Editorial

Sleeve lobectomy and pneumonectomy: can they really be properly compared?

Ramón Rami-Porta[1,2], Sergi Call[1,3]

[1]Department of Thoracic Surgery, Hospital Universitari Mútua Terrassa, University of Barcelona, Terrassa, Barcelona, Spain; [2]Network of Centres for Biomedical Research in Respiratory Diseases (CIBERES) Lung Cancer Group, Terrassa, Barcelona, Spain; [3]Department of Morphological Sciences, Unit of Human Anatomy and Embryology, Medical School, Autonomous University of Barcelona, Bellaterra, Barcelona, Spain

Correspondence to: Ramón Rami-Porta, MD. Department of Thoracic Surgery, Hospital Universitari Mútua Terrassa, Plaza Dr. Robert 5, 08221 Terrassa, Barcelona, Spain. Email: rramip@yahoo.es.

Provenance and Peer Review: This article was commissioned by the Editorial Office, *Translational Lung Cancer Research*. The article did not undergo external peer review.

Comment on: Li Z, Chen W, Xia M, *et al.* Sleeve lobectomy compared with pneumonectomy for operable centrally located non-small cell lung cancer: a meta-analysis. Transl Lung Cancer Res 2019;8:775-86.

Submitted Feb 23, 2020. Accepted for publication Mar 11, 2020.
doi: 10.21037/tlcr.2020.03.30
View this article at: http://dx.doi.org/10.21037/tlcr.2020.03.30

Most new surgical procedures are not properly compared with the old ones. One thoracic surgeon or a group in a given institution device or modify a surgical technique which apparently has more advantages than the one they had been performing for years. They publish their experience and very soon others follow with their own. Then, the building of new knowledge is based on case series of different groups, on comparisons with historical series or propensity matched cohorts or, very, very rarely, on properly designed randomized clinical trials. This is the case of sleeve lobectomy for the treatment of non-small cell lung cancer (NSCLC): Sir Clement Price Thomas is credited for having performed the first bronchial sleeve resection in 1947 (1), and after more than seven decades we still elaborate on its relative benefits.

The article discussed here is a meta-analysis of different comparisons of sleeve lobectomy with pneumonectomy for operable centrally located NSCLC (2). The authors collected 27 evaluable articles for the purpose of their study: 21 cohort studies and 6 retrospective case-control studies. No study had been designed as a prospective randomized comparison of the two surgical procedures, that is, none was a randomized clinical trial. The 27 studies included a total of 14,194 patients: 4,145 had undergone sleeve lobectomy and 10,049, pneumonectomy. The outcomes they wanted to study were operative mortality, 30-day mortality, type and rate of complications, local and distant recurrence rates, and overall survival rates. However, not all studies included the desired information on all the outcomes. Thirteen studies reported on operative mortality, 12 on 30-day mortality, 15 on complications, 15 on local recurrence, 9 on distant recurrence, and 8, 11 and 20 on 1-, 3- and 5-year survival, respectively. Eight studies did not report on tumour stage. It is also important to note that there was a significant unbalance between sleeve and pneumonectomy groups regarding tumour stage. Stage IV (only pulmonary metastases, because patients with extrapulmonary metastases were formally excluded) in the pneumonectomy group accounted for 842 (8.4%) cases, while there were 107 (2.6%) in the sleeve lobectomy group (P<0.00001). The same occurred with stage III: 2,819 (28%) cases in the pneumonectomy group and 679 (16.4%) in the sleeve lobectomy group (P<0.00001). These two stages already carry worse prognosis compared with stages I and II regardless of the resection modality. Therefore, the meta-analysis is biased unfavourably towards pneumonectomy. However, the above comparisons were made taking into account the data shown in Table 1 of the commented article. A close look at the two most recent and largest series included in the meta-analysis seems to indicate that there might be some errors in the description of tumour stage. To mention just one example, in the article by Pagès *et al.* (3), there is no indication of stage IV tumours neither in the sleeve nor in the pneumonectomy groups, but the authors of the meta-analysis indicate that there were 32 and 690 in the sleeve and in the pneumonectomy groups, respectively. When these figures are matched with the figures in the article by Pagès *et al.*, one finds that they correspond to T4 tumours. T4 tumours may be defined by separate tumour nodules in a different ipsilateral lobe, which usually are metastases, but T4 may be a category of stages IIIA, IIIB and IIIC, and it does not define stage IV *per se*. The same occurs with stage III tumours. According to the authors of the meta-analysis, there were 169 in the sleeve lobectomy group and 1,482 in the pneumonectomy group, but these figures correspond to T3 tumours, a category that can be in stage IIB as well as in stages IIIA, IIIB and IIIC, depending on the type of nodal involvement. Therefore, it is likely that the number of stage IV and stage III tumours shown in Table 1 of the meta-analysis is, in fact, lower than shown. The same occurs in the article by Abdelsattar *et al.* (4). Regardless of these inaccuracies, it is clear that more patients with advanced NSCLC were included in the pneumonectomy group.

Despite the intrinsic difficulties of data extraction from original studies for the meta-analysis, the authors made as much as they could of the available data. They found that operative and 30-day mortality rates were significantly higher in the pneumonectomy group. The complication and local recurrence rates were similar in both groups, but distance recurrence was higher in the pneumonectomy group. Regarding 1-, 3- and 5-year survival, patients undergoing pneumonectomy fared significantly worse than those undergoing sleeve lobectomy. When survival was assessed according to pathologic (p) nodal status, those patients with pN0-N1 tumours in the sleeve lobectomy group had a significantly higher 5-year survival rate compared to those undergoing pneumonectomy. This survival advantage of sleeve lobectomy was lost in the group of patients with pN2 disease.

Upon reflecting on the results of the meta-analysis, one wonders if they are really due to the surgical procedures. It already is known that operative mortality is higher for pneumonectomies (5), so, if it can be avoided, the patient will benefit from the lesser sleeve lobectomy. However, complication rates were similar in both groups, indicating that sleeve lobectomies had a higher complication rate than standard lobectomies, which are usually associated with lower complication rates when compared with pneumonectomies (5). Local recurrence rates were similar in both groups, but distant recurrence was higher in the pneumonectomy group, a fact that can be attributed to the more advanced tumour stage and not to the surgical procedure. Finally, the advantage of sleeve lobectomy in cN0-N1 tumours may be due to the higher proportion of early stages in this group (lower T categories) and not to the procedure; and when there is mediastinal nodal disease, the procedure had no impact on survival. The intensity and thoroughness with which clinical staging was determined, i.e., non-invasive *vs.* invasive tests, may alter the results, but these items were not considered in the meta-analysis. It is not known, either, whether N2 disease had been diagnosed preoperatively and the patients operated electively or whether pN2 was an incidental finding at the time of tumour resection or upon pathologic study of the resected specimens.

There are two relevant clinical issues on which this meta-analysis cannot shed light, i.e., the impact of induction therapy on postoperative outcomes and the need to cover the bronchial anastomosis. While induction therapy does not seem to affect postoperative morbidity and mortality after sleeve lobectomy (6), it has a deleterious effect after pneumonectomy (7). Given the number of advanced stage tumours, it is reasonable to think that many patients had received induction therapy, but this item was not included in the meta-analysis, most probably because it was impossible to analyse independently. Since there was a greater number of patients with advanced NSCLC in the pneumonectomy group, induction therapy may have been responsible, at least in part, for the higher mortality rate in this group.

The other point of frequent discussion is the need to cover the bronchial anastomosis. The authors of the meta-analysis describe the different types of bronchial suture and state that it does not modify the outcomes, although they do not provide data to support their statement. They also describe that the bronchial anastomosis and the vascular structures are usually separated by pedicled pleural or pericardial fat, but this procedure was not analysed in the meta-analyses. Some authors do not consider it necessary (8), while others pay a lot of attention to the harvesting, care and placement of viable tissue to cover the anastomosis (9,10). Several procedures have been developed for this purpose, including the intercostal pedicle flap, the pleural and pericardial flaps, the pericardial fat pad flap, the pedicled pericardiophrenic graft, and the omentum (11).

The authors conclude that randomized clinical trials are needed to clarify the value of sleeve lobectomy and pneumonectomy for NSCLC, but do we really need them? They quote Jean Deslauriers saying that pneumonectomy is a disease in itself, which is true for many patients, but it also is a life-saving operation for many others. Pneumonectomy puts the patient in a very vulnerable situation, but a properly performed pneumonectomy achieving an oncologic complete resection (12) is better than a suboptimal sleeve lobectomy that has not attained completeness. Especially in patients who can undergo pneumonectomy, completeness of resection should not be sacrificed to save lung parenchyma. Complete resection of NSCLC is the only surgical procedure significantly associated with longer tumour remission and survival (13-15). Sleeve lobectomy is a time-honoured operation: it is safe, even after induction therapy; it may have a higher rate of postoperative complication than standard lobectomy, but not higher than that of pneumonectomy; it saves lung parenchyma, not only useful from the strict functional point of view, but also useful to help the patient endure adjuvant therapy when needed. In the light of all this, a randomized clinical trial would be, first, difficult not only to design but to perform, because surgical procedures are surgeon-dependent and difficult to standardize; and second, unfair to those patients who, being able to undergo sleeve lobectomy, would be randomly assigned to pneumonectomy.

Considering all that is known today about sleeve lobectomy and in the light of the commented meta-analysis, in our opinion, sleeve lobectomy should be performed in all patients whose tumours can be completely removed with this procedure, even if, from the functional point of view, they can undergo pneumonectomy.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/tlcr.2020.03.30). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Naef AP. The Story of Thoracic Surgery: Milestones and Pioneers. Hogrefe & Huber Publishers, Toronto, 1990:55-8.
2. Li Z, Chen W, Xia M, et al. Sleeve lobectomy compared with pneumonectomy for operable centrally located non-small cell lung cancer: a meta-analysis. Transl Lung Cancer Res 2019;8:775-86.
3. Pagès PB, Mordant P, Renaud S, et al. Sleeve lobectomy may provide better outcomes than pneumonectomy for non-small cell lung cancer. A decade in a nationwide study. J Thorac Cardiovasc Surg 2017;153:184-95.e3.
4. Abdelsattar ZM, Shen KR, Yendamuri S, et al. Outcomes after sleeve lung resections versus pneumonectomy in the United States. Ann Thorac Surg 2017;104:1656-64
5. Kozower BD, Sheng S, O'Brien SM, et al. STS database risk models: predictors of mortality and major morbidity for lung cancer resection. Ann Thorac Surg 2010;90:875-81; discussion 881-3
6. Brouchet L, Bauvin E, Marcheix B, et al. Impact of induction treatment on postoperative complications in the treatment of non-small cell lung cancer. J Thorac Oncol 2007;2:626-31.
7. Shah AA, Worni M, Kelsey CR, et al. Does pneumonectomy have a role in the treatment of stage IIIA non-small cell lung cancer? Ann Thorac Surg 2013;95:1700-7.
8. Naruke T, Suemasu K. Bronchoplastic surgery for lung cancer and the results. Jpn J Surg 1983;13:165-72.
9. Rendina EA, Venuta F, Ricci P, et al. Protection and revascularization of bronchial anastomoses by the intercostal pedicle flap. J Thorac Cardiovasc Surg 1994;107:1251-4.
10. Venuta F, Anile M, Rendina EA. Advantages of the segmental nondivided intercostal muscle flap. J Thorac Cardiovasc Surg 2010;140:485.
11. Venuta F, Diso D, Anile M, et al. Techniques of protection and revascularization of the bronchial anastomosis. J Thorac Dis 2016;8:S181-5.
12. Rami-Porta R, Wittekind C, Goldstraw P, et al. Complete

resection in lung cancer surgery: proposed definition. Lung Cancer 2005;49:25-33.
13. Gagliasso M, Migliaretti G, Ardissone F. Assessing the prognostic impact of the International Association for the Study of Lung Cancer proposed definitions of complete, uncertain, and incomplete resection in non-small cell lung cancer surgery. Lung Cancer 2017;111:124-30.
14. Edwards JG, Chansky K, Van Schil P, et al. The IASLC Lung Cancer Staging Project: analysis of resection margin status and proposals for residual tumor descriptors for non-small cell lung cancer. J Thorac Oncol 2020;15:344-59.
15. Osarogiagbon RU, Faris NR, Stevens W, et al. Beyond margin status: population-based validation of the proposed International Association for the Study of Lung Cancer residual tumor classification recategorization. J Thorac Oncol 2020;15:371-82.

Cite this article as: Rami-Porta R, Call S. Sleeve lobectomy and pneumonectomy: can they really be properly compared? Transl Lung Cancer Res 2020;9(3):434-437. doi: 10.21037/tlcr.2020.03.30

