Emergency Neuroradiology

A Case-Based Approach
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To our families, for the love and unwavering support!
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Foreword

To whom does Emergency Radiology belong? Radiology specialists, radiology generalists, emergency physicians? The truth is that it probably "belongs" to all, depending on where one works. At most teaching hospitals, trainees initially interpret all studies, which are later reviewed by specialists, while at other hospital generalists (sometimes called night hawks) do it all, and at even smaller community hospitals the emergency room personnel may be in charge of rendering the initial imaging interpretations for acutely sick patients. Regardless of who does the initial interpretation of these studies, our knowledge about how to interpret them should come from the best and most experienced specialists, and that is where this case-based book by Drs. Tang, Mukherjee, and Wintermark makes its mark.

Why another case-based book? The way we teach and learn has drastically changed in the last 15 years. While most radiologists of my generation learned by reading (prose) books, younger individuals no longer do it this way. Millennials and Generation Z obtain and process knowledge differently, that is, their knowledge is no longer built in blocks but in a pyramidal fashion by laying a foundation and then building on top of it via the process of accumulating small information bites, synthesizing them, coordinating them, and ending with a good rounded fund of knowledge (or a tall pyramid!). While I learned mostly from text and imagination, newer generations learn mostly in a pictorial fashion, which is perhaps easier and more lasting. This new book does the latter.

Emergency Neuroradiology: A Case-Based Approach is the title of the book you have in your hands – and its name implies expert knowledge, easily delivered and digestible. Beautiful images are accompanied by pithy text and to-the-point information. Cases are grouped into large and general sections, making them easy to find in a hurry. Beyond the usual emergent situations, some cases such as "sinus pericranii" may be useful when facing this entity as an incidental finding in the ED (such as a patient presenting with a bump on the head). CT abounds but MRI, which is increasingly used in emergencies, is also amply represented. We neuroradiologists know that often head emergencies are accompanied by neck and spine ones. Thus, very complete sections on head & neck and spine emergencies are also included.

There is no question that this book will be frequently used in the emergency department, where it belongs – but it should also remind many of us as why we embark on Neuroradiology: it is fun. An expert perusing this book will find its illustrations beautiful and enjoyable, and will still be able to learn something from it.

Mauricio Castillo MD FACR
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Diseases affecting the brain, head and neck, and spine are prevalent in the emergency setting. Traumatic, vascular, or infectious events are more likely to present acutely, while exacerbations or complications of underlying chronic diseases such as inflammatory, neoplastic, metabolic, degenerative, or even congenital processes can also present in an urgent fashion and may pose a significant diagnostic challenge to clinicians and radiologists. Therefore, there is a strong need to adequately prepare radiologists, especially our trainees, for on-call neuroradiological emergencies.

Although many excellent, comprehensive neuroradiology textbooks are available, we feel that the most effective way of preparing for neuroradiological emergencies is through a concentrated series of case reviews. Our aim in this book is to develop a teaching curriculum specific for emergency neuroradiology and to supplement the large-volume reference books with a concise book, using a case-based, picture-rich format. It includes over 150 selected cases, which are divided into three sections and eighteen chapters, and cover the common as well as some uncommon emergent cases in brain, head and neck, and spine neuroradiology. Each case vignette consists of a short history, images, findings, and diagnosis, followed by focused discussion of differential diagnosis and key points, and supplemented with a short list of suggested readings. Readers can use it either as a primary learning tool or as a quick on-call reference guide.

We would like to thank our colleagues at the Virginia Commonwealth University and University of Virginia Medical Centers for their contributions. A number of residents and fellows have participated in writing up the cases and providing valuable feedback. We would also like to thank the editorial staff at Cambridge University Press for making this book possible, and, last but not least, Dr. Mauricio Castillo for writing a foreword to the book.
Abbreviations

ACA anterior cerebral artery
ACE angiotensin-converting enzyme
A-comm anterior communicating artery
ADC apparent diffusion coefficient
ADEM acute demyelinating encephalomyelitis
AIDP acute inflammatory demyelinating polyneuropathy
AIDS acquired immune deficiency syndrome
ALS amyotrophic lateral sclerosis
AOD atlanto-occipital dislocation
AP anteroposterior
AQP aquaporin
AS ankylosing spondylitis
ATRT atypical teratoid–rhabdoid tumor
AV arteriovenous
AVF arteriovenous fistula
AVM arteriovenous malformation
CAA cerebral amyloid angiopathy
CBF cerebral blood flow
CBV cerebral blood volume
CCF carotid–cavernous fistula
CECT contrast-enhanced computed tomography
CID Creutzfeldt–Jakob disease
CM cavernous malformation
CMV cytomegalovirus
CNS central nervous system
CPM central pontine myelinolysis
CPPD calcium pyrophosphate deposition
CRP C-reactive protein
CSF cerebrospinal fluid
CTA computed tomography angiography
CTV computed tomography venography
CVD cortical venous drainage
DAI diffuse axonal injury
DAVF dural arteriovenous fistula
DCI delayed cerebral ischemia
DIC disseminated intravascular coagulation
DNET dysembryoplastic neuroepithelial tumor
DNM descending necrotizing medulainitis
DSA digital subtraction angiography
DVA developmental venous anomaly

DWI diffusion-weighted imaging
ECA external carotid artery
EDH epidural hematoma
EOM extraocular muscle
EPM extrapontine myelinolysis
ESR erythrocyte sedimentation rate
ELST endolymphatic sac tumor
FDG fludeoxyglucose (18F)
FLAIR fluid-attenuated inversion recovery
GBM glioblastoma multiforme
GBS Guillain–Barré syndrome
GC gliomatosis cerebri
GRE gradient-recalled echo
HAART highly active antiretroviral therapy
HIV human immunodeficiency virus
HPV human papilloma virus
HSV herpes simplex virus
HUS hemolytic uremic syndrome
IAC internal auditory canal
ICA internal cerebral artery
ICP intracranial pressure
ICV internal cerebral vein
IHH idiopathic intracranial hypertension
IRIS immune reconstitution inflammatory syndrome
JNA juvenile nasopharyngeal angiofibroma
LCH Langerhans cell histiocytosis
LNH Lyme neuroborreliosis
MCA middle cerebral artery
MDCT multiple-detector computed tomography
MIP maximum-intensity projection
MPRAGE magnetization prepared rapid gradient echo
MRA magnetic resonance angiography
MRI magnetic resonance imaging
MRV magnetic resonance venography
MS multiple sclerosis
MSUD maple-syrup urine disease
MTS mesial temporal sclerosis
MTT mean transit time
NAA N-acetylaspartate
NBS neuro-Behçet’s syndrome
NCC neurocysticercosis
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>NECT</td>
<td>non-enhanced computed tomography</td>
</tr>
<tr>
<td>NMO</td>
<td>neuromyelitis optica</td>
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<tr>
<td>NOE</td>
<td>naso-orbito-ethmoidal</td>
</tr>
<tr>
<td>PACNS</td>
<td>primary angiitis of central nervous system</td>
</tr>
<tr>
<td>PADI</td>
<td>posterior atlanto-dental interval</td>
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<tr>
<td>PCA</td>
<td>posterior cerebral artery</td>
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<tr>
<td>P-comm</td>
<td>posterior communicating artery</td>
</tr>
<tr>
<td>PCNSL</td>
<td>primary CNS lymphoma</td>
</tr>
<tr>
<td>PCR</td>
<td>polymerase chain reaction</td>
</tr>
<tr>
<td>PET</td>
<td>positron emission tomography</td>
</tr>
<tr>
<td>PHPV</td>
<td>persistent hyperplastic primary vitreous</td>
</tr>
<tr>
<td>PICA</td>
<td>posterior inferior cerebellar artery</td>
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<tr>
<td>PML</td>
<td>progressive multifocal leukoencephalopathy</td>
</tr>
<tr>
<td>PNET</td>
<td>primitive neuroectodermal tumor</td>
</tr>
<tr>
<td>PRES</td>
<td>posterior reversible encephalopathy syndrome</td>
</tr>
<tr>
<td>PTA</td>
<td>peritonsillar abscess</td>
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<tr>
<td>rCBV</td>
<td>relative cerebral blood volume</td>
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<td>RCVS</td>
<td>reversible cerebral vasoconstriction syndrome</td>
</tr>
<tr>
<td>SAH</td>
<td>subarachnoid hemorrhage</td>
</tr>
<tr>
<td>SCA</td>
<td>superior cerebellar artery</td>
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<tr>
<td>SCC</td>
<td>squamous cell carcinoma</td>
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<tr>
<td>SLE</td>
<td>systemic lupus erythematosus</td>
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<td>STIR</td>
<td>short tau inversion recovery</td>
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<td>TB</td>
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<td>TMA</td>
<td>thrombotic microangiopathy</td>
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<tr>
<td>TMJ</td>
<td>temporomandibular joint</td>
</tr>
<tr>
<td>tPA</td>
<td>tissue plasminogen activator</td>
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<tr>
<td>TOF</td>
<td>time of flight</td>
</tr>
<tr>
<td>TTD</td>
<td>time to drain</td>
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<tr>
<td>TTP</td>
<td>thrombotic thrombocytopenic purpura</td>
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<tr>
<td>VHL</td>
<td>von Hippel–Lindau</td>
</tr>
<tr>
<td>WD</td>
<td>Wallerian degeneration</td>
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<tr>
<td>ZMC</td>
<td>zygomaticomaxillary complex</td>
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