
Fungal Infections of the Central Nervous System

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Ali Akhaddar
Editors

Fungal Infections of the Central Nervous System

Pathogens, Diagnosis,
and Management

 Springer

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ISBN 978-3-030-06087-9 ISBN 978-3-030-06088-6 (eBook)
<https://doi.org/10.1007/978-3-030-06088-6>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface I

Fungal infections of the central nervous system, once considered rare, have become more frequent and pose a diagnostic and therapeutic challenge in the day-to-day practice. Better awareness of the epidemiological features and elucidation of the risk factors along with advancements in technology in imaging and molecular diagnostics contributed to better understanding of the disease mechanisms and diagnosis. However, geographic variations due to environmental factors, emerging fungi in different clinical scenarios, and genetic factors influence the incidence of fungal infections. Though there is a wealth of information on fungal infections of the central nervous system, textbook like this provides a comprehensive and rapid access to the various aspects of these diseases and serves as a ready reference for the trainee and practicing neuroscientists.

The book has six sections with each section dedicated to one aspect of the disease. The authors were chosen from various parts of the world, based on their contributions and special interest in that subspecialty. Each chapter was edited by an expert in the field to provide concise and up-to-date information on the subject. The chapters were well-illustrated with tables and figures and provided with extensive references to guide further reading for residents, neurologists, internists, and neurological surgeons.

We are grateful to all the authors for their contributions and support to complete this book project in time. We especially wish to thank Springer Nature for their support in ensuring quality publication of the book. We are truly humbled by this experience. We hope this book will be a unique and important addition to the existing books on this subject.

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Preface II

Fungi are ubiquitous organisms found in the soil, water, and environment. Infections of humans are uncommon with only a few species being pathogenic. However, with changes in the environmental factors and immune status of individuals, fungal infections are on the rise. The incidence of fungal infections of the central nervous system (CNS) parallels that of the systemic fungal infections. Fungal infections of the CNS are being increasingly diagnosed in the past few decades due to steady increase in the number of immunosuppressed individuals, better awareness, and improved diagnostic modalities. Infections of the CNS are associated with high morbidity and mortality, but the diagnosis and treatment remain a challenge. Understanding the pathogenesis and host pathogen interactions helps in devising new diagnostic modalities and therapeutic interventions.

The etiologic agents include yeasts, filamentous fungi, and dimorphic fungi. The common yeast fungi include *Cryptococcus* and *Candida*, whereas filamentous fungi with hyaline septate hyphae include *Aspergillus*, *Fusarium*, and *Mucorales* and the pigmented fungi include dematiaceous fungi. The dimorphic fungi include *Blastomyces*, *Histoplasma*, *Coccidioides*, and *Paracoccidioides*. *Aspergillus* and *Mucorales* are usually opportunistic, but *Aspergillus* can cause infections in immunocompetent hosts in certain geographical regions. Dematiaceous fungi are neurotropic and cause infection in immunocompetent hosts, and dimorphic fungi cause infections which are geographically restricted.

The portal of entry is usually by inhalation and subsequent hematogenous dissemination to the CNS. The infection may spread from contiguous structures like paranasal sinuses, orbit, mastoid, or skull bone and by direct inoculation from surgery or trauma.

The size of the conidia or yeast, the virulence factors, and angioinvasiveness of the fungus are important in the pathogenesis. The interplay between host defenses and the strategy of the pathogen to evade immune attack, acquire nutrients, degrade extracellular matrix, and disseminate are not yet completely understood.

The immune status, portal of entry, type of the fungus, and virulence of the organism determine the pathology which in turn manifests as the clinical syndrome. The clinical syndromes include meningitis, intracranial space-occupying lesion, stroke-like manifestation, or spinal syndrome. The pathology includes abscess, granuloma, meningitis, infarct with or without

hemorrhage, or subarachnoid hemorrhage. Imaging provides important clues to diagnosis in appropriate clinical setting.

Diagnosis is established by cerebrospinal fluid examination or tissue obtained at surgery along with culture. Histopathology is useful for delineation of fungal morphology, but species confirmation by culture is needed. Molecular tests, especially in disseminated disease, are warranted. Serum galactomannan is widely used but has several limitations. High index of clinical suspicion in appropriate clinical setting, along with epidemiological consideration, is important for early diagnosis. Management includes neurosurgical intervention, especially for intracranial space-occupying lesions, administration of antifungal treatment, and correction of immune impairment or risk factors.

In this textbook, in several chapters contributed by experts in the field, the epidemiological, clinical, diagnostic, and management aspects of various fungal infections of the CNS are addressed.

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Contents

Part I General Considerations

- 1 Historical Aspects of Fungal Infections.** 3
Nikolaos Ch. Syrmos, Vaitsa Giannouli,
and Mehmet Turgut
- 2 Epidemiology of Central Nervous System
Fungal Infections.** 11
Sanjeet Singh Dadwal
- 3 Morphological Classification of Fungal Infections
(Yeasts, Mold, Dimorphic)** 23
Lakshmi Vemu Gorthi
- 4 Pathogenesis of Fungal Infections** 31
Chandrasekhar Srinivasamurthy Banushree and
Neriyana Sannappa Madhusudhan
- 5 Predisposing Factors.** 43
Shruti Gupta and Sanjay Behari
- 6 Histopathology.** 51
Leonardo F. Jurado and Rocío del Pilar López-Panqueva
- 7 Molecular Genetics and Genomics of Fungal Infections.** 75
Shivaprakash M. Rudramurthy and Arunaloke Chakrabarti

Part II Fungal Pathogens: Pathogenesis, Pathology and Diagnosis

- 8 Aspergillosis.** 91
Sundaram Challa
- 9 Candidiasis.** 107
M. Altay Atalay
- 10 Mucormycosis** 121
A. Serda Kantarcioglu
- 11 Histoplasmosis and Coccidioidomycosis.** 155
María del Rocío Reyes-Montes, Maria Lucia Taylor, Esperanza
Duarte-Escalante, and María Guadalupe Frías-De-León

- 12 Cryptococcosis** 167
Anita Mahadevan and Shankar Krishna Susarla
- 13 Blastomycosis and Phaeohyphomycosis** 187
María Guadalupe Frías-De-León, Erick Martínez-Herrera,
María del Rocío Reyes-Montes, and
Gustavo Acosta-Altamirano
- 14 Cladophialophora bantiana** 195
Hurriyet Deniz Ozgun, Darren L. Jacobs,
and Steven A. Toms
- 15 Cladosporium spp., Fusarium spp., Bipolaris spp.,
Schizophyllum commune, and Scedosporium apiospermum** 205
A. Serda Kantarcioglu

**Part III Clinical Syndromes of Fungal Infections Involving
Central Nervous System and Its Coverings**

- 16 Cranial Vault Lesions** 237
Ali Akhaddar
- 17 Meningitis and Meningoencephalitis** 245
Alexa Bodman and Walter A. Hall
- 18 Raised Intracranial Pressure** 253
Hasan Emre Aydın and Ismail Kaya
- 19 Hydrocephalus** 259
Manish Jaiswal
- 20 Intracranial Space-Occupying Lesions** 269
Erdal Kalkan, Fatih Erdi, Yasar Karatas, and Bülent Kaya
- 21 Invasive Fungal Diseases of the Skull Base** 275
Manogaran Ravi Sankar, Mathialagan Arulalan,
Amit K. Keshri, Arun K. Srivastava, Awadhesh K. Jaiswal,
and Sanjay Behari
- 22 Skull Base Clinical Syndromes** 289
Jagarlapudi M. K. Murthy and Subhendu Parida
- 23 Orbito-Rhinocerebral Syndrome** 295
Gauri S. Mankekar, Rahul Mehta, and Daniel W. Nuss
- 24 Cavernous Sinus Syndrome** 305
Forhad Hossian Chowdhury, Mohammad Raziul Haque,
Mohammad Zahed Hossain, and Mainul Haque Sarker
- 25 Intracranial Fungal Aneurysms** 327
Ali Akhaddar and Sylma Diabira
- 26 Acute Ischemic or Hemorrhagic Stroke Syndromes** 335
Arsovska Anita and Arsovski Zoran

27 Spinal Syndromes	345
Álynsón Larocca Kulcheski, Xavier Soler I. Graells, and André Luís Sebben	
Part IV Radiological Findings of Fungal Infections Involving Central Nervous System and Its Coverings	
28 Imaging of Fungal Infections of the Brain	353
Subhendu Parida	
29 Imaging Findings of Fungal Infections of the Cranial and Peripheral Nerves	367
Ahmet T. Turgut, Elif Başbay Gündoğdu, Can Başaloğlu, and Mehmet Turgut	
30 Imaging Findings of Fungal Infections of the Sinuses Extending into the Brain	387
Ahmed Abdel Khalek Abdel Razek	
31 Imaging Findings of Fungal Infections of Spine and Spinal Cord	393
Jitender Saini, Mudit Gupta, and Rakesh K. Gupta	
Part V Therapy of Fungal Infections Involving Central Nervous System and Its Coverings	
32 Surgical Therapy	407
Mehmet Turgut	
33 Prognosis of Fungal Infections Involving the Central Nervous System and Its Coverings	415
Kartik Munta and Jay Dip Ray Chaudhuri	
Part VI Further Insights into Fungal Infections	
34 Fungal Infections of the Spine Mimicking Tuberculosis	423
Turan C. Dülgeroğlu and Mehmet Turgut	
35 Fungal Infections in Cancer Patients	431
Yaşar Barış Turgut, Gökhan Sargin, and Özgür Tanrıverdi	
36 Invasive Fungal Infections in Patients with Hematologic Malignancies	441
Yaşar Barış Turgut, Gökhan Sargin, and Gökhan Pektaş	
37 Fungal Infections of Central Nervous System and Their Relationship to Neuropsychiatric Disorders	451
Onur Gökçen, Nermin Gündüz, and Mehmet Turgut	
38 Real-Time PCR: Advanced Technologies and Applications	463
Güliz Uyar Güleç and Yaşar Barış Turgut	

39 Next-Generation Sequencing: Current Technologies and Applications 471
Dwarakanath Srinivas and Harsh Deora

40 Current Innovations and Future Trends. 475
Neeraj Kumar, Ravindra Kumar Garg, and Hardeep Singh Malhotra

Conclusion 479