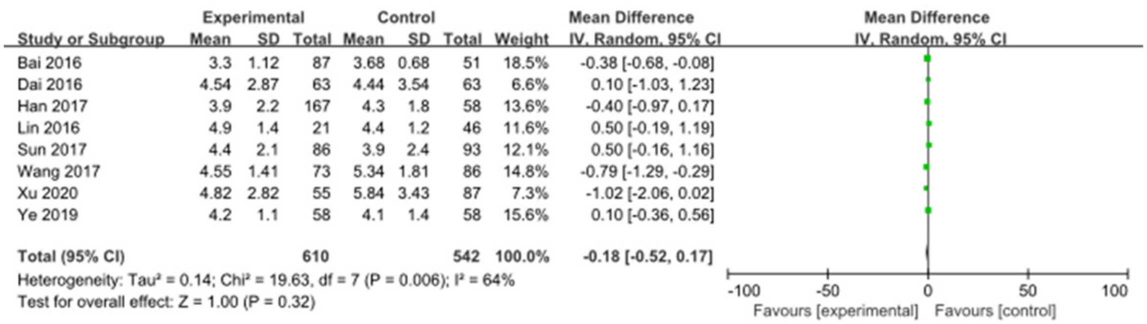

Figure 8. Forest plot for meta-analysis of postoperative drainage time.

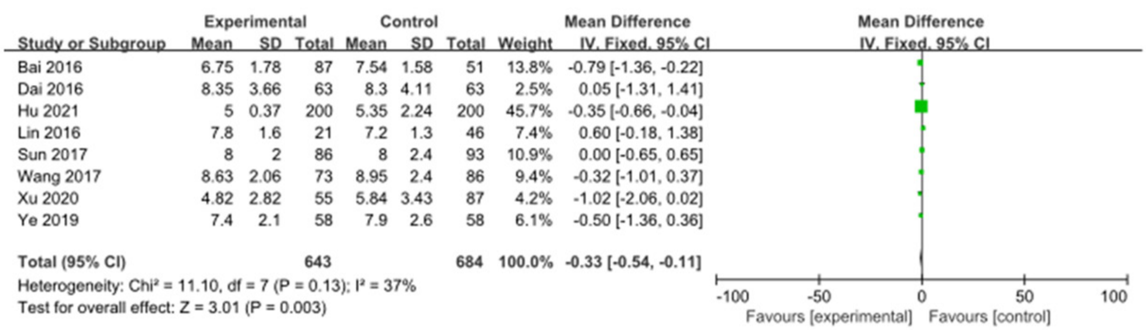

Figure 9. Forest plot for meta-analysis of postoperative hospital stay.

Certainty assessment

Sensitivity analysis was performed for results with $I^2 > 50\%$. There was no statistical difference in the operation time between the two groups. After eliminating the literature one by one, the I^2 value did not change much, and the *P* value changed in the same direction, indicating that the results were stable. We considered that the heterogeneity might be related to different hospitals and doctor techniques. The VAS scores of the two groups were statistically different at 24 h after the operation. After excluding the study of Ye et al., the I^2 value decreased from 73% to 0, and the *P* values before and after exclusion were all < 0.001. The results were stable and had clinical significance. The study of Ye et al. was a randomized controlled trial while the rest were cohort studies. We considered that the reason for the heterogeneity was different types of analysis. There was no statistical difference in the indwelling time of the thoracic drainage tube between the two groups. We eliminated the literature one by one, the I^2 value did not change much, and the *P* value changed in the same direction, indicating that the results were stable. The source of heterogeneity may be the quality of surgery, the difference between patients themselves, and postoperative care.

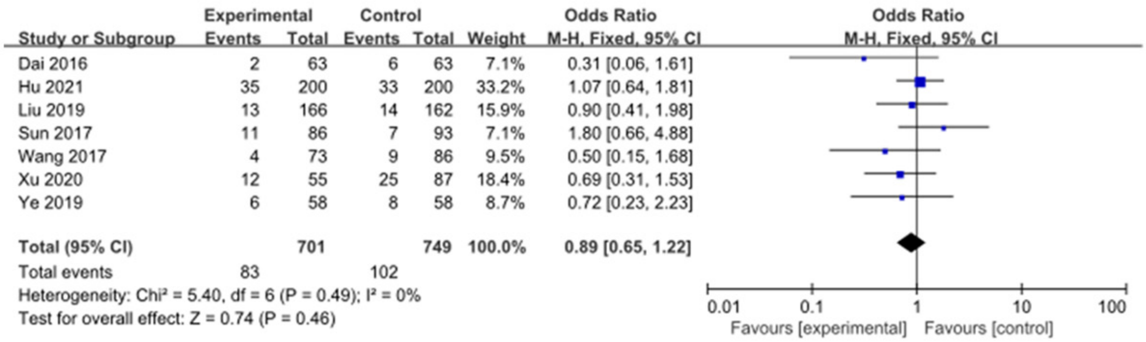

Figure 10. Forest plot for meta-analysis of postoperative complication rate.

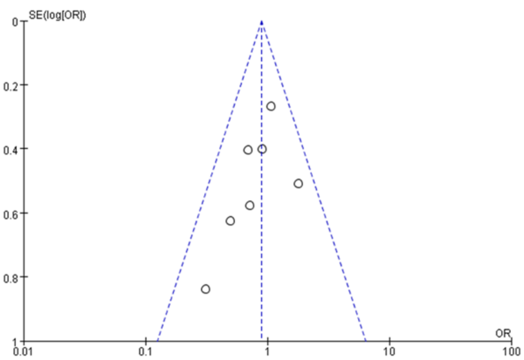

Figure 11. Funnel plot.

Discussion

Radical lung lobectomy is a recognized method for the treatment of early NSCLC. The traditional lung cancer surgery is thoracotomy, which has a large incision, great bleeding volume, severe postoperative pain, and a high incidence of complications that brings great pain to patients. In recent years, with the development of many medical devices and technologies, such as thoracoscopic energy instruments and cutting staplers, minimally invasive surgery has been widely used. Compared to thoracotomy, thoracoscopic lobectomy has apparent advantages in less postoperative pain, fewer perioperative complications, fast recovery speed and short postoperative hospital stay. Also, it shows remarkable benefits in tumor recurrence rate and overall survival rate.

In 2006, the National Comprehensive Cancer Network NSCLC Clinical Practice Guidelines [2] proposed that thoracoscopic surgery should be the standard surgical treatment for early-stage NSCLC. At present, multi-hole, double-hole, and single-hole thoracoscopic lobectomy have been successfully applied in treating NSCLC. Still, the number of chest wall incisions has yet to reach a consensus. With the development of minimally invasive concepts, smaller surgical incisions, higher safety, and fewer complications have become the direction of scholars' efforts. Therefore, single-port thoracoscopic surgery is a more advanced surgical method. However, due to the short time of its formal application, the clinical treatment effect still needs to be further investigated. A domestic meta-analysis [17] has reported that single-hole thoracoscopic lobectomy and three-hole thoracoscopic lobectomy are equally safe and feasible in treating NSCLC, and single-hole surgery has more advantages in shortening hospital stays and reducing injury complications. Therefore, this paper further compares the therapeutic effects of single- and double-hole thoracoscopic lobectomy in NSCLC.

The results of the meta-analysis showed significant differences in intraoperative blood loss, number of lymph nodes dissected, VAS score at 24 h after operation, and postoperative hospital stay between the two groups. The single-hole group had more advantages in reducing intraoperative blood loss, relieving postoperative pain and shortening hospitalization time. It was considered that double-hole thoracoscopic surgery required one 3-5 cm operating hole and one approximately 2 cm observation hole, while single-hole thoracoscopic surgery required only one incision as working hole and observation hole, which reduced the damage of skin and muscle tissue of the chest wall. Due to the increase in posterior axillary line incision and the narrow intercostal space at the rear axillary line, the double-hole thoracoscopic surgery will increase the risk of injury to the back muscles and rear intercostal space. The two intercostal spaces are affected during the operation, resulting in more pain, thus increasing intraoperative blood loss and early postoperative pain. The reason is considered to be the more enormous trauma of the double-hole thoracoscopic surgery and the more severe pain caused by the influence of the two intercostal areas during the operation. In addition, the trocar should be inserted into the observation hole of double-hole thoracoscopic surgery, which can compress the intercostal nerve during the process, making the postoperative pain more obvious. In the single-port thoracoscopic group, there was no nerve compression by the trocar, so the pain was relatively light [18]. Postoperative pain will bring difficulty for patients getting out of bed and thus reducing automatic expectoration. Double-hole thoracoscopic surgery is more invasive than single-hole thoracoscopic surgery. It also causes a certain degree of damage to the body, affects the rehabilitation, and prolongs the hospitalization time [19].

The amount of dissected lymph nodes in the single-hole group was notably less than that in the double-hole group, suggesting that double-hole thoracoscopic lobectomy is more advantageous for lymph node clearance. The reason is that all the instruments of single-hole thoracoscopic surgery enter the body through the same incision, which may reduce the operating space, cause mutual interference between the devices, and make the operation more difficult. In addition, the ultrasonic scalpel and electric scalpel may produce thick smoke during the operation. A single-hole thoracoscopic surgery makes it difficult to discharge the smoke generated by energy instruments, affecting the operative visual field and the number of lymph node dissection. The independent observation hole of the double-hole thoracoscopic surgery can more conveniently show the operative field of view for the surgeon and thus beneficial to lymph node dissection [20]. There were no notable differences in operation time, intraoperative conversion rate, postoperative drainage time, or postoperative complications rate between the two groups. The results suggest that single-port thoracoscopic lobectomy and thoracoscopic lobectomy have similar safety and postoperative efficacy. In the included literature, only one randomized controlled trial described the long-term effectiveness of thoracoscopic lobectomy. Ye et al. showed no statistical difference in the 3- and 5-year survival rates after single-hole and double-hole thoracoscopic lobectomy. The reason why there are few descriptions of long-term postoperative efficacy indicators is that the application time of uniportal thoracoscopic lobectomy is not long. Most studies are based on retrospective cohort studies and lack observation of long-term efficacy.

There are some limitations to this study. (1) The quality of the included research literature is uneven. 2 were randomized controlled studies, 1 was a prospective cohort study, and the rest were retrospective cohort studies. (2) The data included in the study were mainly from hospitals in different parts of China. The research literature has yet to fully describe the region, race and physical conditions in detail, and there is a high possibility of differences. This will inevitably affect the results. (3) There was significant heterogeneity among some effect indicators. Therefore, subgroup analysis was conducted to find significant sources of heterogeneity during the study, but the effect was not obvious. This may also be related to the different research designs of the included literature. More rigor is needed in the research process. Therefore, more high-quality research is needed to support meta-analysis in the future to draw more convincing conclusions.

There is no significant difference in operation time, intraoperative conversion rate, chest drainage tube indwelling time and postoperative complication rate between single-hole and double-hole thoracoscopic lobectomy. Single-port thoracoscopic lobectomy has more advantages in intraoperative blood loss, postoperative 24 h VAS score, and postoperative hospital stay. Double-port thoracoscopic lobectomy has more benefits for lymph nodes clearance. The curative effect of single-port thoracoscopic lobectomy in NSCLC is worthy of recognition. Yet, due to having only one operating hole, various surgical instruments inevitably affect each other, which affects the surgical field to a certain extent and also increases the overall difficulty of the operation. More sophisticated surgical instruments and explore more standardized and streamlined surgical procedures are needed. In summary, surgery has entered the era of minimally invasive surgery. Applying single-port thoracoscopic lobectomy promotes the development of NSCLC treatment surgery and can meet the needs of more patients.

Disclosure of conflict of interest

None.

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