Atlas of Endoscopic Major Pulmonary Resections

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Second Edition

Springer

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ISBN 978-3-319-55900-1 ISBN 978-3-319-55901-8 (eBook)
https://doi.org/10.1007/978-3-319-55901-8

Library of Congress Control Number: 2017958757

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Introduction

The first thoracoscopic lobectomies were reported more than 25 years ago. At that time, only a few pioneers were convinced that the benefits of endoscopic surgery deserved consideration, and the technique remained confidential for years. After the publication of a large series in 2006–2008, the closed chest approach was in some way rediscovered by thoracic surgeons and was brought to light. The number of publications suddenly increased, and, in 2013, the American College of Chest Physicians finally recommended the thoracoscopic approach for resection of early-stage lung carcinomas. At the time of writing this atlas, the use of the thoracoscopic approach for major pulmonary resections ranges from 0% to 80%, depending on countries and institutions. Multiple technical descriptions are now available, and each technique comprises variations.

The different available approaches can be summarized as follows:

1. The *hybrid approach* is a kind of relic of the 1980s, where surgeons were seeking to reduce the size of the thoracotomy with the adjunct of endoscopy. In these techniques, the surgeon does most of the dissection through a small incision, and the endoscope is mainly used as an additional light source. The procedure is done with conventional instruments, although some surgeons prefer hybrid tools, that is, instruments whose design is based on classical instrumentation but whose shaft has been made longer and thinned down.
2. The *single-port approach* is where the endoscope and the instruments are introduced through the same incision. The theoretical advantage is that a single port is supposedly less painful than multiple ports. While the development of thoracoscopic instruments with multiple degrees of freedom is awaited, this approach is impaired by the tangential direction of the instruments in relation to the target and the limited quality of exposure.
3. The *anterior approach* is a hilum-first technique. Some users of this approach do not even open the fissure. Once the lobar bronchus and vein have been controlled, the fissure and arterial branches are stapled en masse, more or less as initially reported by Ralph Lewis in the 1990s under the name "VATS simultaneously stapled lobectomy."
4. The *posterior approach* can be summarized as a conventional technique where the surgeon stands at the patient's back and has a familiar view, comparable to that of open thoracotomy. William Walker now suggests use of the term "fissure-based technique," which is preferable. Indeed, the main principle of this approach is wide opening of the fissure and extensive dissection of the arterial branches, so the risk of anatomical misjudgment is minimized.
5. The *full endoscopic technique* that is described in this atlas is a minor modification of the posterior approach, with the absence of an access incision. Whenever possible, the diameter of the trocars is reduced to a minimum: 5 mm and 3 mm. The reasons for working with small instruments are twofold: (1) to minimize intercostal trauma; and (2) to enhance the precision of dissection because the instrument tips are better suited to the dimensions of the anatomical elements that are dissected. This technique raises two questions:
    1. *Why use multiple ports at a time when more and more publications*

deal with the single-port technique? Our responses are multiple:

- *To be well exposed is a prerequisite for the success of a surgical procedure.* This is what surgeons have learned, and there is no reason why this principle should not be valid also in thoracoscopic surgery. As exposure cannot be obtained by hand or by large conventional retractors, it should be achieved by other means, i.e., multiple instruments. Surgeons can collaborate with instrument manufacturers to design small-diameter devices or even "no-trocar" instruments, which have a minimal impact on the chest wall.
- Surgery cannot be blind, especially when dealing with major vascular hazards. Having optimal vision of the target requires keeping a perfect image. This means the endoscope cannot be soiled, which inevitably occurs when the field is not sufficiently cleared off the lung, as is observed in most surgical videos. This again requires more than one or two ports.
- Finally, as robotic surgeons promote the robot because—out of several advantages—it offers four ports, it is unclear what prevents thoracoscopic surgeons from operating with the same principles.

2. "*Why not use a utility incision, since an extraction incision will be needed anyway?*" is also a frequently asked question. Our responses are again multiple:
   - When a surgeon is using only endoscopic instruments, an access incision is useless.
   - We previously used a video-assisted approach and a utility incision, and found that this gave a false sense of security. The site of the incision is usually chosen for a dedicated step such as hilar dissection or fissure division, so there are always some steps of the procedure for which the incision location is not suitable. The photographs or line drawings showing many different locations for the utility incision illustrate this issue. In addition, in the event of an intraoperative problem, enlarging the incision may be problematic, since it is often not on the line of a posterolateral thoracotomy, which is the most appropriate incision in the event of an emergency.
   - Finally, in other surgical specialties, complex procedures with major vascular dissection are carried out laparoscopically without the help of a utility incision. Those procedures are accepted.

The purpose of this atlas is to provide a step-by-step approach to most thoracoscopic pulmonary resections according to the full endoscopic technique, which was developed at our institution. Even though some readers may prefer another technique, it is hoped that the detailed technical description and the tips and tricks reported in this book will be helpful. With respect to thoracoscopic sublobar resections, the interest is rising and segmentectomies are being rediscovered. On the basis of an experience of 390 thoracoscopic sublobar resections at the time of writing this atlas, we describe the most commonly performed anatomical segmentectomies. We have borrowed some

anatomical descriptions from the outstanding work of Nomori and Okada (*Nomori H, Okada K. Illustrated Anatomical Segmentectomy for Lung Cancer. Tokyo: Springer; 2011*), which is the most comprehensive textbook published in this field.

This is the introduction to the second edition of the *Atlas of Endoscopic Major Pulmonary Resections*. There is no doubt that a third edition will sooner or later be necessary, considering how important the room for progression is.

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Warning

The techniques of video-assisted or thoracoscopic lobectomy are numerous and vary according to:

- The use or nonuse of an access incision
- The number of trocars, ranging from five to a single port
- The type of instruments
- The use or nonuse of a full video display
- The type of approach, i.e., anterior or posterior
- The type of technique, e.g., fissure-based or fissure-last

The techniques described in this atlas are based on the experience and daily practice of the team in the Thoracic Surgery Department at our institution, relying on the following principles:

- A full monitor procedure with a high-definition imaging system and a deflectable scope
- Dedicated instrumentation
- No access incision and multiple ports
- A fissure-based approach

These techniques may differ from others, and we do not claim that they are superior.

The reading of this atlas does not replace direct observation in the operating room and training.

Contents

Abbreviations and Symbols

Abbreviations

3D	Three-dimensional reconstruction
A	Artery
Ao	Aorta
Asc.	Ascending. *For example, "Asc.A^2" means "ascending A^2 artery"*
B	Bronchus
Bas.	Basilar. *For example, "Bas.A" means "basilar arteries"*
Eso.	Esophagus
IBV	Inferior basilar vein
IPV	Inferior pulmonary vein
LLL	Left upper lobe
LN	Lymph node
LUL	Left lower lobe
ML	Middle lobe
MPR	Major pulmonary resection
N	Nerve
NSCLC	Non-small cell lung carcinoma
PA	Pulmonary artery
Rec.A^2	Recurrent A^2 artery
RLL	Right lower lobe
RUL	Right upper lobe
S	Segment. *For example, "S^6" means "segment 6"*
s	Stump. *For example, "A^{6}s" means "stump of A^6 artery"*
SBV	Superior basilar vein
SLR	Sublobar resection
SPV	Superior pulmonary vein
SVC	Superior vena cava
TA	Truncus anterior
V	Vein

Symbols


Patient's apex


Patient's back


Direction of organ retraction


Danger

Trick

Video clip