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Spontaneous ventilation video-assisted thoracoscopic surgery for patients with non-small-cell lung cancer with excess body weight

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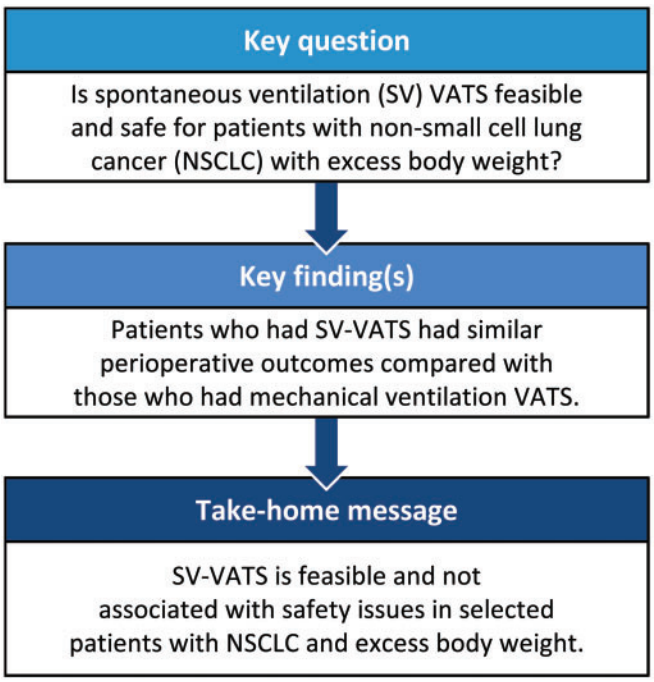

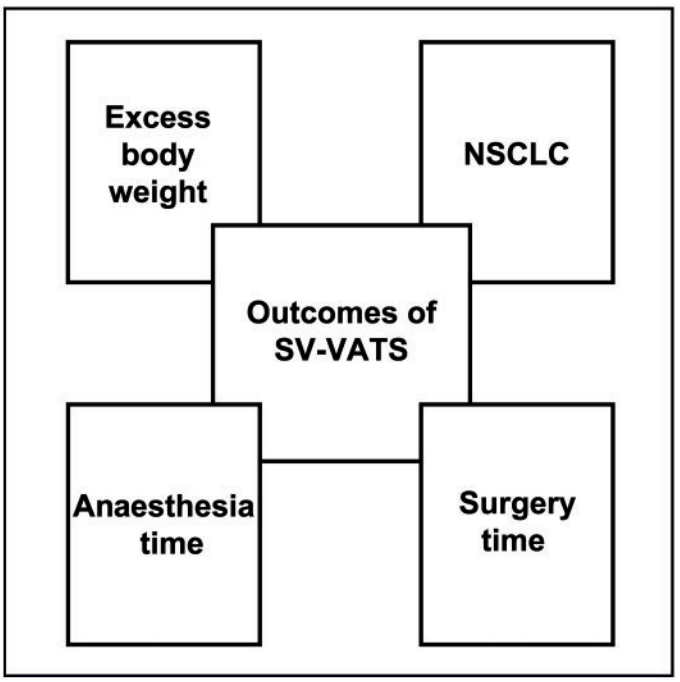

Abstract

OBJECTIVES: The feasibility and safety of spontaneous ventilation (SV) video-assisted thoracoscopic surgery (VATS) for non-small-cell lung cancer (NSCLC) in patients with excess body weight [defined as body mass index (BMI) $\geq$ 25 kg/m^2] remain unclear.

†These authors contributed equally to this work.

METHODS: Patients with NSCLC with excess body weight who underwent SV-VATS or mechanical ventilation (MV) VATS (MV-VATS) between April 2012 and July 2018 were analysed retrospectively. Propensity score matching was applied to balance the distribution of demographic characteristics. The short-term outcomes between the SV-VATS group and MV-VATS group were compared.

RESULTS: From April 2012 to July 2018, a total of 703 patients with excess body weight were included, 68 of whom underwent SV-VATS and 635 of whom underwent MV-VATS. After propensity score matching, the distribution of demographic characteristics was well balanced. BMIs (26.65 ± 1.74 vs 27.18 ± 2.36 kg/m^2; $P = 0.29$) were similar between the groups. Patients who underwent SV-VATS had similar anaesthesia times (213 ± 57 vs 233 ± 67 min; $P = 0.16$) and similar operative times (122 ± 44 vs 142 ± 56 min; $P = 0.086$). The intraoperative bleeding volume, postoperative chest tube duration, volume of pleural drainage, number of dissected N1 and N2 station lymph nodes, length of hospitalization and incidence of complications were comparable between the 2 groups.

CONCLUSIONS: Primary lung cancer resection is feasible and not associated with safety issues under SV-VATS in selected patients with NSCLC with excess body weight.

Keywords: Spontaneous ventilation video-assisted thoracoscopic surgery • Body mass index • Non-small-cell lung cancer

ABBREVIATIONS

BIS	Bispectral index
BMI	Body mass index
MV-VATS	Mechanical ventilation video-assisted thoracoscopic surgery
NSCLC	Non-small-cell lung cancer
PSM	Propensity score matching
RR	Respiratory rate
SIMV	Synchronized intermittent mandatory ventilation
SpO_2	Pulse oxygen saturation
SV-VATS	Spontaneous ventilation video-assisted thoracoscopic surgery
TCI	Target-controlled infusion

INTRODUCTION

In past decades, thoracoscopic operations under mechanical ventilation video-assisted thoracoscopic surgery (MV-VATS) have been widely accepted as the standard care in the surgical management of early-stage non-small-cell lung cancer (NSCLC) due to the better short-term outcomes and long-term survival rates compared with thoracotomy [1–4]. However, interest has been increasing in the adverse effects of conventional intubated general anaesthesia, including postoperative residual neuromuscular blockade, atelectasis in the dependent lung, throat pain, mucosal ulceration and impaired cardiac performance [5–10].

To overcome the perioperative adverse effects of intubated general anaesthesia, spontaneous ventilation video-assisted thoracoscopic surgery (SV-VATS) was recently investigated [11]. SV-VATS offered encouraging short-term outcomes including shorter operative time, shorter anaesthesia time, shorter length of hospitalization, better postoperative pain control, fewer postoperative complications and shorter postoperative fasting time compared with MV-VATS [12, 13].

However, clear indications for SV-VATS are currently lacking. Therefore, selection criteria are left to local teams and are dependent on the specific situation in each of their centres [14]. The inclusion criteria of studies focussing on SV-VATS have had discrepancies in values for body mass index (BMI) in particular [15, 16]. During SV-VATS, surgeons would encounter problems in patients with excess body weight due to potential respiratory depression, distinctive mediastinal motion and some anatomical disadvantages, including a higher mediastinal-to-chest ratio and a higher diaphragm [17]. In a previous study, the mean BMI of patients converted to intubated general anaesthesia was 25.5 kg/m^2, which was greater than the mean BMI of patients who were not converted [18]. The feasibility and safety of primary lung cancer resection in patients with NSCLC with excess body weight (defined as BMI $\geq$ 25 kg/m^2) under SV-VATS remain unclear. In clinical practice, a BMI >25 kg/m^2 was considered a contraindication for Asian patients. The purpose of this study was to compare the short-term outcomes of patients with NSCLC with excess body weight in the SV-VATS group who underwent anatomical resections with those in the MV-VATS group who had anatomical resections. Our goal was to demonstrate that patients with NSCLC with excess body weight may also benefit from SV-VATS, with comparable or even better short-term perioperative outcomes than those who underwent MV-VATS.

MATERIALS AND METHODS

Patients

From April 2012 to July 2018, we identified consecutive patients with NSCLC with excess body weight who underwent SV-VATS or MV-VATS for primary lung cancer at the First Affiliated Hospital of Guangzhou Medical University. Patients were included if they met the following criteria: (i) bronchogenic carcinoma below the secondary bronchi confirmed by computed tomography scans; (ii) BMI $\geq$25 kg/m^2; (iii) tumour size $\leq$5 cm and no obvious invasion to other organs; (iv) Eastern Cooperative Oncology Group score $\leq$1; (v) American Society of Anesthesiologists status class $\leq$3; (vi) no severe arrhythmia such as frequent premature beat and atrial fibrillation and (vii) no cardiopulmonary dysfunction. Exclusion criteria were as follows: (i) a history of infectious diseases such as tuberculosis and pulmonary infection, which could cause more pleural effusion; (ii) a history of thoracic surgery; (iii) patients who had an open operation and (iv) patients who had sleeve resection or pneumonectomy. Informed consent for SV-VATS or MV-VATS was signed by all patients. For patients who were not included in our randomized controlled trials (NCT03016858, NCT03432637), we would have a discussion with the patients (including the patients with slight body weight) about the advantages and disadvantages of SV-

VATS and MV-VATS before the primary lung cancer resection. We chose to perform SV-VATS or MV-VATS based on the patient's preference. Enhanced computed tomography scans of all patients were performed by 2 independent radiologists. The experimental and the control groups were SV-VATS and MV-VATS, respectively. This study was approved by the institutional review board of the First Affiliated Hospital of Guangzhou Medical University.

Preoperative preparation

After the patient entered the operating room, electrocardiograms, respiratory rate (RR), heart rate, blood pressure, pulse oxygen saturation (SpO_2) and the bispectral index (BIS) were routinely monitored. The radial artery was punctured on the non-surgical side for constant monitoring of the invasive blood pressure. Urinary and deep venous catheterizations were performed if necessary. Atropine (0.01 mg/kg) was intravenously administered before anaesthesia was introduced.

Spontaneous ventilation video-assisted thoracoscopic surgery group

Intravenous anaesthesia assisted by local nerve block was commonly used for SV-VATS. The patient was anaesthetized as follows: intravenous anaesthesia + laryngeal mask airway + thoracic paravertebral block + visceral pleural surface anaesthesia + thoracic vagus nerve block on the operated side. Other nerve block methods such as an epidural block could also be used if necessary. Anaesthesia was induced with target-controlled infusion (TCI) of propofol 2.0–4.0 μg/ml and sufentanil 0.1–0.2 μg/kg. No muscle relaxants were used during the procedure. After the BIS value dropped below 60, a laryngeal mask airway was placed for all patients. Sedatives like propofol were used to drop the BIS when it was above 60. Anaesthesia was maintained with TCI of propofol (target plasma concentration of 1.5–3.5 μg/ml) and intravenous remifentanil 0.1–0.2 μg/kg. Dexmedetomidine 0.5–1.0 μg/kg/h was used to maintain the BIS at 40–60 during the operation. Spontaneous ventilation was supported by a laryngeal mask airway that was connected to the anaesthesia machine. A synchronized intermittent mandatory ventilation (SIMV) mode was used at the beginning and end of the operation. Patients were sent to the ward after full anaesthetic recovery. The patient could walk and resume oral intake 4–6 h later.

Mechanical ventilation video-assisted thoracoscopic surgery group

TCI of propofol (target plasma concentration 2–3 μg/ml), intravenous sufentanil 0.3–0.6 μg/kg and cisatracurium 0.2 mg/kg was administrated for anaesthetic induction in the MV-VATS group. A double-lumen endotracheal tube was inserted via a visual laryngoscope 3 min after anaesthetic induction. Subsequently, invasive arterial pressure monitoring and deep venous catheterization were performed. Anaesthesia was maintained with the TCI of propofol (target plasma concentration 0.5–1.0 μg/ml), inhaled sevoflurane 0.8–1.5 times the minimum alveolar concentration, remifentanil 0.05–0.15 μg/kg/min, dexmedetomidine 0.05–0.10 μg/kg/min and cisatracurium 2.0 μg/kg/min. The BIS was maintained at 40–60. During the operation, the patient's RR, tidal volume and SpO_2 were carefully observed to reach ordinary level. Intermittent positive pressure ventilation was used to support the ventilation. The patient was returned to the ward after full anaesthetic recovery and was allowed to walk and resume oral intake 4–6 h after extubation.

Surgical process

The surgical procedure was the same for both the SV-VATS and MV-VATS groups. All video-assisted thoracoscopic operations were performed using a Stryker 1288 HD 3-Chip Camera System (Stryker, Kalamazoo, MI, USA) and endoscopic instruments especially designed in our department. Patients were placed in the lateral decubitus position with the upper arms extended and fixed on the hand support. The procedures were performed with a 1-port, 2-port or 3-port method. The thoracoscope was inserted in the 7th–8th intercostal space on the anterior axillary line with a soft incision protector that protected the skin, subcutaneous tissue, rib and pleura. Thoracoscopic lung resection was performed via a lobectomy, segmentectomy or wedge resection. N1 and N2 station lymph nodes were dissected routinely for all patients. All specimens were removed via a specimen bag.

Data collection and statistical analyses

The baseline data, results of anaesthesia, perioperative outcome and postoperative complications were collected from the medical records. Between the SV-VATS and MV-VATS groups, the propensity score matching (PSM) was generated from the logistic regression to minimize the differences in confounding variables. The variables included in PSM were age, BMI status, gender, histological analysis, T stage, N stage, M stage, American Society of Anesthesiologists status class, tumour position, number of incisions and type of operation. Patients were matched 1:1 on the basis of PSM using the nearest-neighbour method on the logit scale. The calliper was set at 0.01. After PSM, standardized mean differences before and after PSM were calculated. Confounding variables were considered comparable when the standardized mean difference was below 0.10.

The normality of the data was assessed by the Shapiro–Wilk test. Continuous variables were given as mean and standard deviation. The Student's *t*-test or Mann–Whitney test was performed to compare differences between groups with continuous variables. Distribution of categorical variables was presented as a count and percentage. The χ^2 test or Fisher's exact test for small samples was used to compare categorical variables. All tests were 2-sided, and a *P*-value <0.05 was considered statistically significant. SPSS software (SPSS version 25.0; IBM Corp., Armonk, NY, USA) and R software (version 3.6.1, https://www.rproject.org/) were used for all calculations and statistical analyses.

RESULTS

Demographic data of patients

A flow diagram depicting the enrolment process is shown in Fig. 1. From April 2012 to July 2018, a total of 2925 patients

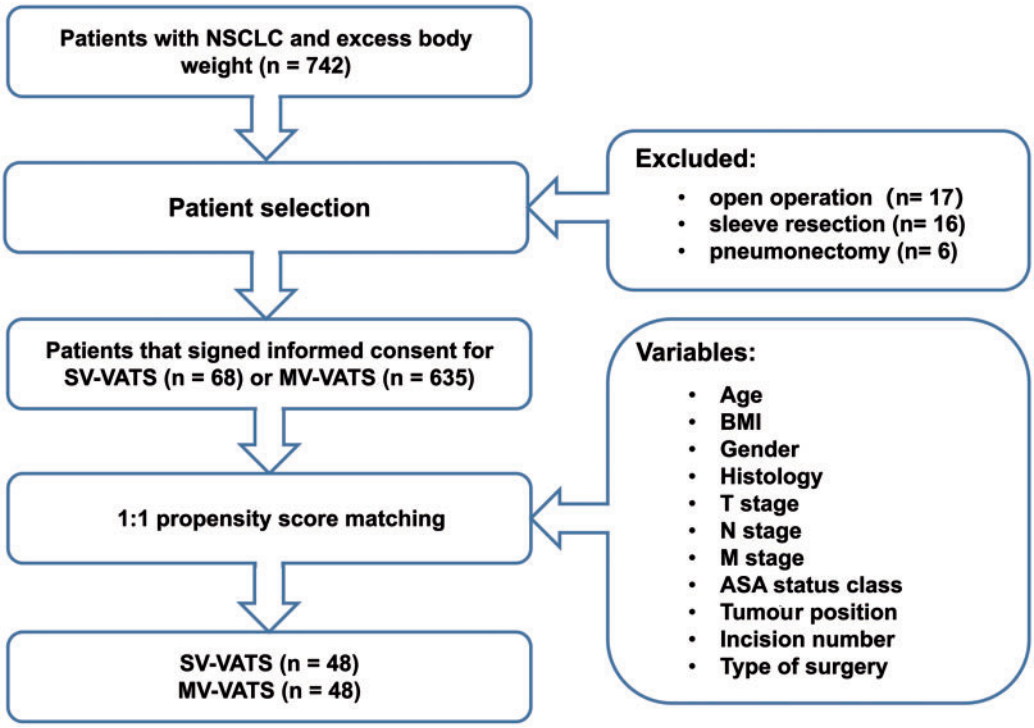

Figure 1: Patient enrolment process. ASA: American Society of Anesthesiologists; BMI: body mass index; M: metastasis; MV-VATS: mechanical ventilation video-assisted thoracoscopic surgery; N: node; NSCLC: non-small-cell lung cancer; SV-VATS: spontaneous ventilation video-assisted thoracoscopic surgery; T: tumour.

with NSCLC underwent primary lung cancer resection in our centre. A total of 703 patients (24%) with excess body weight were included in this study. The BMI (26.65 ± 1.74 vs 27.18 ± 2.36 kg/m^2; $P = 0.29$) was similar between the 2 groups. Baseline characteristics of the study population before and after PSM are presented in Table 1. Among these patients, 68 underwent SV-VATS anatomical resections and 635 underwent MV-VATS. After PSM, 48 patients from the SV-VATS group and 48 patients from the MV-VATS group were finally matched. The distribution of patient characteristics was well balanced between the SV-VATS and MV-VATS groups after PSM. Two confounders including N stage and tumour position were not comparable between the 2 groups.

Comparison of perioperative outcomes

Perioperative outcomes in patients with excess body weight are shown in Table 2. There were no deaths in either group. None of patients in the SV-VATS group required conversion to MV-VATS during the procedure. None of patients in the MV-VATS group was converted to open surgery.

Anaesthesia time (213 ± 57 vs 233 ± 67 min; $P = 0.16$) and operative time (122 ± 44 vs 142 ± 56 min; $P = 0.086$) were similar in the SV-VATS group. The intraoperative bleeding volume (49 ± 51 vs 38 ± 31 ml; $P = 0.31$), number of dissected N1 station lymph nodes (3 ± 4 vs 2 ± 5; $P = 0.093$), number of dissected N2 station lymph nodes (6 ± 9 vs 3 ± 6; $P = 0.066$), chest drain duration (4 ± 3 vs 4 ± 2 days; $P = 0.46$) and volume of pleural drainage (481 ± 402 vs 260 ± 274 ml; $P = 0.11$) were comparable between the 2 groups. The length of hospitalization (15 ± 8 vs 16 ± 7 days; $P = 0.50$) was similar between the 2 groups. Four complications including fever, anaemia, pulmonary infection and rash developed in 6 patients (13%) in the SV-VATS group. Two complications developed in 2 patients (4%) in the MV-VATS group. The incidence of complications (13% vs 4%, $P = 0.27$) was comparable in the 2 groups. The details of perioperative complications are summarized in Table 3.

DISCUSSION

In previous studies of thoracic diseases in our centre, we have shown the feasibility and safety of SV-VATS in patients with a BMI <25 kg/m^2 [16, 19, 20]. However, the feasibility and safety of SV-VATS in patients with NSCLC with excess body weight are unknown. The prevalence of overweight and obese patients has increased globally from 21% in men and 24% in women in 1975 to nearly 40% in both sexes in 2016 [21]. As this trend continues, we have seen more overweight and obese patients with NSCLC in need of thoracic operations. It is therefore necessary to fully understand the effect of BMI on the perioperative outcomes of SV-VATS in patients with NSCLC due to the high prevalence of overweight and obese patients and the perioperative adverse effects of intubated general anaesthesia.

SV-VATS has been confirmed to be feasible and safe in geriatric patients and patients with impaired pulmonary function, indicating that it may be a valid alternative when managing certain patients [22, 23]. Our study demonstrates perioperative outcomes in patients with NSCLC with excess body weight who undergo SV-VATS. After matching, only 2 characteristics—N stage and tumour position—were not comparable between the 2 groups. In addition, the 2 confounders were not associated with the short-

Table 1: Distribution of preoperative confounders among patients with excess body weight (defined as BMI ≥ 25 kg/m^2) in the SV-VATS and MV-VATS groups

	SV-VATS (*n* = 68)	SD (%)	MV-VATS (*n* = 635)	SD (%)	SMD before PSM	SV-VATS (*n* = 48)	SD (%)	MV-VATS (*n* = 48)	SD (%)	SMD after PSM
Age (years)					0.355					0.049
<60	46	68	322	51		37	77	36	75	
60–75	19	28	280	44		11	23	12	25	
>75	3	4	33	5		0	0	0	0	
Gender					0.299					0.099
Male	49	72	368	58		36	75	38	79	
Female	19	28	267	42		12	25	10	21	
BMI (kg/m^2)					0.048					0.080
25–29.9	63	93	580	91		45	94	44	92	
>30	5	7	55	9		3	6	4	8	
T stage					0.204					<0.001
T1–2	60	88	597	94		46	96	46	96	
T3–4	8	12	38	6		2	4	2	4	
N stage					0.097					0.305
N0	53	78	483	76		41	85	45	94	
N1	7	10	67	11		4	8	1	2	
N2	7	10	80	13		3	6	2	4	
N3	1	1	5	1		0	0	0	0	
M stage					0.090					<0.001
M0	66	97	611	96		48	100	48	100	
M1a	1	1	17	3		0	0	0	0	
M1b	1	1	7	1		0	0	0	0	
ASA status class					0.199					<0.001
I–II	65	96	575	91		48	100	48	100	
III	3	4	60	9		0	0	0	0	
Tumour position					0.132					0.472
RUL	24	35	222	35		19	40	17	35	
RML	6	9	58	9		4	8	3	6	
RLL	13	19	102	16		10	21	4	8	
LU	15	22	171	27		9	19	16	33	
LL	10	15	82	13		6	13	8	17	
Incision number					0.575		0			<0.001
Single	24	35	78	12		18	38	18	38	
Double	32	47	437	69		24	50	24	50	
Triple	12	18	120	19		6	13	6	13	
Pathology					0.297					<0.001
AC	55	81	477	75		42	88	42	88	
SCC	7	10	42	7		3	6	3	6	
Others	6	9	116	18		3	6	3	6	
Surgery					0.363					0.087
Lobectomy	41	60	488	77		29	60	31	65	
Segmentectomy	10	15	58	9		8	17	7	15	
Wedge resection	17	25	89	14		11	23	10	21	

AC: adenocarcinoma; ASA: American Society of Anesthesiologists; BMI: body mass index; LL: left lower lobe; LU: left upper lobe; M: metastasis; MV-VATS: mechanical ventilation video-assisted thoracoscopic surgery; N: node; PSM: propensity score matching; RLL: right lower lobe; RML: right middle lobe; RUL: right upper lobe; SCC: squamous carcinoma; SD: standard deviation; SMD: standardized mean difference; SV-VATS: spontaneous ventilation video-assisted thoracoscopic surgery; T: tumour.

term outcomes. The results of PSM were satisfactory. We found no significant differences in anaesthesia time, operative time, intraoperative bleeding volume, number of dissected N1 and N2 station lymph nodes, chest tube duration, volume of pleural drainage, length of hospitalization and incidence of complications between the SV-VATS and MV-VATS groups. These results showed that surgery under SV-VATS is feasible and can be performed safely with comparable perioperative outcomes in selected patients with excess body weight. The mean BMI of patients included in current study was 26.92 kg/m^2 with only 7 obese patients. Thus, the findings are only applicable to moderately overweight but not obese patients.

Previous studies have reported shorter durations of SV-VATS compared with MV-VATS [13]. A trend towards shorter anaesthesia and operative times was observed in our study, which may be associated with simplified preoperative preparations, including no muscle relaxants, a reduced dose of a general sedative, no tracheal intubations and no bronchoscopic examinations. The speed of the procedure may be improved subjectively because anaesthetists sometimes urged surgeons to complete the procedures faster in patients having SV-VATS.

Uncontrolled cough, distinctive mediastinal motion and patient movements may contribute to a trend towards a larger volume of pleural drainage in the SV-VATS group [14]. However, no patients

Table 2: Perioperative outcome after 1:1 propensity score matching

	SV-VATS (*n* = 48)	SD (%)	MV-VATS (*n* = 48)	SD (%)	*P*-value
Anaesthesia time (min)	213	57	233	67	0.16
Operative time (min)	122	44	142	56	0.086
Hospitalization (days)	15	8	16	7	0.50
Bleeding (ml)	49	51	38	31	0.31
Chest tube duration (days)	4	3	4	2	0.46
Pleural drainage (ml)	481	402	260	274	0.11
LN number	9	11	5	10	0.14
N1 number	3	4	2	5	0.093
N2 number	6	9	3	6	0.066
Complications					0.27
Yes	6	13	2	4	
No	42	88	46	96	
Conversion					1.00
Yes	0	0	0	0	
No	48	100	48	100	

LN: lymph node; MV-VATS: mechanical ventilation video-assisted thoracoscopic surgery; N: node; SD: standard deviation; SV-VATS: spontaneous ventilation video-assisted thoracoscopic surgery.

Table 3: Perioperative complications after 1:1 propensity score matching

Complications	SV-VATS (*n* = 48), *n* (%)	MV-VATS (*n* = 48), *n* (%)
Fever	1 (2)	2 (4)
Anaemia	2 (4)	0
Pulmonary infection	2 (4)	0
Rash	1 (2)	0

MV-VATS: mechanical ventilation video-assisted thoracoscopic surgery; SV-VATS: spontaneous ventilation video-assisted thoracoscopic surgery.

required reoperation to treat a large volume of pleural drainage. In this study, we found a trend towards more complications in the SV-VATS group, which may be caused by the distinctive mediastinal motion in patients with excess body weight. However, all the complications that happened in this study were mild and below grade III, based on the Clavien–Dindo classification. Thus, we considered that the overall incidence of complications was not a major concern in our study. These difficulties should be overcome with experience. The comparative number of dissected lymph nodes suggested that the quality of lymph node dissection was not a major concern in SV-VATS.

SV-VATS offers some advantages compared with MV-VATS. One advantage of SV-VATS is that intubation-related complications, such as ventilation-induced lung injury and atelectasis in the dependent lung, can be avoided [5–7]. Additionally, it also avoids the residual effects of muscle relaxants, including weakness of upper airway muscles and diaphragmatic dysfunction, which will accelerate recovery of breathing functions [8]. Besides, SV-VATS may also offer better recovery of digestive functions due to avoidance of postoperative gastrointestinal dysfunction caused by general intubated anaesthesia [24]. Furthermore, no muscle relaxants and a reduced dose of general sedative were used during SV-VATS. Thus, patients could breathe by themselves, which contributed to a satisfactory ventilation situation.

There are also some concerns that should be considered with the use of SV-VATS in patients with excess body weight. The biggest challenge of SV-VATS is mediastinal motion, which is more distinctive in patients with excess body weight. Mediastinal motion, which is caused by significantly higher ipsilateral intrathoracic pressure in iatrogenic pneumothorax and the impact of anaesthetic drugs on breathing functions, results in a limited expansion of the contralateral lung [16]. Noticeable mediastinal motion will affect the surgical procedure and render it more technically demanding, particularly during the isolation of the pulmonary vessels and structures, which may be associated with more intraoperative bleeding. Intercostal nerve block and thoracic vagus nerve block can be performed to prevent mediastinal motion. To overcome the impact of mediastinal motion during an SV-VATS procedure, anaesthesiologists can reduce the respiratory tidal volume and RR by reducing the target plasma concentration of propofol, which may greatly influence the breathing functions. The SIMV mode, which is often adopted when dealing with patients with excess body weight, can effectively support these patients [25].

Conversion from spontaneous ventilation to intubated general anaesthesia is another major challenge during SV-VATS. The emergency conversion to thoracotomy and MV-VATS in the SV-VATS group can be more difficult and require more time. Conversion rates reported in previous studies were 0–10% [12]. No patient in the SV-VATS group was converted to intubated general anaesthesia. The common causes of conversion to intubated general anaesthesia were remarkable mediastinal motion, major bleeding, hypoxaemia (defined as SpO_2 < 90%) and hypercapnia (defined as $PaCO_2 \geq 60$ mmHg) [26]. The major bleeding caused by injuries to vascular structures is the most serious reason for unplanned conversion and might evolve into a pneumonectomy. Intraoperative hypoxaemia was a potential risk but uncommon in our centre. Manually assisted ventilation or SIMV (FiO_2 = 100%, ventricular tachycardia 3–5 ml/kg, RR 12–15 times/min and oxygen flow 4–5 l/min) could be used when SpO_2 was below 90%. Intraoperative hypoxaemia usually occurred after complete collapse of the operated lung. When the ipsilateral lung completely collapsed, the ipsilateral airway resistance was higher

than that of the contralateral side, so most of the ventilated gases would enter the contralateral lung during low tidal volume ventilation. Thus, hypoxaemia rarely resulted in the inflation of the ipsilateral lung, which did not cause inflation of the operated lung and thereby had a negligible impact on the surgical operation [26]. Besides, hypercapnia is more common than hypoxaemia. If the PaO_2 is ≥60 mmHg, manually assisted ventilation or SIMV can be performed, along with the adjustment of the target plasma concentration of propofol [26].

Limitations

Several limitations in this study should be considered. First, though the PSM was performed to balance the demographic characteristics, our single-institution retrospective design might cause bias in patient selection. Second, we do not have data about some postoperative and post-discharge outcomes such as quality of life, pain score and analgesia use. Third, our study showed only short-term outcomes. In addition, there is a lack of high quality prospective, randomized studies for SV-VATS in patients with NSCLC with excess body weight. Fourth, because only 7 obese patients were included in this study, the effect of SV-VATS in obese patients remains unclear.

CONCLUSION

Our results revealed that surgery under SV-VATS is feasible and not associated with safety issues in selected patients with NSCLC with excess body weight. Comparable short-term outcomes between the SV-VATS group and the MV-VATS group suggest that SV-VATS may be an alternative to MV-VATS when managing patients with NSCLC with excess body weight.

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Author contributions

Donghong Wu: Conceptualization; Formal analysis; Methodology; Software; Visualization; Writing—original draft; Writing—review & editing. **Hengrui Liang:** Conceptualization; Data curation; Formal analysis; Methodology; Software; Writing—original draft; Writing—review & editing. **Wenhua Liang:** Conceptualization; Methodology; Software; Writing—original draft; Writing—review & editing. **Hui Liu:** Conceptualization; Methodology; Project administration; Validation; Writing—review & editing. **Chuqiao Wang:** Conceptualization; Methodology; Writing—original draft; Writing—review & editing. **Yaokai Wen:** Conceptualization; Methodology; Writing—review & editing. **Yu Jiang:** Conceptualization; Methodology; Writing—review & editing. **Zixuan Su:** Conceptualization; Formal analysis; Writing—review & editing. **Haoxin Peng:** Conceptualization; Methodology; Writing—review & editing. **Runchen Wang:** Conceptualization; Methodology; Writing—review & editing. **Yingying Chen:** Methodology; Software; Writing—review & editing). **Long Jiang:** Conceptualization; Methodology; Writing—review & editing. **Yi Zhao:** Conceptualization; Methodology; Writing—review & editing. **Wei Wang:** Data curation; Methodology; Project administration; Resources; Supervision; Validation; Writing—review & editing. **Jun Liu:** Data curation; Funding acquisition; Methodology; Project administration; Resources; Supervision; Validation; Writing—review & editing. **Jianxing He:** Data curation; Funding acquisition; Project administration; Resources; Software; Supervision; Validation.

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