

Table S1 Search strategy

Database	Details of search strategy
MEDLINE	<p>#1 video-assisted thoracoscopic surgery[MeSH Terms],,,""thoracic surgery, video-assisted""[MeSH Terms]"</p> <p>#2 video-assisted thoracoscopic surgery[Title/Abstract],,,""video assisted thoracoscopic surgery""[Title/Abstract]"</p> <p>#3 VATS[MeSH Terms],,,""thoracic surgery, video-assisted""[MeSH Terms]"</p> <p>#4 VATS[Title/Abstract],,,""VATS""[Title/Abstract]"</p> <p>#5 thoracoscopic surgery[MeSH Terms],,,""thoracoscopy""[MeSH Terms]"</p> <p>#6 thoracoscopic surgery[Title/Abstract],,,""thoracoscopy""[Title/Abstract]"</p> <p>#7 thoracoscope[MeSH Terms],,,""thorascopes""[MeSH Terms]"</p> <p>#8 thoracoscope[Title/Abstract],,,""thorascopes""[Title/Abstract]"</p> <p>#9 video-assisted thoracic surgery[MeSH Terms],,,""thoracic surgery, video-assisted""[MeSH Terms]"</p> <p>#10 video-assisted thoracic surgery[Title/Abstract],,,""video assisted thoracic surgery""[Title/Abstract]"</p> <p>#11 minimally invasive thoracic surgery[MeSH Terms],,,""minimally""[All Fields] AND ((((((("invasibility""[All Fields] OR "invasible""[All Fields]) OR "invasion""[All Fields]) OR "invasions""[All Fields]) OR "invasive""[All Fields]) OR "invasively""[All Fields]) OR "invasiveness""[All Fields]) OR "invasives""[All Fields]) OR "invasivity""[All Fields])) AND ("thoracic surgical procedures""[MeSH Terms] OR "thoracic surgery""[MeSH Terms])"</p> <p>#12 minimally invasive thoracic surgery[Title/Abstract],,,""minimally invasive thoracic surgery""[Title/Abstract]"</p> <p>#13 thoracoscopy[MeSH Terms],,,""thoracoscopy""[MeSH Terms]"</p> <p>#14 thoracoscopy[Title/Abstract],,,""thoracoscopy""[Title/Abstract]"</p> <p>#15 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14)</p> <p>#16 chest tube[MeSH Terms],,,""chest tubes""[MeSH Terms]"</p> <p>#17 chest tube[Title/Abstract],,,""chest tube""[Title/Abstract]"</p> <p>#18 chest drain[MeSH Terms],,,""chest tubes""[MeSH Terms]"</p> <p>#19 chest drain[Title/Abstract],,,""chest drain""[Title/Abstract]"</p> <p>#20 chest drainage[MeSH Terms],,,""("chested""[All Fields] OR "thorax""[MeSH Terms]) OR "thorax""[All Fields]) OR "chest""[All Fields]) OR "chests""[All Fields]) AND "drainage""[MeSH Terms]"</p> <p>#21 chest drainage[Title/Abstract],,,""chest drainage""[Title/Abstract]"</p> <p>#22 pleural drainage[MeSH Terms],,,""("pleura""[MeSH Terms] OR "pleura""[All Fields]) OR "pleural""[All Fields]) AND "drainage""[MeSH Terms]"</p> <p>#23 pleural drainage[Title/Abstract],,,""pleural drainage""[Title/Abstract]"</p> <p>#24 thorax drainage[MeSH Terms],,,""("thorax""[MeSH Terms] OR "thorax""[All Fields]) OR "thoraxes""[All Fields]) AND "drainage""[MeSH Terms]"</p> <p>#25 thorax drainage[Title/Abstract],,,""thorax drainage""[Title/Abstract]"</p> <p>#26 (#16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)</p> <p>#27 (#15 AND #26)</p>
EMBASE	<p>#1 video-assisted thoracoscopic surgery.ti. or video-assisted thoracoscopic surgery.ab. or video assisted thoracoscopic surgery.ti. or video assisted thoracoscopic surgery.ab. or thoracic surgery, video-assisted.ti. or thoracic surgery, video-assisted.ab. or VATS.ti. or VATS.ab. or thoracoscopic surgery.ti. or thoracoscopic surgery.ab. or thoracoscopy.ti. or thoracoscopy.ab. or thoracoscope.ti. or thoracoscope.ab. or thorascopes.ti. or thorascopes.ab. or video-assisted thoracic surgery.ti. or video-assisted thoracic surgery.ab. or video assisted thoracic surgery.ti. or video assisted thoracic surgery.ab. or minimally invasive thoracic surgery.ti. or minimally invasive thoracic surgery.ab. or minimally invasibility thoracic surgery.ti. or minimally invasibility thoracic surgery.ab. or minimally invisable thoracic surgery.ti. or minimally invisable thoracic surgery.ab. or minimally invasion thoracic surgery.ti. or minimally invasion thoracic surgery.ab. or minimally invasions thoracic surgery.ti. or minimally invasions thoracic surgery.ab. or minimally invasively thoracic surgery.ti. or minimally invasively thoracic surgery.ab. or minimally invasives thoracic surgery.ti. or minimally invasives thoracic surgery.ab. or minimally invasiveness thoracic surgery.ti. or minimally invasiveness thoracic surgery.ab. or minimally invasivity thoracic surgery.ti. or minimally invasivity thoracic surgery.ab. or minimally invasiveness thoracic surgical procedures.ti. or minimally invasiveness thoracic surgical procedures.ab. or minimally invasives thoracic surgical procedures.ti. or minimally invasives thoracic surgical procedures.ab. or minimally invasive thoracic surgical procedures.ti. or minimally invasive thoracic surgical procedures.ab. or minimally invasively thoracic surgical procedures.ti. or minimally invasively thoracic surgical procedures.ab. or minimally invasion thoracic surgical procedures.ti. or minimally invasion thoracic surgical procedures.ab. or minimally invasions thoracic surgical procedures.ti. or minimally invasions thoracic surgical procedures.ab. or minimally invasibility thoracic surgical procedures.ti. or minimally invasibility thoracic surgical procedures.ab. or minimally invisable thoracic surgical procedures.ti. or minimally invisable thoracic surgical procedures.ab.</p> <p>#2 chest tube.ti. or chest tube.ab. or chest tubes.ti. or chest tubes.ab. or chest drain.ti. or chest drain.ab. or chest drainage.ti. or chest drainage.ab. or chested drainage.ti. or chested drainage.ab. or chests drainage.ti. or chests drainage.ab. or thorax drainage.ti. or thorax drainage.ab. or pleural drainage.ti. or pleural drainage.ab. or pleura drainage.ti. or pleura drainage.ab. or thoraxes drainage.ti. or thoraxes drainage.ab.</p> <p>#3 (#1 AND #2)</p>
Web of Science	<p>#1 TS=(video-assisted thoracoscopic surgery) OR TS=(video assisted thoracoscopic surgery) OR TS=(thoracic surgery, video-assisted) OR TS=(VATS) OR TS=(thoracoscopic surgery) OR TS=(thoracoscopy) OR TS=(thoracoscope) OR TS=(thorascopes) OR TS=(video-assisted thoracic surgery) OR TS=(video assisted thoracic surgery) OR TS=(minimally invasive thoracic surgery) OR TS=(minimally invasibility thoracic surgery) OR TS=(minimally invisable thoracic surgery) OR TS=(minimally invasion thoracic surgery) OR TS=(minimally invasions thoracic surgery) OR TS=(minimally invasively thoracic surgery) OR TS=(minimally invasives thoracic surgery) OR TS=(minimally invasiveness thoracic surgery) OR TS=(minimally invasivity thoracic surgery) OR TS=(minimally invasivity thoracic surgical procedures) OR TS=(minimally invasiveness thoracic surgical procedures) OR TS=(minimally invasives thoracic surgical procedures) OR TS=(minimally invasive thoracic surgical procedures) OR TS=(minimally invasively thoracic surgical procedures) OR TS=(minimally invasion thoracic surgical procedures) OR TS=(minimally invasions thoracic surgical procedures) OR TS=(minimally invasibility thoracic surgical procedures) OR TS=(minimally invisable thoracic surgical procedures)</p> <p>#2 TS=(chest tube) OR TS=(chest tubes) OR TS=(chest drain) OR TS=(chest drainage) OR TS=(chests drainage) OR TS=(chested drainage) OR TS=(thorax drainage) OR TS=(thoraxes drainage) OR TS=(pleura drainage) OR TS=(pleural drainage)</p> <p>#3 (#1 AND #2)</p>
Cochrane Library	<p>#1 (video-assisted thoracoscopic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#2 (video assisted thoracoscopic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#3 (thoracic surgery, video-assisted):ti,ab,kw (Word variations have been searched)</p> <p>#4 (VATS):ti,ab,kw (Word variations have been searched)</p> <p>#5 (thoracoscopic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#6 (thoracoscopy):ti,ab,kw (Word variations have been searched)</p> <p>#7 (thoracoscope):ti,ab,kw (Word variations have been searched)</p> <p>#8 (thorascopes):ti,ab,kw (Word variations have been searched)</p> <p>#9 (video-assisted thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#10 (video assisted thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#11 (minimally invasive thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#12 (minimally invasibility thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#13 (minimally invisable thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#14 (minimally invasion thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#15 (minimally invasions thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#16 (minimally invasively thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#17 (minimally invasives thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#18 (minimally invasiveness thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#19 (minimally invasivity thoracic surgery):ti,ab,kw (Word variations have been searched)</p> <p>#20 (minimally invasivity thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#21 (minimally invasiveness thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#22 (minimally invasives thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#23 (minimally invasive thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#24 (minimally invasively thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#25 (minimally invasion thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#26 (minimally invasions thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#27 (minimally invasibility thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#28 (minimally invisable thoracic surgical procedures):ti,ab,kw (Word variations have been searched)</p> <p>#29 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #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)</p> <p>#30 (chest tube):ti,ab,kw (Word variations have been searched)</p> <p>#31 (chest tubes):ti,ab,kw (Word variations have been searched)</p> <p>#32 (chest drain):ti,ab,kw (Word variations have been searched)</p> <p>#33 (chest drainage):ti,ab,kw (Word variations have been searched)</p> <p>#34 (chests drainage):ti,ab,kw (Word variations have been searched)</p> <p>#35 (chested drainage):ti,ab,kw (Word variations have been searched)</p> <p>#36 (thorax drainage):ti,ab,kw (Word variations have been searched)</p> <p>#37 (thoraxes drainage):ti,ab,kw (Word variations have been searched)</p> <p>#38 (pleural drainage):ti,ab,kw (Word variations have been searched)</p> <p>#39 (pleura drainage):ti,ab,kw (Word variations have been searched)</p> <p>#40 (#30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39)</p> <p>#41 (#29 AND #40)</p>

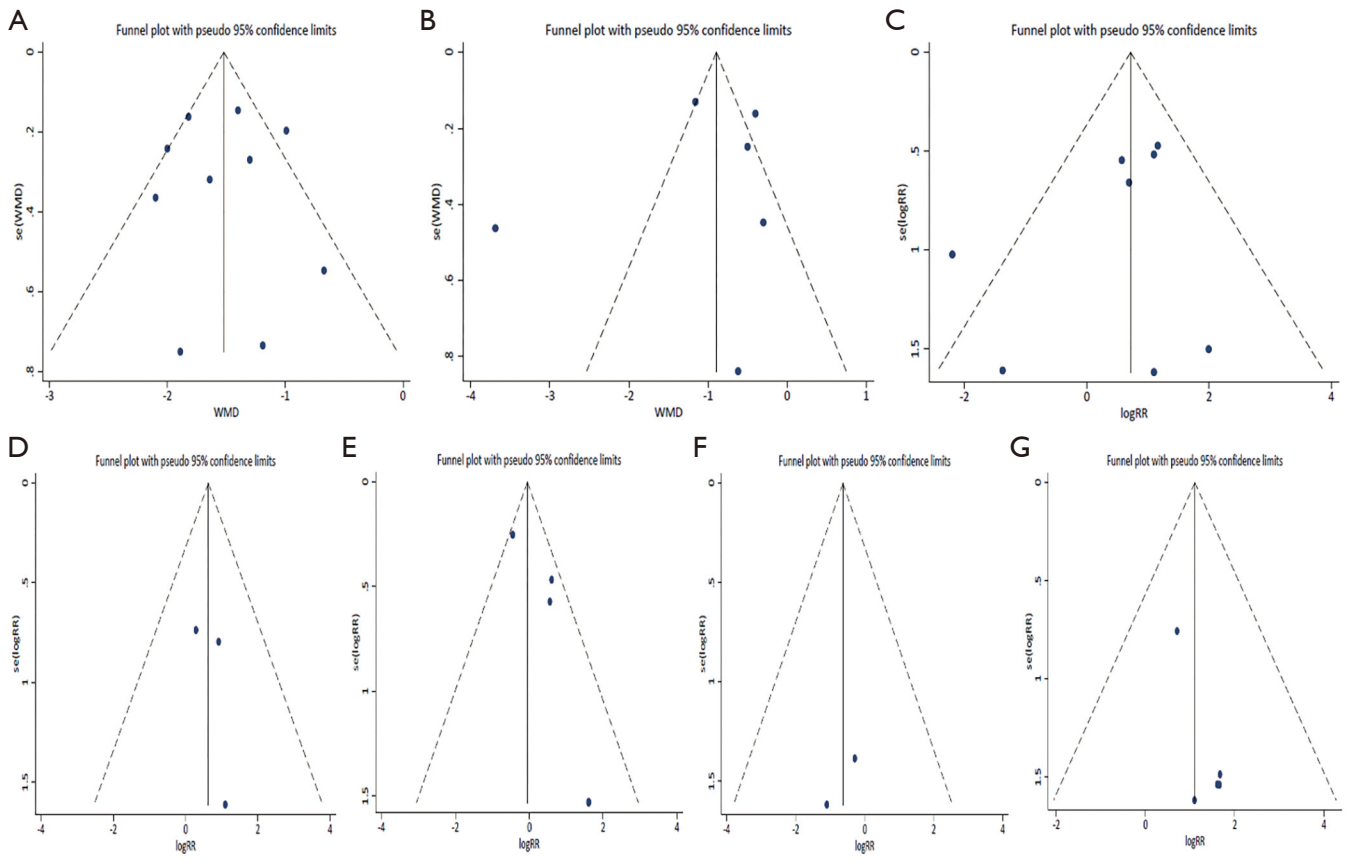


Figure S1 Funnel plot of (A) length of stay in hospital; (B) postoperative pain; (C) pneumothorax; (D) pleural effusion; (E) subcutaneous emphysema; (F) pneumonia; (G) drain insertion or thoracentesis.

Table S2 Criteria for intervention group and air leakage text of included studies

Author	Criteria for intervention group	Air leakage test
Luckraz <i>et al.</i> (19)	<ul style="list-style-type: none"> No air leak was demonstrated 	<ul style="list-style-type: none"> Water sealing test
Park <i>et al.</i> (32)	<ul style="list-style-type: none"> No previous ipsilateral thoracic surgery and secondary spontaneous pneumothorax associated with underlying lung diseases such as pulmonary tuberculosis, empyema, cystic fibrosis, and chronic obstructive pulmonary disease No air leak was demonstrated 	<ul style="list-style-type: none"> Water sealing test
Lesser <i>et al.</i> (33)	<ul style="list-style-type: none"> No pulmonary nodules larger than 3 cm in diameter or location deeper to the visceral pleura than the nodule diameter No more than one resection required No bullous emphysema or preoperative pleural effusion No intraoperative air fistula or diffuse pleural adhesions or bleeding or air leakage No injury of the visceral pleura, visible intraoperatively 	<ul style="list-style-type: none"> Thoracoscopic inspection Digital measurement
Liao <i>et al.</i> (34)	<ul style="list-style-type: none"> Nodule located within 2 cm of the visceral pleura and having a diameter <2 cm No moderate-to-severe obstructive or restrictive pulmonary diseases (GOLD guidelines: presence of post-bronchodilator forced expiratory volume in one second (FEV1) <80% in combination with a FEV1/forced vital capacity (FVC) <70%) No multiple wedge resections No air leaks following pulmonary resection No previous ipsilateral thoracic operation or pregnancy or lactation No other serious concomitant illnesses or medical conditions such as congestive heart failure, bleeding tendency, liver cirrhosis, chronic renal disease, a condition requiring long-term use of anticoagulants or steroids, or active infection requiring intravenous antibiotics 	<ul style="list-style-type: none"> Water sealing test Vacuum ball
Steunenber <i>et al.</i> (27)	<ul style="list-style-type: none"> No air leak during the perioperative sealing test No bullous or emphysematous changes of the lung No dense pleural adhesions 	<ul style="list-style-type: none"> Water sealing test
Nakashima <i>et al.</i> (28)	<ul style="list-style-type: none"> No air leaks during an intraoperative sealing test without additional suturing for endostaple lines No bullous or emphysematous changes in the lung or dense pleural adhesion or preoperative pleural effusion requiring chest drainage No high risk for postoperative bleeding For simultaneous bilateral resections, only the second side was considered for the study 	<ul style="list-style-type: none"> Water sealing
Yang <i>et al.</i> (29)	<ul style="list-style-type: none"> Peripheral pulmonary nodules within 2 cm of the visceral pleura and smaller than 2 cm Wedge resection of less than 12 cm in the longest dimension of the resected lung No obstructive ventilatory defects, anticipated difficulty in airway management or previous segmentectomy or lobectomy Body mass index ≥ 28 No air leak was demonstrated 	<ul style="list-style-type: none"> Water sealing test Vacuum ball
Lu <i>et al.</i> (30)	<ul style="list-style-type: none"> Lesion located in the outer third of the lung field No bullous or emphysematous changes in the lung No air leaks, seen grossly or during a water sealing test No dense adhesion of pleura or oozing or accumulation of pleural effusion 	<ul style="list-style-type: none"> Water sealing test
Liu <i>et al.</i> (38)	<ul style="list-style-type: none"> No tumour invasion to the great vessels or bilateral mediastinal surgery No unanticipated intraoperative bleeding or severe dense adhesion or accidental lung injuries or air leaks No myasthenia gravis history No concomitant pulmonary wedge resections, pericardial window, or pleural biopsies 	<ul style="list-style-type: none"> Water sealing test
Liu <i>et al.</i> (39)	<ul style="list-style-type: none"> Lesion of size ≤ 2 cm No severe intrapleural adhesions observed during surgery No malignant or infectious pleural diseases or a history of thoracic surgery No anatomic pulmonary resection or ≥ 3 individual unilateral wedge resections For primary spontaneous pneumothorax, including those with identifiable blebs or bullae under thoracoscopic vision and excluding those with haemothorax, pleural adhesions, lung parenchymal disease and a history of thoracic surgery 	<ul style="list-style-type: none"> Digital measurement/thoracoscopic inspection and water sealing test