Long-term results of video-assisted thoracic surgery lobectomy for stage I non-small cell lung cancer: a single-centre study of 104 cases

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Abstract

The use of video-assisted thoracic surgery (VATS) for carrying out major pulmonary resections in the treatment of lung cancer is still controversial. In order to contribute to knowledge about the long term results obtained with this technique in the treatment of stage I NSCLC, we present data relating to research in our institute over the past 10 years. From January 1993 to December 2002, 138 patients with peripheral clinical stage I NSCLC were selected to undergo VATS lobectomy. The procedure was based on a mini-thoracotomy without rib spreading, with hilar dissection and separate sectioning of the arteries, veins and bronchi; this was associated with hilar and mediastinal lymph-node sampling. Follow-up consisted of clinical and radiological examination every 6 months in the first 2 years after surgery, then once a year; a CT scan was carried out 1, 3 and 5 years after surgery. The probability of survival was estimated with the Kaplan–Meier method. Surgery by VATS was successfully completed in 122 cases, with a thoracotomy conversion rate of 11.6%. Of these, stage I was confirmed by pathological examination in only 104 cases: there were 56 T1N0 and 48 T2N0. With a mean follow-up of 65 months, the 5-year survival rate was found to be 67\%\pm\%\%\, in the T1N0 it was 68\%\pm\%\, whereas in the T2N0 it was 67\%\pm\%\, The rate of local or regional recurrence was 4.8\%\, while the systemic recurrence rate was 15.4\%. From an appraisal of the study results we consider VATS to be a valid approach for carrying out lobectomy for the treatment of stage I pulmonary carcinoma. The long-term results are comparable to those obtained in open surgery both in terms of survival and the rate of local recurrence. Therefore in selected cases, where there is no increase in surgical risk, VATS may be the preferred approach.

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Keywords: Video-assisted thoracic surgery; Pulmonary lobectomy; VATS lobectomy; Lung cancer

1. Introduction

There are numerous studies in the literature that demonstrate the feasibility and reliability of pulmonary lobectomies by VATS—both for benign conditions and for stage I NSCLC [1–5], and even the first studies of long term results [4–6] do not seem to present significantly different findings from those for open surgery. These procedures are currently performed only in certain centres and have not become as widespread as other videothoracoscopy and video-assisted surgery over the same period.

In order to contribute to more widespread knowledge and a greater utilisation of major pulmonary resection by VATS, we present the results of our experience over a 10-year period. This paper follows on from our previous report [3], but it is limited to stage I carcinomas, with updated results and a mean follow-up of more than 5 years.

2. Materials and methods

From January 1993 to December 2002 at the Thoracic Surgery Unit of S. Maria delle Croci Hospital in Ravenna (Italy) we selected for VATS lobectomy 138 patients with stage I pulmonary carcinoma, accounting for 83.6\% of all the cases operated on with this technique (165 patients), and for 6.50\% of all the cases of lung cancer treated in the same period (2122 patients). This group comprised 103 men and 35 women aged between 38 and 82 years (mean age: 63 years). Preoperative investigation was standard for pulmonary neoplasia and included chest X-ray, CT scan, bronchoscopy with transbronchial biopsy, transcutaneous biopsy only in the cases indicated and the study of breathing.
function. In the last year of this study positron emission tomography (PET) was also introduced.

Mediastinoscopy was used only in cases in which the CT scan revealed mediastinal lymph nodes with a maximum diameter $\leq 1\, \text{cm}$.

In cases in which the indication for surgery was an indeterminate pulmonary nodule, thoracoscopic resection was carried out and, in cases in which a frozen section a carcinoma was found, VATS lobectomy was performed in the same session.

The operation was indicated on the basis of a careful appraisal of the CT scan: the tumour was required to be no greater than $4\, \text{cm}$ in diameter at the widest point, with no infiltration of the parietal pleura, the diaphragm or the mediastinum, and with no hilar adenopathies. Moreover, the tumour was required not to be visible at bronchoscopy.

The procedure, as previously described [3], consisted of a mini-thoracotomy without rib spreading, hilar dissection with separate isolation and division of the arteries, veins and bronchi. This was associated with hilar and mediastinal lymph-node sampling.

Follow-up consisted of clinical and radiological examination every 6 months in the first 2 years after surgery, then once a year; a CT scan was carried out 1, 3 and 5 years after surgery.

The probability of survival was estimated with the Kaplan–Meier method. The influence of the survival variables (univariate analysis) was examined by means of the log-rank test; values of $P < 0.05$ were considered to be significant.

### 3. Results

Of the 138 patients it proved possible to carry out the entire operation with VATS in 122 cases (Table 1), whereas open surgery was required in the remaining 16 cases, with a conversion rate of 11.6%. The causes of conversion were as follows: 10 for oncological reasons, two for haemorrhage, and four for technical reasons of various kinds [3].

With regard to mediastinal lymphadenectomy, it must be underlined that it was not carried out in three cases at the beginning, in 25 cases a complete dissection was performed, and in 94 cases sampling was carried out, which is also the technique of choice in open surgery.

Postoperative course was uneventful in all the 16 patients who underwent thoracotomy and in 108 of the other

<table>
<thead>
<tr>
<th>Type of major pulmonary resections performed by VATS in 138 patients</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper lobectomy</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>Middle lobectomy</td>
<td>–</td>
<td>7</td>
</tr>
<tr>
<td>Lower lobectomy</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>Bilobectomy</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Pneumonectomy</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Conversion to open surgery</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

Fig. 1. Overall survival of 104 patients with stage I NSCLC treated by VATS lobectomy.

OS 0.88 (0.83–0.95) 0.67 (0.56–0.78)
122 (88.5%) undergoing VATS. The mean length of postoperative stay was 6.1 days (range: 4–21 days). The postoperative complications in the 14 patients were seven cases of persistent air leak, four cases of pneumonia, two cases of atrial fibrillation and one case of haemorrhage from a duodenal ulcer.

Post-surgical staging showed that in 104 (85.2%) of the 122 cases of primary tumours treated completely with VATS were really stage I NSCLC; of these, 56 were T1N0 and 48 T2N0. In the remaining cases we collected 10 T1–2N1 (in this group it is included the case of pneumonectomy), 4 T1–2N2, 3 T1NX and one broncho-alveolar carcinoma.

In the 104 patients with stage I the mean follow-up was 65 months (range: 3–114 months). The overall 5-year survival rate after the operation (Fig. 1) was 67% (confidence limits: 56–78%). In the first 5 years 23 patients died, but the death was correlated to the tumour in just 18 of these cases. Over the same period three other patients reported a recurrence, resulting in a 5-year disease-free survival rate (Fig. 2) of 67% (confidence limits: 57–78%). The recurrence was local or regional in five cases (4.8%) and systemic in 16 others (15.4%). It must be noted that in two patients with local recurrence we carried out a completion pneumonectomy at 22 and 30 months after VATS, respectively after a right upper and left lower lobectomy. In the first case the recurrence was in a segmental bronchi of the lower lobe and in the second case it was in the middle of the main bronchus.

The other three patients, with local recurrence 11, 19 and 32 months after the operation, were treated with radiotherapy or chemotherapy as it was not possible to perform radical surgery due to mediastinal infiltration in two cases and pleural effusion in one.

As shown in Fig. 3 overall survival in the T1N0 was 68 ± 15%, whereas for the T2N0 it was 67 ± 16%. The minimal difference between the two curves T1 and T2, actually not statistically significant \( (P > 0.05) \), may be due to the fact that the majority of patients who died for reasons not correlated to pulmonary tumour were T1.

4. Discussion

It is generally accepted that the surgical treatment of choice for stage I pulmonary carcinoma is lobectomy with lymph-node staging. The standard approach by thoracotomy yields satisfactory results both in terms of postoperative morbidity and long term results. VATS is now available as an alternative to this access, offering the benefits deriving from the absence of thoracotomy, while providing the same type of pulmonary resection. Although among the various centres carrying out VATS lobectomy there are differences in terms of technique, including some of considerable significance, such as rib spreading in mini-thoracotomy \([4, 7]\) and en-bloc section of the pulmonary hilum \([8]\), that do not attract the support of others \([1–3, 5]\), it may be said that the thoracoscopic method presents clear postoperative
advantages. These advantages compared to thoracotomy have been well documented by means of control studies [5, 9, 11] and are: pain reduction, reduced morbidity, improved breathing function, reduction of hospital stay, and a rapid return to normal activity with reduced aesthetic damage.

The long term advantages of VATS remain an open question: in a study carried out by Li et al. [12] after a mean period of 33 months, in patients operated on with thoracoscopy fewer symptoms were reported and functional levels were better, but these differences were not significant in comparison with patients undergoing thoracotomy. With regard just to breathing function, it appears that just 2 weeks after surgery the results of VATS and thoracotomy are broadly comparable [7]. However, chronic postoperative pain was found to be more intense in patients undergoing thoracotomy in a study carried out by Sugiura et al. [10]. Though not supported by a specific study, it is also our impression that over time mini-thoracotomy with VATS has a minor negative impact, also in relation to limited thoracotomy and muscle-sparing, on the quality of life and the overall performance of the patient.

The long term oncological results of the series in this report show that overall survival is 67% and disease-free survival is also 67%. This statistical coincidence for a 5-year period may be due to the limited number of cases and the fact that the figures for overall survival include five patients who died for reasons other than pulmonary tumour. These results are less satisfactory than those reported by Kaseda et al. [11], who report an exceptional 5-year survival rate of 97%, and Walker et al. [6], who report a rate of 78%.

The extensive series in the literature show that pulmonary lobectomy for stage I NSCLC carried out by thoracotomy results in a 5-year survival rate, for T1N0, stage IA, of 67–83%, and for T2N0, stage IB, of 43–78% [13]. The results reported in this study of VATS lobectomy are therefore at the lower end of the range (68%) for T1N0, whereas for T2N0 they are towards the upper end of the range. Slightly lower survival rates for a similar number of patients are reported by Thomas et al. [4]: 65% for T1N0 and 61% for T2N0. Only for stage 1A Sugi et al. [14] report a study in which the 5-year survival rate is 90% for the group operated on with VATS, and 85% for those undergoing thoracotomy. We are of the opinion that from the figures available to us it may be said that the long term results for VATS are at least comparable to those for thoracotomy, and that it cannot be expected to obtain different results, either better or worse, in the surgical treatment of pulmonary tumours by changing the surgical approach. Therefore we believe that the scarce spread of this procedure does not depend on its results, but is related to the long time of training to learn it and to the controversies of its advantages.

The local and regional recurrence of the disease is believed to be due to inadequate excision, with an incidence in open surgery of 7% [15]. In the experience with VATS lobectomy reported it is 4.8%, whereas Sugi et al. [14] report 6%; Walker et al. [6] report 25–30%, but in relation
to all stages. These figures, though relating to a limited number of cases, do not appear to differ substantially from those for open surgery.

In conclusion, we believe that the long term results of VATS lobectomy in the treatment of stage I pulmonary carcinoma are broadly comparable to those obtained with open surgery both in terms of survival and of the rate of local recurrence. Therefore, considering its postoperative advantages, VATS could be the approach of choice in selected cases, when there are no technical difficulties and there is no increase in the risks arising from the procedure.

References


Appendix A. ICVTS on-line discussion

Author: Dr. Erkan Yıldırım, Ankara Numune Education and Research Hospital, Thoracic Division, Talatpasa Bulv., Samanpazari, Ankara, 06418 Turkey

Date: 18-Nov-2003

Message: I would kindly ask you comment on the accuracy rates of open surgery vs VATS from the point of detecting mediastinal LN positivity? In 16 patients, the recurrence occurred systemically. Do you think VATS was sufficient in discerning LN positivity? Or is open surgery superior to VATS?

Response

Author: Dr. Luciano Solaini, Thoracic Surgeon, S. Maria delle Croci Hospital, Thoracic Surgery Unit, V. le Randi, 5, Ravenna, 48100 Italy

Date: 30-Nov-2003

Message: The question posed about mediastinal lymph node dissection during VATS lobectomy was widely discussed in the early period of the application of this technique. There are many reports [1–3] in which it is clearly showed that there is no difference between VATS and open surgery in the amount and stations of lymph nodes removed. Also on the basis of our experience, we are of the opinion that the accuracy rate for the detection of the mediastinal lymph node positivity is the same as those achieved by open surgery. The reported systemic recurrence in 16 patients (15.4%) is believed to be a satisfying result; in the cited article of Martini and Coll. (15) based on 588 patients treated by open surgery, they found 20% of systemic recurrences. In the end it is necessary to highlight that the mediastinal lymphadenectomy has never been demonstrated to improve survival.

References


Author: Dr. Erkan Yıldırım, Ankara Numune Education and Research Hospital, Thoracic Division, Talatpasa Bulv., Samanpazari, Ankara, 06418 Turkey

Date: 14-Dec-2003

Message: Dr. Solaini mentions that “it is necessary to highlight that the mediastinal lymphadenectomy has never been demonstrated to improve survival”. However, I have recently read a manuscript claiming that “The quality of lymphadenectomy, represented quantitatively by the number of totally removed lymph nodes during thoracotomy, may impact on a more accurate tumor stage, and will affect the survival rate for patients with stage I NSCLC as well as other well known clinical and histopathological factors” [1].
Reference


Response

Author: Dr. Luciano Solaini, Thoracic Surgeon, S. Maria delle croci Hospital, Thoracic Surgery Unit, V. le Randi, 5, Ravenna 48100, Italy

Date: 20-Dec-2003

Message: The affirmation we have been discussing about wants to emphasize the opinion that the type of lymphadenectomy does not influence the results in the studies reported using VATS lobectomy. Currently the brought up question in lung cancer surgery does not have a definite answer. At the first reply I would add that, as maintained by Dr. Ginsberg [1], the aim of the surgical procedure is to achieve a complete pulmonary resection and to allow an adequate staging. In a prospective study reported by the same Author from the Lung Cancer Study Group, the cancer recurrence rate, 20%, is similar in both lymphadenectomy and lymph node sampling and therefore complete mediastinal lymph nodes dissection has not been demonstrated to improve survival.

I think that the recently published article by Wu and Coll. cited by Dr. Yildirim is very interesting and could help to resolve the controversy, but it is retrospective and based on a limited number of cases. I believe that further studies need to clearly show that the patients treated with wide mediastinal lymph node removals will have the best prognosis.

Reference