

SEGMENTECTOMY FOR THORACIC DISEASES

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Segmentectomy for Thoracic Diseases

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Segmentectomy for Thoracic Diseases (FIRST EDITION)

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We are pleased to announce that the “AME Research Time Medical Book Series” co-launched by AME Publishing Company, Central South University Press and DXY.cn will be published as scheduled.

Finishing my medical degree after 4 years and 3 months of study, I decided to quit going on to become a doctor only after 3 months of training. After that, I had been muddling through days and nights until I started engaging in medical academic publishing. Even 10 years after graduation, I had not totally lost the affection for being a doctor. Occasionally, that subconscious feeling would inadvertently arise from the bottom of my heart.

In April 2011, Mr. Tiantian Li, the founder of DXY.cn, and I had a business trip to Philadelphia, where we visited the Mütter Museum. As part of The College of Physicians of Philadelphia, the museum was founded in 1858 and has now become an exhibition hall of various diseases, injuries, deformities, as well as ancient medical instruments and the development of biology. It displays more than 20,000 pieces of items including pictures of wounded bodies at sites of battle, remains of conjoined twins, skeletons of dwarfs, and colons with pathological changes. They even exhibited several exclusive collections such as a soap-like female body and the skull of a two-headed child. This museum is widely known as “BIRTHPLACE OF AMERICAN MEDICINE”. Entering an auditorium, we were introduced by the narrator that the inauguration ceremony of the Perelman School of Medicine at the University of Pennsylvania would take place there every year. I asked Mr. Li, “If it was at this auditorium that you had the inauguration ceremony, would you give up being a doctor?” “No,” he answered.

In May 2013, we attended a meeting of British Medical Journal (BMJ) and afterwards a gala dinner was held to present awards to a number of outstanding medical teams. The event was hosted annually by the Editor-in-Chief of BMJ and a famous BBC host. Surprisingly, during the award presentation, the speeches made by BMJ never mentioned any high impact papers the teams had published in whichever prestigious journals over the past years. Instead, they laid emphasis on the contributions they had made on improving medical services in certain fields, alleviating the suffering of patients, and reducing the medical expenses.

Many friends of mine wondered what AME means.

AME is an acronym of “Academic Made Easy, Excellent and Enthusiastic”. On September 3, 2014, I posted three pictures to social media feeds and asked my friends to select their favourite version of the AME promotional leaflet. Unexpectedly we obtained a perfect translation of “AME” from Dr. Yaxing Shen, Department of Thoracic Surgery, Zhongshan Hospital, Shanghai, who wrote: enjoy a grander sight by devoting to academia (in Chinese, it was adapted from the verse of a famous Chinese poem).

AME is a young company with a pure dream. Whilst having a clear focus on research, we have been adhering to the core value “Patients come first”. On April 24, 2014, we developed a public account on WeChat (a popular Chinese social media) and named it “Research Time”. With a passion for clinical work, scientific research and the stories of science, “Research Time” disseminates cutting-edge breakthroughs in scientific research, provides moment-to-moment coverage of academic activities and shares rarely known behind-the-scene stories. With global vision, together we keep abreast of the advances in clinical research; together we meet and join our hands at the Research Time. We are committed to continue developing the AME platform to aid in the continual forward development and dissemination of medical science.

It is said that how one tastes wine indicates one’s personality. We would say how one reads gives a better insight to it. The “AME Research Time Medical Books Series” brings together clinical work, scientific research and humanism. Like making a fine dinner, we hope to cook the most delicate cuisine with all the great tastes and aromas that everyone will enjoy.

Stephen Wang
Founder & CEO,
AME Publishing Company

“Which vein shall be transected during the left upper lobe apical/posterior segmentectomy?”, the question was put forward by Dr. Morihito Okada, representative of Japanese team during the postgraduate symposium Master Cup of the 2017 Annual Meeting of the European Society of Thoracic Surgeons (ESTS). Young representative thoracic surgeons from European and American countries seemed completely dazed on site. “v1+2^{b+c}”, their Chinese and Japanese counterparts vied to answer without hesitation on the other hand, thinking it too straightforward a question to answer. It is a young surgeon who shared the above episode with me in surprise. For him, and other Asian surgeons, it's hard to imagine such a basic anatomical question would turn out to be a big headache for surgeons in western countries. The generally lacking of anatomy knowledge for thoracic surgeons in European and American countries reveals the unpopularity and rawness of anatomical segmental resection among them. After all, theoretical knowledge and practical experience cooperated each other in surgery field.

It's been definitely established that China is trailing the West in medical sciences in the past century; however, unwavering efforts made by generations of Chinese doctors have earned us a good reputation in the international community of medical sciences, and had the “voice of China” heard. Specifically in the field of thoracic surgery, China is now basically on the same page with the advanced nations after two decades of blistering catch-up endeavors. We also improved the surgical technologies to satisfy people's growing demand in China for better healthcare. Thanks to a series of comprehensive training on standardized treatment for lung cancer and esophageal cancer, a large majority of minimally invasive thoracic surgeries have been successfully carried out even in small hospitals. As a result, patients no longer have to rush to big medical centers which are already overcrowded.

Within two decades, technology will remain the primary driving force in thoracic surgery and witness the establishment and maintaining of thoracic surgery an advantaged specialty with efforts of all thoracic surgeons. An advantaged specialty like thoracic surgery, which grows rapidly relying on technology, normally takes two steps to get there, technology adoption and popularization. It can be easily observed in the development of a specific surgery procedure, minimally invasive segmentectomy. Adopting and popularizing the technology smoothly and quickly, eastern countries now seem leading the trend in the field. Japanese thoracic surgeons have been well recognized and favored by their peers worldwide in translating and concluding their valuable experience as academic accomplishments. Chinese thoracic surgeons on the other hand would take over the task to transcend, enlarge the leading trend and converting it into a leading advantage.

Segmentectomy for Thoracic Disease, compiled by Drs. Qun Wang, Shugeng Gao and K. Robert Shen, is a primary achievement of Chinese thoracic surgeons in building thoracic surgery an advantaged specialty worldwide. The book covers a full range of information from basic settings, indications, technical essentials, to treatment of complications, in relation to anatomical segmental resection and encompasses a series of academic literature selected from journal titles published by AME Publishing Company over the years. It will definitely serve as a guidebook for thoracic surgeons and help popularizing segmentectomy.

If history is to be reviewed in the future, the current should no doubt make us proud. For this is the moment when we are fluttering our wings and ready to soar, clearing our throats and ready to sing. We are ready to transcend which is more significant than just to lead. As a book collecting experience of generations of surgeons, hopefully it will enlighten more surgeons and patients benefit eventually.

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One of the most important advances in the recent history has been the demonstration of the value of screening for lung cancer using low dose computed tomography. With the introduction of screening for lung cancer, the development of more precise radiographic techniques, and an aging population worldwide, increasing numbers of patients will be identified with small, early stage lung cancer, for which sublobar resection will be the procedure of choice. In many centers worldwide, wedge resection is too often performed, and segmentectomy remains the preferred approach for sublobar resection of selected patients with early stage lung cancer detected with screening.

This volume, “*Segmentectomy for Thoracic Diseases*” presents to most up to date data available regarding the use of segmentectomy for both malignant and benign conditions. The current evidence, relevant controversies, and future directions are critically discussed by an international panel of experts, from Asia, Europe, and North America. The editors have compiled more than 30 outstanding contributions, which describe in detail the evidence regarding the benefits of anatomic segmentectomy, the anatomic details of segmentectomy, and conduct of specific procedures, and a discussion of many specific clinical scenarios.

The volume is well-written and well-edited, providing much necessary information for experienced surgeons and surgeons in training alike, without unnecessary repetition. In addition, the spectrum of clinical approaches is represented—thoracoscopic, robotic, uniportal and hybrid approaches—allowing the reader to assess the relative benefits of each approach. This is an outstanding reference, that will be extremely useful for the modern management of lung cancer in the era of lung cancer screening.

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“What are you doing, doc?” a radiologic technologist asked me when I was using a computed tomography workstation at night about 10 years ago. “I’m looking at data from a patient on whom we are planning to perform an operation tomorrow,” I replied. At that time, there were only two CT machines/workstations in our hospital, and only a few technologists could reconstruct 3-D images from computed tomography volume data. Furthermore, it took them more than 2 hours to do so, so we were generally hesitant to ask them to perform these complex tasks. In those days, I usually obtained and installed the patients’ data on my PC and made the 3-D images using free software. However, it was complex work, so I sometimes used the workstation after the technologists who worked day shift were finished. Over time, I became close with this technologist. For some difficult segmentectomies, we manipulated real-time images using my PC and a sterilized mouse in the OR to rotate and resize the 3-D images until they appeared just as in the surgical view. This technologist became the head of the technologists and helped me introduce a client reconstruction system to our hospital’s OR. Many things have changed since that time, including imaging technology, which has in turn led to surgical advances.

Although the standard surgical procedure for resection of lung cancer has been lobectomy, the demand for sublobar resection has increased because the detection of small-sized lung nodules considered malignant has increased as CT resolution continues to develop. Wedge resection is simple but has some problems, such as surgical margins, non-palpable features, depth of nodules, and so forth. I thought that the resolution of these problems should be through the development of anatomical segmentectomy, especially via thoracoscopy. Basal, superior, lingular, and left upper division segmentectomies are simple to dissect in the intersegmental plane. However, both lungs can be divided into 18 segments, and each segment has 2 or 3 subsegments; therefore, there are various segmentectomy patterns for resecting tumors with sufficient margins but without excessive volumes. Moreover, the segmental anatomy of one patient is quite different from that of another. I began designing resections using 3-D reconstruction from multidetector CT for respective anatomical interpretation.

If our hospital had had a sufficient number of radiologic technologists or radiologists who could have easily handled the 3-D imaging of patients, we would not have understood lung anatomy in such detail and would not have been able to perform the various kinds of precision anatomical segmentectomies. I have to appreciate the environmental circumstances of that era, as we discovered a lot about anatomy and surgical procedures during the process of overcoming these difficulties. Lung segmentectomy might be considered a complex or difficult procedure in some aspects, but I do not think it is. It has become easy with the development of imaging technology. I also believe that this procedure will become the standard of care even for lung cancer in the near future of personalized medicine. Therefore, every lung surgeon should get rid of hesitation about using it.

This book, *Segmentectomy for Thoracic Diseases*, covers the background, logic, oncology, techniques, and more. A lot of important topics but concise data from outstanding contributors from all over the world are included. I would like to give my deep thanks for the outstanding work done by all of the contributors in the production of this timely textbook. I hope that all readers enjoy this book and that lung segmentectomy will become easy for you.

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Cometh the hour, cometh the surgery

There is a great momentum of progress in thoracic surgery today, driven by the explosion of innovative minimally invasive in recent years (1,2). The future holds many exciting developments for our specialty, and the forces in play are complex and myriad.

One of the most significant of these developments from the patient's perspective may be the re-evaluation of the extent of resection necessary for lung malignancy.

For the past several decades, the lobectomy was considered the gold standard for curative resection of primary non-small cell lung cancer. Although the first anatomic segmentectomy was described in 1939 by Churchill and Belsey for the treatment of benign lung conditions (3), its application for pulmonary neoplasms has been limited. The 1995 randomized trial by Ginsberg and colleagues was instrumental in stigmatizing sublobar resection as an 'inadequate' treatment modality (4). Its role was therefore largely reserved for patients unable to tolerate lobectomy because of compromised cardiopulmonary function or significant medical comorbidities. However, accumulation of clinical experience in recent years have demonstrated that anatomic pulmonary segmentectomy can be effective in the resection of small lung primary lung tumors (5). 'Intentional' segmentectomy—and maybe even wedge resection—has been suggested to offer equivalent therapy as lobectomy for selected lesions (namely small lesions with completely or predominantly ground-glass opacity appearances). The potential attraction of preserving more lung functional lung parenchyma is that patients should have better pulmonary function and better quality of life after surgery.

Interest in such intentional sublobar resections has been amplified by two complementary developments in lung cancer management. Firstly, it is becoming recognized that modern developments in CT imaging have made this an effective screening tool for early stage lung cancer that can directly impact on patient survival (6). The upshot of this is that increasing use of CT screening will corresponding increase rates of detection of asymptomatic, small, ground glass opacity (GGO) lesions in the years ahead—precisely the lesions that may benefit most from sublobar resection. Secondly, surgical approaches for lung neoplasm resection have evolved at a remarkable pace over the last 20 years. Conventional open surgery has been replaced by video-assisted thoracic surgery (VATS) as the preferred approach for early stage lung cancer, and conventional VATS has in turn evolved into 'next generation' techniques such as robot-assisted surgery, Uniportal VATS, subxiphoid VATS, and non-intubated thoracic surgery (1,2). This minimization of surgical access forms a natural synergy with the minimization of surgical extent through sublobar resection. Despite the anatomical challenges, it has been shown that segmentectomy is entirely feasible through these 'next generation' approaches and that this will produce a package for patients that is better than the sum of its parts.

Nevertheless, many technical questions remain regarding sublobar resection, such as in the areas of ideal operative strategy, lesion localization, and so on. Future prospective studies will also be required to compare treatment effectiveness of intentional sublobar resections versus lobectomy. More importantly, we believe that sublobar resection should not replace lobectomy as the gold standard, but rather supplement lobectomy in the surgeon's armamentarium. Those future studies need to precisely identify tumor-specific indications and patient-specific criteria for applying the sublobar strategy.

This book offers a magnificent compilation of articles demonstrating the technique and demonstrating the outcomes of sublobar resection, authored by some of the most experienced specialists in this field. It is hoped that these articles will not only show how and why sublobar resection is performed, but what work still needs to be done to define its ultimate role in the management of patients with lung neoplasms.

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Since the first successful segmentectomy (lingulectomy) performed by Churchill and Belsey in 1939, controversial debate has persisted regarding the surgical indications and strategies for treating thoracic malignancy through segmentectomy. Advocates have emphasized its advantages of being parenchymal sparing and less invasive to cardiopulmonary reserved function, having oncologic security equivalent to that of standard lobectomy, and being an alternative surgical application for patients with physical impairment. However, although opponents have criticized limited resection of segmentectomy for being complicated by a potentially inadequate safety margin, a randomized controlled trial study by the Lung Cancer Study Group (LCSG) in 1995 presented evidence of an additional local recurrence rate and strongly recommended that segmentectomy for non-small cell lung carcinoma (NSCLC) be limited to patients with marginal cardiopulmonary function.

However, the spectrum of thoracic malignancy has shifted and surgical techniques have evolved. Currently, a growing number of ground glass opacity (GGO) pulmonary lesions have been detected through low-dose high-resolution computed tomography scans in an increasing number of cases of peripheral smaller noninvasive lung adenocarcinoma. In addition, various innovations and surgical applications have been developed, including 3D CT configuration, preoperative localization, and intraoperative identification of tiny radiographic abnormalities and segmental structures; all of which have been combined with the development of minimally invasive surgery, such as video-assisted thoracic surgery (VATS), uniportal or single skin incision VATS, and robotic-assisted thoracoscopic surgery (RATS), to cooperate systemically and lead a new era of segmentectomy application.

Although anatomic segmentectomy is acknowledged to be more technically complex than lobectomy because of frequently encountered anatomic variation and deeply buried intra-parenchymal segmental branches, recently increasing evidences indicate that segmentectomy is a reasonable treatment option for patients with NSCLC (≤ 2 cm) when a sufficient segmental margin is obtainable, particularly in patients of advanced age, with poor performance status, or with poor cardiopulmonary reserve.

Furthermore, through minimally invasive procedures—whether classical VATS, uniportal VATS, or RATS—radically anatomic segmentectomy can achieve less invasive resection of a smaller volume of lung tissue; equivalent oncological outcomes; and the benefits of less postoperative pain, shorter lengths of stay, reduced rates of morbidity, and even lower costs.

On the basis of the discussion and summary, we recommend that readers maintain interest in and concern about current segmentectomy to realize comprehensively the rapidly shifting spectrum of thoracic malignancy and surgical innovations.

Finally, ongoing, well-designed prospective RCTs should receive continuing attention regarding the different outcomes of open, thoracoscopic, and robotic segmentectomy, such as CALGB140503 and JCOG0802/WJOG4607L, for further clarifying the role of segmentectomy in treating NSCLC.

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Lung cancer, being one of the most malignant tumours, is the second most commonly diagnosed cancer in both sexes. According to American Cancer Society, there will be an estimated 222,500 newly diagnosed cases of lung cancer in 2017, which makes up a quarter of all cancer cases in the States. It is by far the top cancer killer with roughly 1 out of 4 cancer deaths caused by lung cancer (an estimated 155,870 deaths in 2017).

Despite a drop in its incidence rates since 2004 (about 2% per year and 1% per year in men and women respectively), thoracic surgery experts have never given up on devoting themselves to studying intensively the most effective surgical method to treat early stage lung cancer so as to straighten out a brighter future of lung cancer cure. Among the most popular types of pulmonary resection for lung cancer treatment (i.e. pneumonectomy, lobectomy, sublobar resection, wedge resections and segmentectomy), whether lobectomy and segmentectomy is a better surgical approach in terms of preoperative criteria, operative techniques, and postoperative effects has been a subject of much controversy. No matter which approach to adopt, one common goal among surgeons is to minimize patient's surgical trauma while retaining his/her pulmonary function and avoiding as much recurrence as possible. With the advent of thoracoscopic and robotic technologies, surgeons and patients are now bestowed upon more available alternatives. In the meantime, two profound questions loom: What are the potential surgical risks and postoperative impacts of such techniques? How do we judge which method is most appropriate for a particular patient in the real world that is full of complexities?

In search of a common remedy, scholars from different parts of the world have been joining hands to gather diversified knowledge and experience through collaborative research and a variety of academic conferences, the most representative of which would be the European Society of Thoracic Surgeons (ESTS) annual meeting, in which a Sino-European special session regarding thoracic surgery have been held since last year with exceptionally high rating. As a product of the continuous co-operation and knowledge exchange among these world experts, this book *Segmentectomy for Thoracic Diseases* is undeniably a milestone in the field of thoracic surgery where most of the prevalent surgical approaches, including segmentectomy and lobectomy, are explored, discussed, and compared. Later on, readers will be able to keep abreast of the rapidly advanced technologies in thoracic surgery by having an in-depth look at different types of segmentectomies, such as uniportal video-assisted thoracoscopic surgery (VATS) segmentectomy, robotic segmentectomy, and subxiphoid uniportal VATS segmentectomy. Last but not least, the real case studies presented by multitudinous experts from all over the world will certainly serve as a useful learning gateway for physicians and researchers worldwide, whom we hope will make the best out of it and, thus, patients from all corners of the globe will be benefited. Together we will arm ourselves to fight against any form of lung tumours.

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