



Video-assisted thoracic surgery lobectomy beyond the learning curve

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In the last decade an increasing, more and more widespread use of video-assisted thoracic surgery (VATS) anatomical lung resections has become a standard primary operative procedure in many thoracic units worldwide, especially in high volume centers. VATS surgery was proved to be superior to a conventional open thoracotomy approach in regard to postoperative enhanced recovery and at least equivalent mid to long-term oncological outcome. This issue could be evidenced and demonstrated in many recent studies (1-4).

It is generally accepted that a learning curve of approximately 30 to 50 individual operative VATS-lobectomy cases is necessary to gain sufficient confidence with a thoracoscopic approach to lobectomy in order to include also higher than stage I tumors in the routine-operative schedule subsequently.

The retrospective review article by Amore and coauthors (5), analyzing 571 consecutive patients undergoing VATS lobectomy in a single institution between 2011 and 2017, shows very well how the reasons for conversion to open thoracotomy changed with increasing experience after completion of a learning curve of 50 operative cases. During the learning curve-period the most frequent reasons for conversion were an incomplete fissure, enlarged mediastinal or hilar lymphnodes, intraoperative bleeding due to vessel injury and pleural adhesions, resulting in a conversion rate of 18% (9 out of 50). In the period after the learning curve the major causes for conversion were intraoperative bleeding due to vessel injury mainly to the pulmonary artery, followed by malignant and/or benign, calcified hilar lymphadenopathy, vascular adventitial fibrosis and incomplete fissures. The rate

of conversion decreased to 5.9% in the later period, although also more complex cases were included.

Some years ago, our group (6) could show in a multivariate logistic regression analysis ($P=0.013$) that the only significant risk factor for conversion was administration of neoadjuvant chemotherapeutic treatment leading to a more than 4-fold risk for conversion to open thoracotomy. Furthermore, tumor size was also an independent risk factor for conversion ($P=0.04$) in our series of 232 consecutive patients from 2009 to 2012, especially in the first half of the study period. Here we also noted a trend to bleeding as a major cause for conversion, whereas in the later period there was a trend to conversion mainly because of oncological/technical reasons, like massive pleural adhesions. Neoadjuvant treatment and tumor size predominantly lead to an overall conversion rate of 6.5% (15 patients) in our study. Nevertheless, conversion to open thoracotomy did not result in a higher overall rate of postoperative complications, longer chest drain duration or in-hospital mortality, but significantly increased length of hospital stay in these patients, i.e., median 11 *vs.* 9 days in VATS patients ($P=0.028$).

Similarly, our findings could also be confirmed to date and are outlined in *Figure 1*. The overall conversion rate in 650 consecutive patients who underwent VATS anatomical lung resections in our center is actually 4.9%. Advanced and more complex cases like VATS broncho/angioplastic procedures, bilobectomies, pneumonectomies and segmentectomies are included.

With increasing experience and confidence in VATS surgery we were also able to improve ability for successful management of some intraoperative complications

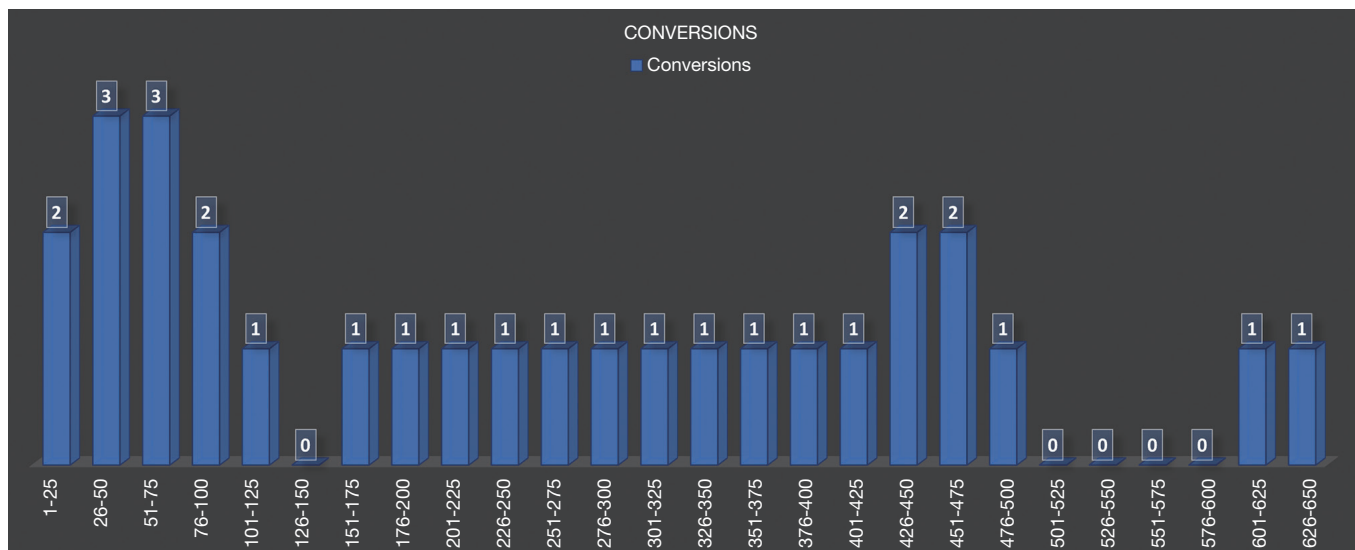


Figure 1 Conversions in VATS and consecutive case number. VATS, video-assisted thoracic surgery.

by minimal invasive “trouble-shooting”, particularly bleeding from pulmonary vessels or consistent bronchial air-leaks (7). Minimal invasive control of an eventual intraoperative complication also contributed to a decreasing rate of conversions. Currently, in most centers performing a high volume VATS program conversion rate is reported to range between 5% and 6%. The authors of the discussed article also confirm this by their experience. Although incomplete fissures and malignant or benign/calcified enlarged hilar lymphnodes sometimes represent a consistent problem in VATS lobectomy we could not outline this as an independent significant risk factor for conversion in our series. It would be interesting to know, if the authors noted a higher prevalence of previous and/or concomitant chronic pulmonary disorders in their patients, for example history of lung tuberculosis, silicosis or chronic emphysema. Furthermore, there is no note on the rate of neoadjuvant treated patients, which could also represent a significant part of their reported cases converted to thoracotomy. Nevertheless, In our study we could not evidence that VATS conversion rate was statistically influenced by patient age, nodal stage (pN0 *vs.* pN+), body mass index, presence of chronic obstructive pulmonary disease, lung function (FEV1) or benign lymphnode disease (6).

During our experience in minimal invasive anatomical lung resections of almost 10 years, when performing a VATS lobectomy we learned that it is of paramount importance to be prepared for critical intraoperative situations resulting from various potentially dangerous risk

factors for conversion as referred above. Planned strategies to handle intraoperative complications and interdisciplinary communication of these with anesthesiological and operative teams are the key for an uneventful intra- and perioperative management. As a primary issue, patient safety comes first and conversion to thoracotomy—open surgery should not be considered as a failure.

In accordance with the authors of the paper discussed, we would also wish to highlight the importance of identifying clear preoperative risk factors when performing a minimal invasive, anatomical lung resection in order to further reduce rates of an unexpected conversion to thoracotomy in an eventual emergency setting. On the other hand, we also point out that “no conversion is absolutely not to be considered equivalent to no complication”; concomitantly, intraoperative trouble-shooting by intraoperative minimal invasive complication management should be implemented particularly in those centers with a growing and robust experience in VATS anatomical lung resections.

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