

Emergency Neuroradiology

A Case-Based Approach

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Yang Tang, Sugoto Mukherjee and Max Wintermark
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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.

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Preface

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	DWI	diffusion-weighted imaging
ACE	angiotensin-converting enzyme	ECA	external carotid artery
A-comm	anterior communicating artery	EDH	epidural hematoma
ADC	apparent diffusion coefficient	EOM	extraocular muscle
ADEM	acute demyelinating encephalomyelitis	EPM	extrapontine myelinolysis
AIDP	acute inflammatory demyelinating polyneuropathy	ESR	erythrocyte sedimentation rate
AIDS	acquired immune deficiency syndrome	ELST	endolymphatic sac tumor
ALS	amyotrophic lateral sclerosis	FDG	fludeoxyglucose (18F)
AOD	atlanto-occipital dislocation	FLAIR	fluid-attenuated inversion recovery
AP	anteroposterior	GBM	glioblastoma multiforme
AQP	aquaporin	GBS	Guillain-Barré syndrome
AS	ankylosing spondylitis	GC	gliomatosis cerebri
ATRT	atypical teratoid-rhabdoid tumor	GRE	gradient-recalled echo
AV	arteriovenous	HAART	highly active antiretroviral therapy
AVF	arteriovenous fistula	HIV	human immunodeficiency virus
AVM	arteriovenous malformation	HPV	human papilloma virus
CAA	cerebral amyloid angiopathy	HSV	herpes simplex virus
CBF	cerebral blood flow	HUS	hemolytic uremic syndrome
CBV	cerebral blood volume	IAC	internal auditory canal
CCF	carotid-cavernous fistula	ICA	internal cerebral artery
CECT	contrast-enhanced computed tomography	ICP	intracranial pressure
CJD	Creutzfeldt-Jakob disease	ICV	internal cerebral vein
CM	cavernous malformation	IIH	idiopathic intracranial hypertension
CMV	cytomegalovirus	IRIS	immune reconstitution inflammatory syndrome
CNS	central nervous system	JNA	juvenile nasopharyngeal angiofibroma
CPM	central pontine myelinolysis	LCH	Langerhans cell histiocytosis
CPPD	calcium pyrophosphate deposition	LNB	Lyme neuroborreliosis
CRP	C-reactive protein	MCA	middle cerebral artery
CSF	cerebrospinal fluid	MDCT	multiple-detector computed tomography
CTA	computed tomography angiography	MIP	maximum-intensity projection
CTV	computed tomography venography	MPRAGE	magnetization prepared rapid gradient echo
CVD	cortical venous drainage	MRA	magnetic resonance angiography
DAI	diffuse axonal injury	MRI	magnetic resonance imaging
DAVF	dural arteriovenous fistula	MRV	magnetic resonance venography
DCI	delayed cerebral ischemia	MS	multiple sclerosis
DIC	disseminated intravascular coagulation	MSUD	maple-syrup urine disease
DNET	dysembryoplastic neuroepithelial tumor	MTS	mesial temporal sclerosis
DNM	descending necrotizing mediastinitis	MTT	mean transit time
DSA	digital subtraction angiography	NAA	<i>N</i> -acetylaspartate
DVA	developmental venous anomaly	NBS	neuro-Behçet's syndrome
		NCC	neurocysticercosis

Abbreviations

NECT	non-enhanced computed tomography	RCVS	reversible cerebral vasoconstriction syndrome
NMO	neuromyelitis optica	SAH	subarachnoid hemorrhage
NOE	naso-orbito-ethmoidal	SCA	superior cerebellar artery
PACNS	primary angiitis of central nervous system	SCC	squamous cell carcinoma
PADI	posterior atlantodental interval	SLE	systemic lupus erythematosus
PCA	posterior cerebral artery	STIR	short tau inversion recovery
P-comm	posterior communicating artery	TB	tuberculosis
PCNSL	primary CNS lymphoma	TIA	transient ischemic attack
PCR	polymerase chain reaction	TMA	thrombotic microangiopathy
PET	positron emission tomography	TMJ	temporomandibular joint
PHPV	persistent hyperplastic primary vitreous	tPA	tissue plasminogen activator
PICA	posterior inferior cerebellar artery	TOF	time of flight
PML	progressive multifocal leukoencephalopathy	TTD	time to drain
PNET	primitive neuroectodermal tumor	TTP	thrombotic thrombocytopenic purpura
PRES	posterior reversible encephalopathy syndrome	VHL	von Hippel–Lindau
PTA	peritonsillar abscess	WD	Wallerian degeneration
rCBV	relative cerebral blood volume	ZMC	zygomaticomaxillary complex