Extreme thoracic surgery: the past and the present of extended pulmonary resections

Since the first resection of a chest wall tumour was reported by Parham in 1899 (1), extended pulmonary resections due to locally advanced lung cancer remain a challenge for many thoracic surgeons. Milestones of this long and exciting history include the report by Shaw *et al.* in 1961 on superior sulcus tumour management (2), as well as the detailed techniques described by Dartevelle *et al.* in 1991 concerning prosthetic replacement of the superior vena cava and the anterior approach to thoracic inlet tumours in 1993 (3,4).

Despite the development of medical and radiation therapies, non-small cell lung cancer (NSCLC) tumours with invasion of the superior vena cava, descending thoracic aorta, left atrium, main pulmonary artery, vertebral bodies and the tracheal carina have a poor prognosis without radical surgery. On the other hand, highly selected patients could benefit from successful surgical treatment administered in high volume centers.

The surgical principles of extended pulmonary resections are the same as for standard procedures: *en bloc* resection of the specimens, tumour-free section margins and systematic lymphadenectomy. Complex pulmonary resections have to be performed by well experienced thoracic surgeons under safe conditions, including invasive anaesthesiology monitoring and availability of cardiopulmonary bypass on demand. It can also be very hard to deal with this kind of procedure without surgical teams possessing dedicated skills in vascular and cardiac surgery.

A pre-operative multidisciplinary team evaluation is mandatory for all clinical T4N0 lung tumours: a careful mediastinal staging [Endobronchial Ultrasound (EBUS) or video mediastinoscopy] to rule out occult N2 disease and a full cardiopulmonary preoperative assessment must be carried out. Neoadjuvant therapy is an option to be considered, taking into account its risks and benefits (5). In these scenarios the treatment of resectable locally advanced NSCLC is still a subject of debate and the role of surgery as gold standard therapy is not universally accepted. To this effect, the latest the European Society for Medical Oncology (ESMO) Guidelines indicate that surgery should be limited to cT4N0 patients and after induction therapy with the hope of avoiding a pneumonectomy (6).

While the advances in video-assisted thoracic surgery (VATS) in the last decade allowed experienced surgeons to succeed in thoracoscopic treatment of locally advanced NSCLC (7-9), this issue is dedicated to really extreme thoracic surgery that is difficult to think of under a minimally invasive approach point of view.

We are grateful for time and effort spent by several authors who have either described their experience or have summarized existing published experience in open extended thoracic surgery for T4 NSCLC with or without cardiopulmonary bypass assistance in this issue. While local recurrence remains of concern, the primary sites of failure of these patients are distant. Looking to the future, we hope that the explosion of therapies in the realm of medical oncology will make more of these patients resectable and improve the long term outcomes of patients that are currently considered resectable. It remains to be seen if neoadjuvant therapy with newer classes of agents, particularly immunotherapeutic agents make the actual operation easier or more difficult.

In conclusion, highly selected patients with T4 NSCLC can benefit from aggressive surgical treatment when an R0 resection is feasible. The aim of this issue is to rekindle interest amongst readers with focused papers covering all aspects of T4 NSCLC management from diagnosis to challenging surgical techniques.

Acknowledgments

It was a privilege to collaborate with Silvia Zhou of the Editorial Office of the *Journal of Xiangya Medicine*. Without her passion and dedication to work this issue wouldn't be so easy to carry out. We are also grateful to all the authors that contributed to a great extent.

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Journal of Xiangya Medicine* for the series "Extended Pulmonary Resections for T4 Non-Small-Cell-Lung-Cancer". The article did not undergo external peer review.

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jxym.2018.01.04). The series "Extended Pulmonary Resections for T4 Non-Small-Cell-Lung-Cancer" was commissioned by the editorial office without any funding or sponsorship. FD and SY served as the unpaid Guest Editors of the series. FD serves as an unpaid editorial board member of *Journal of Xiangya Medicine* from Jul 2017 to Jun 2019. The authors have no other 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.

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Received: 17 January 2018; Accepted: 30 January 2018; Published: 05 February 2018.
doi: 10.21037/jxym.2018.01.04
View this article at: http://dx.doi.org/10.21037/jxym.2018.01.04

doi: 10.21037/jxym.2018.01.04
Cite this article as: Davoli F, Yendamuri S. Extreme thoracic surgery: the past and the present of extended pulmonary resections. J Xiangya Med 2018;3:6.

