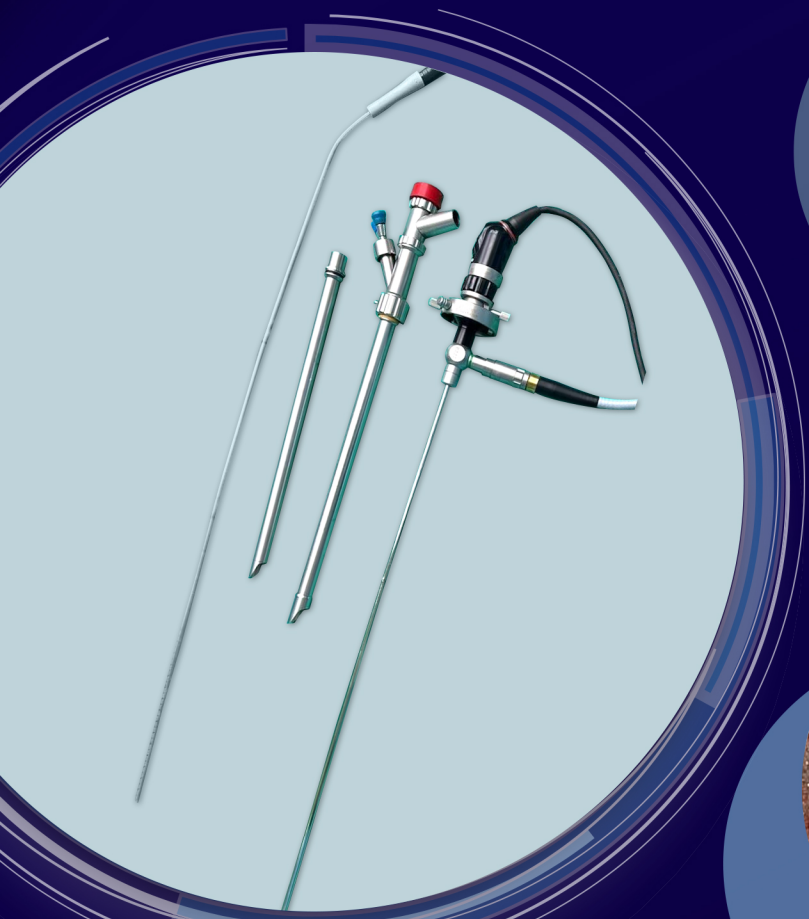
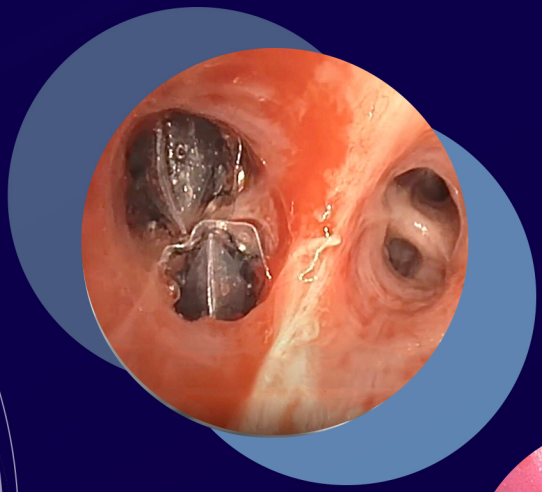
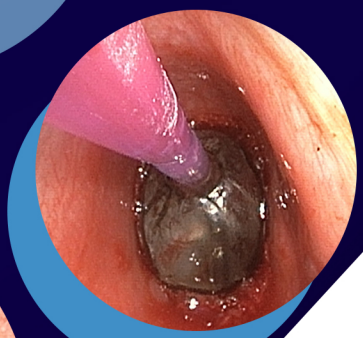
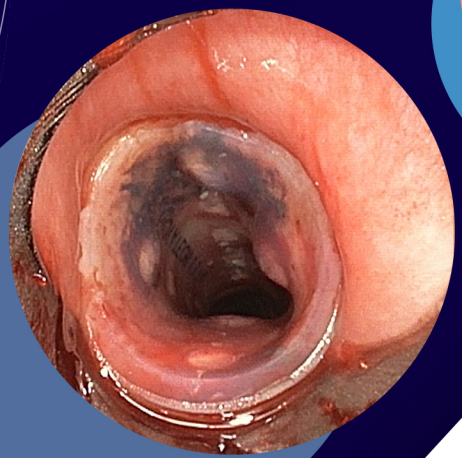
# A CASE-BASED APPROACH TO INTERVENTIONAL PULMONOLOGY:

## A FOCUS ON ASIAN PERSPECTIVES









Editors:
**Jamalul Azizi Abdul Rahaman**
**Tinku Joseph**

**Bentham Books**

# A Case-Based Approach to Interventional Pulmonology: A Focus on Asian Perspectives

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# A Case-Based Approach to Interventional Pulmonology: A Focus on Asian Perspectives

Editors: Jamalul Azizi Abdul Rahaman and Tinku Joseph

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# CONTENTS

# FOREWORD

My friend Jamalul has got a brilliant idea of writing a very original interventional pulmonology (IP) book based on clinical case scenarios. Today, evidence-based medicine and statistics are ruling our daily practice. Thus, each case is unique and each patient, somehow, follows his/her own way regardless of what the theory predicts or commands.

The Asian perspective is also of great importance given the differences in the etiologies compared to other regions of the world. Asia is the leading region in terms of population and the high incidence of certain airway and lung diseases is an amazing source for fundamental and clinical research.

Asia now possesses all the technical expertise to face this medical burden and IP experts, such as Jamalul, play a crucial role in training and spreading the knowledge. Jamalul honors me in calling me his mentor and, through me, he is part of the IP school of Marseille initiated by Jean-François Dumon, the father of interventional pulmonology. I can tell that he is a real member of this school which implies a passion for the art of bronchoscopy and IP procedures, mainly therapeutic bronchoscopy with the rigid bronchoscope.

Upon returning from Marseille, Jamalul pioneered rigid bronchoscopy amongst the pulmonologists in Malaysia. Over the past 14 years, he has dedicated himself to giving rigid bronchoscopy training to many local and overseas pulmonologists.

Tinku Joseph was one of Jamalul's former students who is now doing excellent work and regularly teaching IP fellows. He started the first exclusive IP unit in Kerala state, India which performs basic and advanced bronchoscopic procedures. He is also a recipient of many international and national awards and was the first Indian doctor to win the best overall IP procedure award from the World Association for Bronchology and Interventional Pulmonology (WABIP).

Without passion, there is no positive energy in what anyone does. Without sustained motivation, there is no transmission of knowledge to the younger generation. Jamalul and Tinku Joseph have all the necessary passion and motivation to inspire our young colleagues and this book is certainly the cornerstone of this inspiration source.

**Hervé Dutau**
Associate Professor of Pulmonology
Head of the Thoracic Endoscopy Unit
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# PREFACE

Our book primarily focuses on various aspects of Interventional Pulmonology (IP). To ensure an easy learning process, we have included many interesting diagnostic and therapeutic airway and pleural procedure cases. Leading experts in the field of IP from Asia, Canada and the US have contributed various cases.

Over the past 10 years, a lot of diagnostic and therapeutic innovations have taken place, paving the way for a significant boom in IP. The contents of our book have been divided into four different sections with a primary aim of case-based scenarios and solutions.

Section A consists of diagnostic IP procedures like linear and radial EBUS, navigation bronchoscopy, cryo lung biopsies and cone beam CT. We have included newer diagnostic modalities like cellvizio and robotic bronchoscopy as well.

Section B focuses on therapeutic rigid bronchoscopic procedures. Besides airway stenting and laser bronchoscopy, we have included recent interventions such as bronchial thermoplasty, bronchoscopic lung volume reduction, 3D printing and microwave ablation. Section C is dedicated to pleural procedures with the addition of the more recent ones such as indwelling pleural catheter (IPC) and fibrinolytics. Section D is dedicated to common paediatric IP procedures. The purpose of this book is not to provide the principles, theory or evidence of clinical practice of these procedures but to present actual case scenarios. We hope the book will complement the many IP books on the market that already cover the theory, principles and evidence of clinical practice.

Each case is presented with the history, including clinical, radiological, bronchoscopic/pleuroscopic findings and final outcomes. Many of these cases also have video illustrations as well. As a mark of respect to our patients, privacy identifiers have been intentionally omitted in the text and video presentations. Learning points are highlighted at the end of the case presentation.

Finally, we thank all the authors and co-authors for their hard work in making sure the work could be completed on time.

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# ACKNOWLEDGEMENTS

**Dr. Jamalul Azizi**

I would like to thank my wife Suhani and our son Muhammad Izzat Al-Amin for allowing me to pursue my ambitions. It was not an easy job to complete the work during the COVID-19 pandemic. My gratitude to my mentor Dr. Hervé Dutau for inspiring me in the field of interventional pulmonology by imparting his skills and knowledge. A special thanks to Serdang Hospital where I work and the Malaysian Association for Bronchology and Interventional Pulmonology (MABIP) for their support building the interventional pulmonology subspecialty in Malaysia. Last but not least, my appreciation to Editor, Dr. Tinku Joseph for helping me with this project.

**Dr. Tinku Joseph**

Having an idea and turning it into a book is as hard as it sounds. To be honest, writing this book was harder than I thought and more rewarding than I could have ever imagined. None of this would have been possible without my supportive wife, Sania. From reading early drafts to giving me advice on the cover to keeping our little munchkin's (Nichelle and Mikhail) out of my hair so I could edit, she was as important to getting this book done as I was. Thank you so much, dear.

I am eternally grateful to my parents, in-laws and brother for being my pillar of support throughout my life. Writing and editing a book, focusing on various aspects of Interventional Pulmonology was a surreal process and I express my sincere thanks to my mentor Dr. Jamalul Azizi for giving me an opportunity to be a part of this book. Also, a special thanks to my colleagues (especially Dr. Sreeraj) at Amrita hospital where I work, and to Mr. Sam who supported us in designing this book. I must thank God and my patients most of all, because without them I wouldn't have been able to do any of this.

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# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| **AFB** | = | Acid Fast Bacilli |
| **AHI** | = | Apnoea Hypopnoea Index |
| **APC** | = | Argon Plasma Coagulation |
| **BAL** | = | Broncho-Alveolar Lavage |
| **BPF** | = | Bronchopleural Fistula |
| **BT** | = | Bronchial Thermoplasty |
| **BTVA** | = | Bronchoscopic Thermal Vapor Ablation |
| **CAO** | = | Central Airway Obstruction |
| **CBCT** | = | Cone Beam CT |
| **CECT** | = | Contrast-Enhanced Computed Tomography |
| **CHP** | = | Chronic Hypersensitivity Pneumonitis |
| **CIS** | = | Carcinoma *in Situ* |
| **CLE** | = | Confocal Light Endomicroscopy |
| **COPD** | = | Chronic Obstructive Pulmonary Disease |
| **CPAP** | = | Continuous Positive Airway Pressure |
| **CRE** | = | Controlled Radial Expansion |
| **CT** | = | Computed Tomography |
| **CTA** | = | Computed Tomography Angiography |
| **CT TAP** | = | Computed Tomography Thorax, Abdomen, Pelvis |
| **CXR** | = | Chest X-Ray |
| **CTPA** | = | CT Pulmonary Angiogram |
| **DLCO** | = | Diffusing Capacity for Carbon Monoxide |
| **DLT** | = | Double Lumen Tube |
| **DNASE** | = | Deoxyribonuclease |
| **DPLD** | = | Diffuse Parenchymal Lung Disease |
| **EBUS** | = | Endobronchial Ultrasound |
| **ECMO** | = | Extracorporeal Membrane Oxygenation |
| **EDAC** | = | Excessive Dynamic Airway Collapse |
| **EGFR** | = | Epidermal Growth Factor Receptor |
| **ENB** | = | Electromagnetic Navigation Bronchoscopy |
| **ES** | = | Electrosurgery |
| **EUS-B-FNA** | = | Endoscopic Ultrasound With Bronchoscope-Guided Fine Needle Aspiration |
| **EWC** | = | Extended Working Channel |
| **EWS** | = | Endobronchial Watanabe Spigot |

**FEV1** = Forced Expiratory Volume in One Second
**FVC** = Forced Vital Capacity
**FB** = Foreign Body
**FNA** = Fine Needle Aspiration
**FOB** = Fibreoptic Bronchoscopy
**GGO** = Ground Glass Opacity
**GS** = Guide Sheath
**HPE** = Histopathological Examination
**HRCT** = High Resolution Computed Tomography
**ICD** = Intercostal Chest Drain
**IHC** = Immunohistochemistry
**ILD** = Interstitial Lung Disease
**IPC** = Indwelling Pleural Catheter
**LB1 + 2** = Left Upper Lobe Apicoposterior Segment
**LB3** = Left Upper Lobe Anterior Segment
**LB9** = Left Lower Lobe Lateral Basal Segment
**LUL** = Left Upper Lobe
**LLL** = Left Lower Lobe
**MMRC** = Modified Medical Research Council
**MPE** = Malignant Pleural Effusion
**MRI** = Magnetic Resonance Imaging
**OR** = Operating Room
**OSA** = Obstructive Sleep Apnoea
**PA** = Pulmonary Artery
**PAP** = Pulmonary Alveolar Proteinosis
**PCR** = Polymerase Chain Reaction
**PDT** = Photodynamic Therapy
**PEEP** = Positive End Expiratory Pressure
**PET** = Positron Emission Tomography
**POCUS** = Point of Care Ultrasound
**RB1** = Right Upper Lobe Apical Segment
**RB2** = Right Upper Lobe Posterior Subsegment
**RB3** = Right Upper Lobe Anterior Subsegment

**RB7** = Right Lower Lobe Medial Basal Segment
**RB9** = Right Lower Lobe Lateral Basal Segment
**RB10** = Right Lower Lobe Posterior Basal Segment
**rEBUS** = Radial Endobronchial Ultrasound
**RLL** = Right Lower Lobe
**ROSE** = Rapid On-Site Evaluation
**RUL** = Right Upper Lobe
**SBRT** = Stereotactic Body Radiotherapy
**SPN** = Solitary Pulmonary Nodule
**$SUV_{MAX}$** = Maximum Standardized Uptake Value
**SVC** = Superior Vena Cava
**TB** = Tuberculosis
**TBB** = Transbronchial Biopsy
**TBLC** = Transbronchial Lung Cryobiopsy
**TBM** = Tracheobronchomalacia
**TBNA** = Transbronchial Needle Aspiration
**TKI** = Tyrosine Kinase Inhibitor
**TSTB** = Tracheobronchial Stenosis Secondary to Endobronchial Tuberculosis
**USG** = Ultrasonography
**VATS** = Video-Assisted Thoracoscopic Surgery
**V-V ECMO** = Veno-Venous ECMO
**WLL** = Whole Lung Lavage
**YAP** = Yttrium Aluminium Perovskite

# Section A

## Diagnostic Interventional Pulmonology

**Case 1**

# Linear EBUS

## Not So Black and White - Principles of Staging Assessment in Non-Small Cell Lung Cancer *via* EBUS

**Tay Chee Kiang Melvin**[1,*], **Soo Chun Ian**[2] and **Anantham Devanand**[1]

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[2] *University of Malaya Medical Center, Kuala Lumpur, Malaysia*

**Keywords:** Lung cancer, Mediastinal staging, Mediastinal lymphadenopathy, EBUS, Rapid on-site cytologic examination (ROSE).

### Presentation

A 76-year-old woman presents with cough and dyspnea for 2 months. No constitutional symptoms or family history of malignancy.

### Comorbidities

Active smoker of 40 pack-years, hypertension.

### Chest Imaging

CXR showed a rounded retrocardiac opacity (Fig. **1**). Chest computed tomography (CT) revealed enlarged left hilar, left lower paratracheal, subcarinal and right paratracheal lymph nodes (Figs. **2a**-**c**). There was a 7.2cm heterogeneous mass in the left lower lobe (Fig. **2d**). There were no other significant CT findings.

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**Jamalul Azizi Abdul Rahaman & Tinku Joseph (Eds.)**

# Section B

# Therapeutic Interventional Pulmonology

**Case 1**

# Benign Central Airway Obstruction

## Central Airway Obstruction due to Cryptococcus Neoformans

**Rosmadi Ismail**[1,*]

[1] *Sunway Medical Centre, Selangor, Malaysia*

**Keywords:** Benign tracheal mass, Cryptococcus neoformans, Interventional bronchoscopy, Central airway obstruction, Mechanical debulking.

### Presentation

A 47-year-old lady, presented with recurrent intermittent haemoptysis over 3 months. She denied weight loss or febrile episodes.

### Comorbidities

None.

### Chest Imaging

CT-thorax showed a lobulated lower tracheal mass on the right lateral wall, right upper lobe nodule and mediastinal lymphadenopathy (Figs. **1a** and **b**).

She had CT guided biopsy of the right upper lobe nodule and the histopathological examination was consistent with non-specific inflammatory process and negative for AFB.

Initial flexible bronchoscopy showed lower tracheal mass with increased vascularity.

### Intervention

Rigid bronchoscopy showed an intraluminal broad-based mass arising from the lateral wall of the distal end of trachea extending 2.0cm inferiorly till the right upper

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# Section C

# Pleural Procedures

**Case 1**

# Pleuroscopy

## Pleuroscopy: A Step by Step Approach

**Hema Yamini Ramarmuty**[1,*]

[1] *Respiratory Department, Queen Elizabeth Hospital, Kota Kinabalu, Sabah, Malaysia*

**Keywords:** Complications, Contra-indications, Indication, Pleuroscopy, Steps.

Pleuroscopy (sometimes referred to as medical thoracoscopy) is a procedure performed to examine the pleura and obtain biopsies from the parietal pleura by introducing an endoscope into the pleural cavity under direct vision [1]. It is also used to perform therapeutic interventions within the pleural cavity [2].

### Indications

### Diagnostic

- Undiagnosed pleural effusions.
- Suspected malignant effusions: for biopsy, staging and additional tests to identify driver mutations.
- To obtain biopsies for MTB culture and histology in tuberculous pleural effusions.

### Therapeutic

- Pleurodesis (talc poudrage).
- Drainage and mechanical adhesiolysis in complex parapneumonic effusions and empyema.

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# Section D

# Paediatric Interventional Pulmonology

**Case 1**

# Foreign Body Removal (Different Techniques)

## Peanut in the Airway- A Hard Nut to Crack?

**Harikishan Gonuguntla**[1,*] and **Belgundi Preeti Vidyasagar**[1]

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**Keywords:** Bronchoscope, Basket, Emergency, Foreign body, Stridor.

### Presentation

A 2-year-old child was rushed to the emergency room with complaints of sudden onset of cough after a witnessed episode of peanut ingestion. No stridor or cyanosis was noted at presentation. His resting room air oxygen saturation was 98%. Clinical examination showed bilateral conducted sounds on auscultation.

### Comorbidities

None.

### Chest Imaging

Plain CXR demonstrated bilateral parenchymal infiltration (Fig. **1**).

### Intervention

Diagnostic bronchoscopy (BF 190, Olympus Medical, Tokyo, Japan) was performed under general anaesthesia using a supraglottic device. The foreign body was localised to RB10 (Postero-basal segment of the right lower lobe) (Figs. **2a** and **b**).

A 4mm Fogarty embolectomy catheter (Edward Lifesciences, USA) (Fig. **3**) was passed through the working channel of the bronchoscope and was placed distal to the foreign body and inflated (Fig. **4**). Pus was noted oozing from the side of the

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# SUBJECT INDEX

## A



## B



## C

## D



## E



## F

## G



## H



## I



## L

## M



## N



## O



## P

## R



## S



## T

## U



## V



## Z

## Jamalul Azizi Abdul Rahaman

Dr. Jamalul Azizi graduated from the Royal College of Surgeons in Ireland and received training in pulmonary medicine and interventional pulmonology (IP) in Malaysia, Western Australia, France and the USA. Dr. Jamalul Azizi has published in many peer-reviewed journals and serves on the editorial board of The Interventionalist Journal (TIJ) He organised the first interventional bronchoscopy course in Malaysia in 2007 and established the Malaysian Association for Bronchology and Interventional Pulmonology (MABIP) in 2013 of which he is the current Chair. He is a regular speaker on IP in India, Indonesia, Thailand and Japan and has trained IP fellows from India, Indonesia, USA and UK. He is a reviewer for Respirology, Respirology Case Report journal and American Journal of Respiratory and Critical Care Medicine. Dr Jamalul Azizi's main areas of interest are rigid bronchoscopy and pulmonary physiology. His passion lies in the dissemination of knowledge and skills to developing countries.

## Tinku Joseph

Dr.Tinku Joseph is currently working as professor & Head of Interventional Pulmonology at Amrita Institute of Medical Sciences, Kochi, Kerala, India. He is the founder of Amrita Bronchology and Interventional Pulmonology (ABIP), which started India's first exclusive advanced Interventional pulmonology fellowship program. Under the banner of ABIP, Dr. Joseph has trained many pulmonologists from different parts of the world in managing various complex airway and pleural disorders. His notable achievements are: performing the world's first lung cryobiopsy procedure in an infant to diagnose the etiology of DPLD. First in India to do bronchial stenosis repair in newborn babies using a biodegradable stent and he was also a part of the team which performed India's first autologous Tracheal transplant surgery. Dr. Tinku Joseph is a recipient of many International & National awards in the field of Pulmonary Medicine and is well known in the community for his humble nature & excellent communication skills.