



Awake non-intubated thoracic surgery: an attempt of systematic review and meta-analysis

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Abstract: The challenge of surgeons in our era is a less-invasive procedure. Over the last 20 years, video assisted thoracic surgery (VATS) become the treatment of choice in multiple chest related illnesses. Usually, VATS requires general anaesthesia with the selective intubation. However, in severe patients, with a high comorbidity index or elevated risk for anaesthesia, general anaesthesia may not be possible. An alternative is to perform the VATS in patients under local anaesthesia, awake, and non-intubated. We conducted an attempt of systematic literature review and meta-analysis of non-intubated VATS (AVATS) focusing attention on mortality rate, the complications and the hospital length of stay. AVATS is a feasible and safe technique that is increasingly aware of the possibility of applying for surgery even patients with high indexes of comorbidity, reduced cardiovascular function and general conditions contraindicating general anaesthesia. Nevertheless, further investigations are required to confirm these findings.

Keywords: Lung cancer; non-intubated video assisted thoracic surgery (AVATS); lung resection; systematic review; meta-analysis

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Introduction

The challenge of surgeons in our era is a less-invasive procedure. Over the last 20 years, video assisted thoracic surgery (VATS) become the treatment of choice in multiple chest related illnesses. Usually, VATS requires general anaesthesia with the selective intubation (1,2). However, in severe patients, with a high comorbidity index or elevated risk for anaesthesia, general anaesthesia may not be possible. An alternative is to perform the VATS in patients under local anaesthesia, awake, and non-intubated (3-5). We conducted a systematic literature review and meta-analysis of non-intubated VATS (AVATS) focusing attention on mortality

rate, the complications and the hospital length of stay.

Material and methods

We designed a search strategy using a combination of free-text words, relevant MeSH terms and appropriate filters in EMBASE (via Ovid), MEDLINE (via PubMed) and Cochrane CENTRAL from 1997 until 2017, without imposing any language or time restrictions. Records identified by the search strategy were exported into a reference management software. The eligibility criteria were: [(thoroscopic surgery OR vats) AND (awake OR not intubated OR tubeless OR local anaesthesia) AND

outcome]. Two authors assessed each identified study based on the eligibility criteria; when multiple studies contained overlying data, the most informative study was included. We excluded letters, editorials, case reports, and reviews. Disagreements were debated and resolved by consensus. Data extracted included study characteristics, baseline patient characteristics primary and secondary outcomes. The risk of bias of included RCT and has been evaluated following Cochrane recommendations (6). The meta-analysis was attempted by combining the reported survival results of the individual studies using a random effect model. The odds ratio (OR) and standard error were extracted or calculated from each study using Kaplan-Meier graphs with methods reported in the literature (7,8). Confidence intervals (CI) were set to 95%. Heterogeneity was measured using χ^2 test and I^2 . Values of $P < 0.10$ or $I^2 > 50\%$ represented substantial heterogeneity. Publication bias was evaluated using the funnel plot. Details of the protocol for this systematic review were registered on PROSPERO (CRD42017072141) and can be accessed at http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017072141. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used to improve the report of this systematic review (9). Data analysis was performed using Review Manager 5.3 (Nordic Cochrane Centre, Copenhagen, Denmark) (10). For all analyses, $P < 0.05$ was considered statistically significant.

Results

According to PRISMA statement, the flow diagram of the study selection process was showed in *Figure 1*. The search strategy identified 101 records. Following deduplication, 76 records were screened at the title and abstract level, and six were excluded as irrelevant. The remaining 70 records were assessed in the full text. Of those, 20 were included in the systematic review and meta-analysis (1,11-29). Baseline characteristics of patients were balanced in each study. Most of these qualified studies were based on the retrospective data. The size of the cohorts varied from 14 to 221, with a total number of 1,024 patients. In all calculations, the awake VATS were chosen as the reference. Lack of blinding was not considered likely to influence the primary outcome due to its objective nature. Hence, all studies were at reduced risk of bias despite being open label. It was not possible to demonstrate

statistical significance relative to mortality due to the insufficiency of data. Regarding the hospital length of stay, the data suggest that AVATS was characterised by a shorter duration of hospitalisation (*Figure 2*). The pooled mean difference was -1.32 (95% CI: -1.55 to -1.10 ; $P < 0.00001$), the Cochrane tests for heterogeneity disclosed that $\chi^2 = 15.48$, degree of freedom = 17 ($P = 0.56$); $I^2 = 0\%$. Regarding the complication (*Figure 3*), the OR was 0.50 (95% CI: $0.37-0.67$; $P < 0.00001$), heterogeneity showed that $\chi^2 = 12.36$, degree of freedom = 17 ($P = 0.78$) $I^2 = 0\%$. Data demonstrated some benefits of AVATS in patients with high comorbidity index. On the contrary, OR for mortality (*Figure 4*) showed the absence of statistical significance (OR = 0.53 ; 95% CI: $0.18-1.52$; $P < 0.024$).

Discussion

VATS has become a globally accepted alternative to thoracotomy for the surgical treatment of patients with various thoracic conditions involving lung, pleura and mediastinum. Recently, as a less invasive surgical technique, non-intubated VATS under loco-regional anaesthesia has gained increasing widespread attention globally. Excellent outcomes of non-intubated VATS under loco-regional anaesthesia were not only reported in some case reports, but also in some RCT with a small sample size. However, as mentioned above, the currently available studies about non-intubated VATS under loco-regional anaesthesia were all carried out in a small sample size, which lacks robust evidence to elucidate its actual feasibility and safety for thoracic surgery. We conducted an attempt of meta-analysis aiming to establish the safety profile of AVATS. Our data suggested that AVATS exhibited favourable effects in improving the short-term outcomes of patients and yielded significantly shorter in-operating room time and hospital stays, as well as a significantly lower rate of postoperative complications than intubated VATS under general anaesthesia. In patients with incompatibility with general anaesthesia due to significant comorbidity and severe respiratory failure (ASA 4), AVATS was feasible and efficient (3). AVATS is also possible in major lung surgery. Surgical parameters (blood loss, drainage duration, drainage volumes, the length of stay, the rate of complications, etc.) have shown that AVATS is feasible and beneficial compared to VATS in general anaesthesia. In pulmonary resections, the utility of AVATS has also been demonstrated

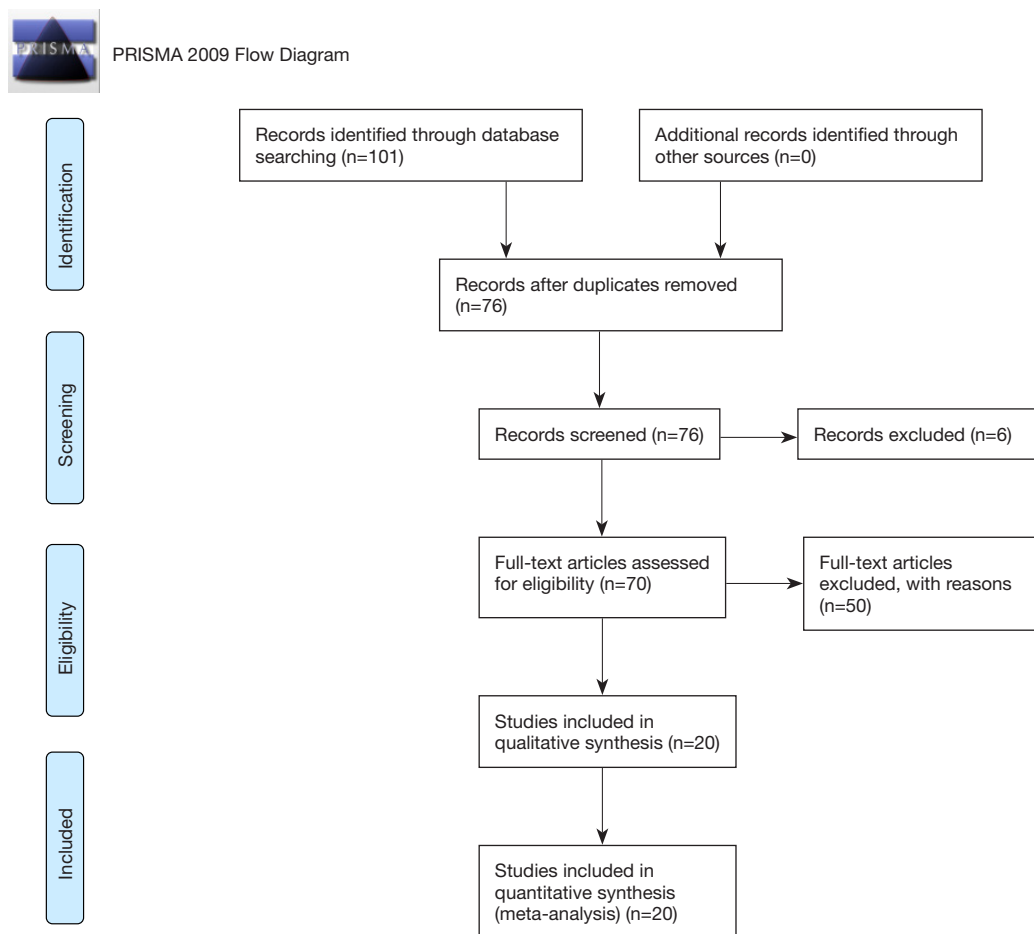


Figure 1 Summary of search strategy performed to identify relevant comparative studies on AVATS for lung resection (PRISMA flow diagram). AVATS, awake video thoracoscopic surgery. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

in segmentectomy that is technically possible and how can it be considered a valid alternative in compromised patients. Authors found that AVATS achieved a shorter anaesthesia time which may account for shorter global in-operating room time. In patients treated with AVATS, perioperative mortality was not observed, related to inclusion and exclusion criteria and the reduced invasiveness of AVATS. Therefore, all the evidence proved that AVATS.

Our study presents some limitations. First, the experimental group was very heterogeneous, with epidural, paravertebral, intercostal and other forms of anaesthesia, with and without sedation. Secondly, the surgery performed is highly different from minor procedures in healthy patients to major lung resection to palliation of advanced malignancy. The mortality analyses presented based on these studies

(which contain all the events) cannot be used to conclude due to the multiple disease states and operations included.

Conclusions

AVATS is a feasible and safe technique that is increasingly aware of the possibility of applying for surgery even patients with high indexes of comorbidity, reduced cardiovascular function and general conditions contraindicating general anaesthesia. With the reduction in the rate of complications, it allows for shorter stay times, resulting in lower costs for overlapping results or better than VATS in general anaesthesia. With the development of anesthesiology and surgery, an increasing number of patients could benefit from AVATS, and the indications for surgery could be

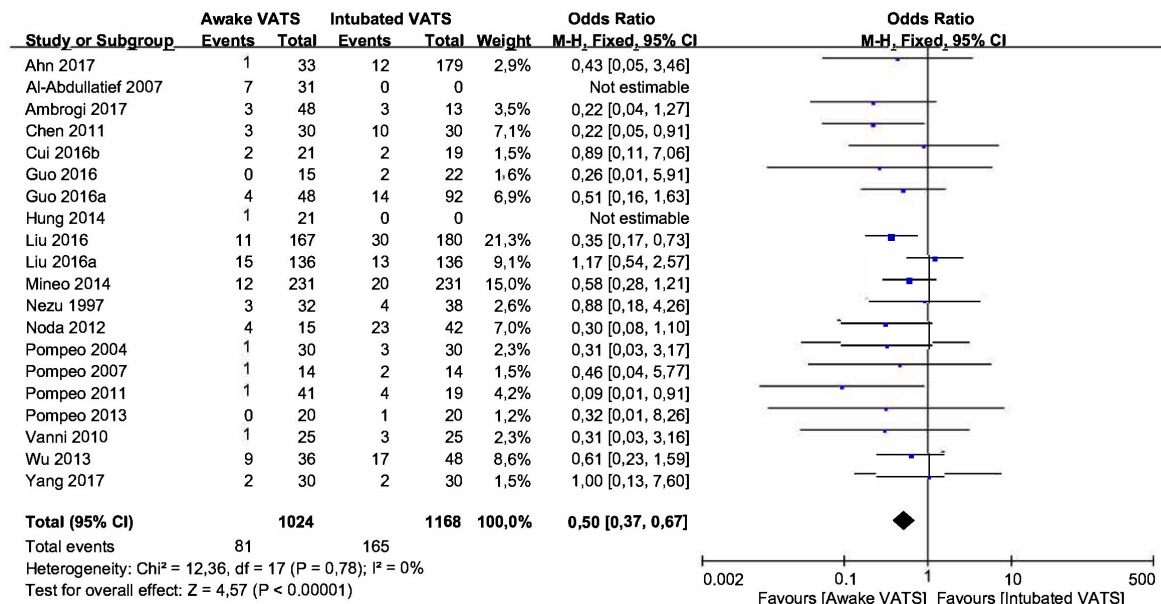


Figure 2 Forest plot of complications in AVATS for lung resection (OR =0.50; 95% CI: 0.37–0.67, P=0.78). OR, odds ratio; AVATS, awake video thoracoscopic surgery; CI, confidence interval; df, degree of freedom.

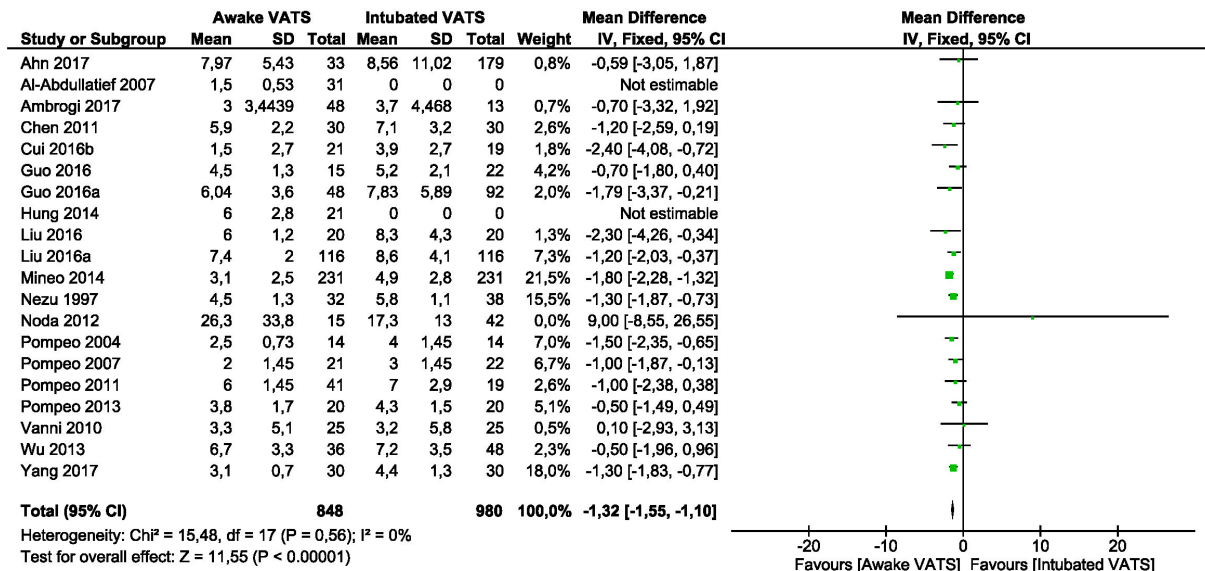


Figure 3 Forest plot of the mean difference in hospital length of stay in AVATS (OR =-1.32; 95% CI: -1.55 to -1.10, P=0.56). OR, odds ratio; AVATS, awake video thoracoscopic surgery; CI, confidence interval; df, degree of freedom.

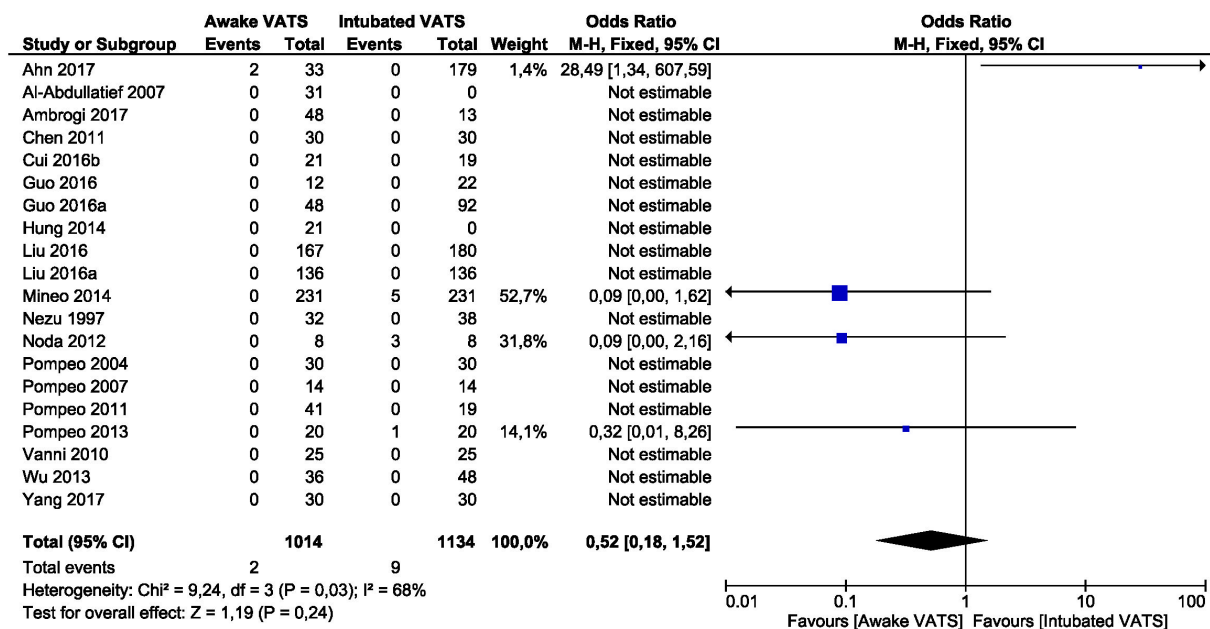


Figure 4 Forest plot of the odds ratio for mortality of AVATS (OR =0.53; 95% CI: 0.18–1.52; P<0.024). OR, odds ratio; AVATS, awake video thoracoscopic surgery; CI, confidence interval; df, degree of freedom.

expanded. However, its effects on long-term prognosis need to be verified by establishing prospective, multicentre clinical trials with a large sample size. Nevertheless, further investigations are required to confirm these findings.

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Footnote

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