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# Radiology of Influenza

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Hongjun Li  
Editor

# Radiology of Influenza

A Practical Approach

 Springer

*Editor*  
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## Foreword

Radiological study of influenza targets on the diseases caused by influenza virus and its subtypes to characterize the radiological signs of lesions and their evolution based on clinical staging and pathological findings.

Although influenza is a common disease, it is characterized by global transmission, repeated occurrence all year round, high incidence, wide involvement, and great harm to human health, which should attract scholarly attention. It is necessary to set up special research projects for systematic study to reveal the characteristic radiological signs and to assess its application value in clinical practice. Systemic studies can also enrich and extend the theory of medical radiology and contribute to improving clinical management of pneumonia induced by influenza. Previously, human infected avian influenza was caused by subtypes H1N1, H1N2, and H3N2 of type A influenza virus. And subtypes of avian influenza virus have shown their capability to cross the species barrier and infect human. On February 19, 2013, the first case of human infected H7N9 avian influenza was reported in Shanghai, China. In May 9, 2013, WHO announced that 131 cases with definitive laboratory diagnosis were reported, including 32 cases of death. By June 30, 2013, a total of 134 cases were definitively diagnosed, including 43 cases of death. In the subsequent period of time, sporadic cases of human infected H7N9 avian influenza were reported in different areas of China. The clinical manifestations of human infected avian influenza vary from asymptomatic infection and mild upper respiratory tract symptoms to severe pneumonia and multiple organs failure. Because radiological findings are the demonstrations of pathological changes and the pathological changes are the basis of radiological signs, radiology plays important roles in monitoring the changes of lesions, non-invasive diagnosis, and therapeutic assessment. Along with the rapid social and economic development and the changes of human life style, influenza control is no longer a national or regional issue, but a global issue. The disciplinary construction should be focused on global strategic top-level design. Only a global holistic strategy can effectively prevent and control influenza, and thus guarantee the human well being and national security. From these perspectives, we systematically summarized radiological signs of each clinical type of influenza to gain more knowledge about influenza. In such a way, we intended to extend our understanding about the occurrence, development, and evolution of influenza, which help in formulating appropriate therapeutic plan. In addition, we chose a format of case guidance to facilitate reading, understanding, and clinical use.

This book is characterized by systemic introduction of the epidemiology, clinical symptoms, pathomechanism, laboratory tests, and radiological findings of each type of influenza. This book has rich contents, complete images and data, and typical cases demonstration, which can be satisfactorily used in research, clinical practice, and pedagogy.

The data and radiological images in this book were from many hospitals in China. Their contributions help this book to come into being. Here, on behalf of the editorial committee of this book, I would like to express my sincere gratitude to the commitment, obligation, and sincerity from the collaborative hospitals!

The editing of this book was supported and assisted by LI Ning, the president of Beijing Youan Hospital (Affiliated to Capital Medical University, Beijing, China), and my team members, to whom I expresses my heartfelt thanks here!

The editing of this book was invited and funded by Science Press, Beijing, and we express our gratitude to the leaders and editors in publication of this book!

We hope that the publication of this book will play a role in inducing more publications in this research area. And we also sincerely hope that it obtain understanding and help from colleagues in radiology. The development of a discipline is a process of gradual understanding and advancing. And the weaknesses are unavoidable and need to be improved. We expect our colleagues in radiology point out the weaknesses so as to improve this book.

The editing of this book was supported by Specific Foundation for Development of Clinical Medicine by Beijing Municipal Hospital Authority (Project No. ZYLX201511).

Beijing, China

Hongjun Li

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## Brief Introduction

Influenza is an acute respiratory tract disease caused by influenza virus, with high infectivity and rapid transmission. The research team, led by Prof. LI Hongjun, for the first time systematically summarized the disease spectrum of influenza based on careful screening of the typical cases and their studies from perspectives of clinical data, radiological data, autopsy, and pathological contrasts. Such a systemic study was to systematically reveal the radiological evolution of the lesions as well as their underlying pathological mechanisms. Therefore, such a systematic study provides valuable, scientific, and rigorous first-hand information for the diagnosis, prevention, treatment, and scientific research of influenza and its complications.

This book, instead of just plain text, integrated literature review and case study, which helps the readers to obtain more comprehensive knowledge from both theoretical and practical perspectives. Therefore, a compound structure was selected that is more readers friendly than singular atlas, literature review, or title introduction. The whole book is composed of 2 parts including 13 chapters. The first part is the general introduction, which mainly elucidates the basic theories about etiology, epidemiology, and radiological examinations of influenza. The second part introduces various types of influenza, specifically including influenza, type A H1N1 influenza, human infected H5N1 avian influenza, human infected H7N9 avian influenza, human infected H5N6 avian influenza, and human infected H10N8 avian influenza. Each chapter is focused on one disease with several typical cases, which were elucidated with complete case history, laboratory tests findings, pathological figures, and radiological data (X-ray and CT scan). And each clinical case is characterized by the completeness of the clinical data, typical radiological images, and detailed key points for differential diagnosis. The discussion section in the case study clinches the point and helps the clinicians to differentiate similar radiological signs and thus make accurate diagnosis. This book is recommendable to clinicians working in the department of diagnostic imaging and other clinical departments as well as students studying medicine.

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## Brief Introduction to the Editor



**Hongjun LI**, male, aged 49 years, MD, chief physician, professor, supervisor of master degree candidates in Capital Medical University and Wuhan University, overseas talent from UK, an expert receiving special allowance of the State Council due to his outstanding contribution.

**Research direction:** Radiology of infections and infectious diseases.

**Current position:** Director at Radiology Department, Affiliated Beijing Youan Hospital, Capital Medical University, Beijing, China; Deputy director at Department of Medical Imaging and Nuclear Medicine, Capital Medical University, Beijing, China; Chief-editor of Radiology of Infectious Diseases.

**Social service:** Expert Reviewing Committee member for Chinese Award in Medicine; Expert Reviewing Committee member for National Overseas Study Foundation, China; Reviewing Committee member for Beijing Municipal Natural Science Foundation; Chairman, Radiology committee on infectious and inflammatory diseases, Chinese research-oriented hospital; Chair of Radiology of Infection Sub-branch, Radiology Branch, Chinese Medical Association; Chair of Radiology of Infection Branch, Working and Treating Committee of Chinese HIV/AIDS and STD Association; Chair of Radiology of Infectious Diseases Management Sub-branch, Infectious Diseases Management Branch, Hospital Management Association in China; member at Abdominal Radiology Sub-branch, Radiology Branch, Chinese Medical Association; standing member at Beijing Medical Radiology Association, Chinese Medical Association; member of Korean Radiology Society; editorial committee member of 14 journals including Chinese Medical Journal.

**Clinical work:** Prof. LI specializes in radiological diagnosis and differential diagnosis for liver disease, infections, infectious diseases, (such as HIV/AIDS-related diseases) and is a senior radiologist specializing in radiological grading, localizing, quantitative and qualitative

diagnosis of HBV-related hepatocellular carcinoma and AIDS based on clinical and pathological staging as well as noninvasive multimodal radiological biomarker.

**Scientific research:** Prof. LI has directed and participated in 8 national and provincial research projects and international collaborative research projects, with a total foundation of up to 10 million RMB yuan. He has published 116 papers, including 45 SCI-indexed papers (IF ranging from 1.016 to 9.416); and his research projects have been successively funded by National Natural Science Foundation, Beijing Natural Science Foundation, Beijing Sailing Program, International Publishing Fund, and Research Foundation by Ministry of Health in China for 27 times. He also have edited and published 19 books, including 6 books internationally published by Springer, and 2 books nationally published as the national blueprints. In addition, he has won 7 provincial awards including Second Prize of Chinese Science and Technology Award in Medicine as the director and holds 16 national patents and intellectual property rights as the director and/or owner.

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## Preface



Influenza (abbreviated as flu) is an acute respiratory infectious disease caused by influenza virus, which is characterized by acute onset, rapid spread, wide prevalence, and liabilities of regional epidemic or pandemic. In various types of influenza virus, type A influenza virus often causes epidemic outbreaks and even pandemic of influenza, and small-scale epidemic of influenza occurs every 2 to 3 years. In March 2009, outbreak of human infected swine influenza occurred in Mexico, which then rapidly spread worldwide and was later nominated by WHO as type A H1N1 influenza. In May 1997, outbreak of human infected H5N1 avian influenza occurred in Hong Kong, which was the first time that human has been infected by avian influenza with consequent occurrence of death and attracted global concern. In April 2013, the first case of human infected H7N9 avian influenza was reported in eastern China, which is fatal with a high mortality rate, and its death rate in 2013 was 32.6%. Following the cases of human infected H7N9 avian influenza, the cases of human infected H5N6 and H10N8 avian influenza were reported. The outbreaks and epidemics of influenza negatively affect human health and the quality of life, and consume a large quantity of health care resources that result in substantial loss both socially and economically.

Complication is the main cause of death in patients with influenza; therefore, the early diagnosis and differential diagnosis of complications constitute the key factor influencing the survival rate and life quality in patients with influenza. Radiological examination is an important procedure for the diagnosis and differential diagnosis of complications. Targeting on the plain facts about influenza and its complications, Prof. LI collaborated with radiologists from dozens of hospitals in China to integrate multi-center resources and analyzed the data of patients with influenza systematically and comprehensively. With their collective efforts, this book, *Radiology of Influenza*, has been edited. This book, based on typical clinical cases, elucidated the etiology, pathology, clinical manifestation, radiological finding, and differential diagnosis of various complications following influenza. A discussion section at the final part of each case study puts forward comments and clinical experience to elucidate radiological findings of each complication following influenza. Such a well-structured format is intended to provide more practical guidance and reference for radiologists and clinicians.

This book covers 2 parts including 13 chapters in about 0.2 million words with more than 300 figures. The text and figures are in a well-structured format to demonstrate the main radiological signs of influenza for convenience of reading. And this book provides a favorable reference for the diagnosis and therapeutic assessment of influenza.

Deputy Director of Radiology Branch, Chinese Medical Association

Shiyuan Liu

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