

MRI Findings in Epilepsy

Elham Rahimian



First Published 2016

by Vije Nashr

No. 1, Havapeimaee Alley, Ostad Nejat allahi St., Enghelab Ave.

© 2016 Elham Rahimian

All rights reserved for Author.

A catalogue record for this book is available from the National Library and Archives of I.R of Iran (NLAI)

NLAI Cataloging in Publication Data

Rahimian, Elham, 1966 –

MRI findings in epilepsy / Elham Rahimian.

[6], xi p, 237 p. : illus., tables. 27.5 cm.

Includes index

1. Epilepsy. 2. Epilepsy--diagnosis. 3. Epilepsy--therapy.

LC Classification RC372

Dewey class no. 616.853

National bib no. 4080133

ISBN: 978-964-7440-64-6

Printed and Bound in Iran



T: +98(021)88910091 – F: +98(021)88910430

www.vijehnasahr.com

info@vijehnasahr.com

MRI Findings in Epilepsy

Elham Rahimian, MD

Neuroradiologist

Haghighat imaging and research center

Tehran, Iran

info@elhamrahimian.com

Cover design and typesetting: Alireza Tahsini

Production Coordinator: Advanced Bio Ray GmbH, Düsseldorf, Germany

Sponsored by: Haghighat imaging and research center



مرکز تصویربرداری پزشکی (دکتر رحیمیان) - تلفن: ۷۷۱۵۷۵۱۹-۲۰

سرشناسه	رحیمیان، الهام، ۱۳۴۵-
عنوان و نام پدید آور	Rahimian, Elham
مشخصات نشر	MRI findings in epilepsy / Elham Rahimian
مشخصات ظاهری	تهران: ویژه نشر، ۱۳۹۴ = ۲۰۱۵ م.
شابک	صفحه شمار گوناگون: مصور (رنگی)، جدول. ۱۹،۵ * ۲۷،۵
وضعیت فهرست نویسی	۶-۶۴-۷۴۴۰-۹۶۴-۹۷۸
یادداشت	فیپا
یادداشت	انگلیسی
آشفت	نمایه
آبویس	ام آر آی...
موضوع	صرع
موضوع	موضوع - - تشخیص
موضوع	صرع - درمان
رده بندی کنگره	RC۳۷۲/۳، ۳۹۴ الف
رده بندی دیویی	۶/۸۵۳
شماره کتابشناسی ملی	۴۰۸۰۱۳۳

MRI Findings in Epilepsy

نویسنده: دکتر الهام رحیمیان

چاپ اول: ۱۳۹۴

تعداد: ۷۰۰ نسخه

شابک: ۶-۶۴-۷۴۴۰-۹۶۴-۹۷۸

ناشر: شرکت انتشارات ویژه نشر

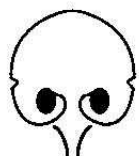
آدرس: تهران - خیابان استاد نجات اللهی - کوچه هوشیار - پلاک ۱

تلفن: ۰۲۱۸۸۹۱۰۰۹۱ دورنگار: ۰۲۱۸۸۹۱۰۴۳۰

www.vijehnasr.com info@vijehnasr.com

لیتوگرافی و چاپ: طایفه

● کلیه حقوق چاپ و نشر این اثر انحصاراً برای ناشر محفوظ و هرگونه بهره برداری از این کتاب،
موقوف به اجازه کتبی ناشر است. نقل بخشی از متن با ذکر منبع بلامانع است.



Preface

Epilepsy is one of the important subjects in Neuroradiology. In the recent decades with remarkable advances in imaging modalities, new therapeutic options developed and now more new cases are diagnosed and treated successfully. It was from 14 years ago that we decided to promote the seizure advanced imaging and surgery in Iran. We started from optimizing our MRI protocols and perform dedicated images. Now we have over 5000 patients in our data base. This Book is the result of our more than 14 years clinical and academic interest in seizure. Several case series with clinical and imaging correlations have

been presented in our regular seizure meetings. Our colleagues from all part of Iran gathered together to share their knowledge and discussed about the seizure cases from whole the country. We attempted to share our experience in seizure imaging in this book and tried to provide insight into different disease processes that may cause seizure and their association with clinical symptoms with a practical view. Also we introduced a specific chapter about postar post traumatic epilepsy and opened this discussion in the text with case presentations.



Acknowledgement

I want to thank the editorial team in the Interventional and Neuroimaging department of Tübingen University – Germany esp. Prof. Klose, Prof. Nagel and Dr. Bender for their kind contribution in editing of the book and important advices during gathering this book and case presentations.

Hereby I express my deepest thanks to all the technical, nursing, engineering and Secretarial staff of the MRI department in Haghghat imaging and research center for their support and concern.

Also I appreciate the case contribution from Khatamolanbia hospital 3T MRI department, Shefa Neuroscience research center Dr. Kazemi, Mr. Koolivand, Dr. Taheri and the pathology department.

I would like to appreciate Isfahan medical university, Ayatollah Kashani hospital's epilepsy

department esp. Dr. Mehvari, Dr. Moein et al; Shahid Beheshti medical university Mofid hospital esp. Dr. Ghofrani, Dr. Tonakaboni and Dr. Karimizade; Loghman hospital, Dr. Guive Sharifi, Dr. Gharagozli; Imam Hossein hospital, Dr. Nahid Beladi Moghadam; Tehran Medical university, Sina hospital Dr. Motamedi et al; Pars epilepsy department, Dr. Hashemi Fesharaki, et al; Razavi hospital in Mashad, Dr. Hakak; for case contribution of them.

I hope this book could be useful in diagnosis and treatment of epilepsy patients. All cases which are presented in this book are from our database and all introduced cases are pathology proved.

Finally, especial thank from my kind and supportive family for their encouragement and tolerance. Also I appreciate all my friends who encouraged me to finish this book.



Contributors

Majid. R. Tahsini

Biomedical Engineer
Haghighat Imaging Center
Tehran, Iran

Uwe Klose, PhD

Professor of Physics
Department of Diagnostic and Interventional
Neuroradiology
University Hospital Tübingen
Germany

Jafar Mehvari, MD

Associate Professor of Neurology
Department of Neurology
Ayatollah Kashani Hospital
Isfahan University of Medical Science
Isfahan, Iran

Sohrab Hashemi Fesharaki, MD

Department of Epilepsy
Pars Hospital
Tehran, Iran

Mahmoud Motamedi, MD

Associate Professor of Neurology
Department of Neurology
Sina Hospital
Tehran University
Tehran, Iran

Mohammad Ghodsi, MD

Professor of Neurosurgery
Department of Neurosurgery
Shariati Hospital
Tehran University of Medical Sciences
Tehran, Iran

Houshang Moeini, MD

Associate Professor of Neurosurgery
Department of Neurosurgery
Ayatollah Kashani Hospital
Isfahan University of Medical Science
Isfahan, Iran

Nahid Beladi Mogadam, MD

Associate Professor of Neurology
Department of Neurology
Loghman Hakim Hospital
Shahid Beheshti University
Tehran, Iran

Guive Sharifi, MD

Associate Professor of Neurosurgery
Department of Neurosurgery
Loghman Hakim Hospital
Shahid Beheshti University
Tehran, Iran

Hasan Tonekaboni, MD

Professor of Pediatric Neurology
Department of Pediatric Neurology Disease
Mofid Children's Hospital
Shahid Beheshti University of Medical Science
Tehran, Iran

Kamosh Gharagozli, MD

Associate Professor of Neurology
Department of Neurology
Loghman Hakim Hospital
Shahid Beheshti University
Tehran, Iran

Mohammad Ghofrani, MD

Professor of Pediatric Neurology
Department of Pediatric Neurology
Shahid Beheshti University of Medical Sciences
Tehran, Iran

Parvaneh Karimzadeh, MD

Professor of Pediatric Neurology
Department of Pediatric Neurology Disease
Mofid Children's Hospital
Shahid Beheshti University of Medical Science
Tehran, Iran

Taher Taheri, MD

Department of Neurosurgery
Shefa Neuroscience Research Center
Tehran, Iran

Majid Barekatin, MD

Professor of neuropsychiatry
Isfahan University of Medical sciences
Isfahan, Iran

Susan Amirsalari, MD

Associate Professor of Pediatric Neurology
Baqiyatallah University of Medical Sciences
Tehran, Iran

Jalil Arab Kheradmand, MD

Department of Neurosurgery
Milad Hospital
Tehran, Iran

Marzieh Gharakhani

General Practitioner
Department of Epilepsy
Shefa Neuroscience Research Center
Tehran, Iran

Mohsen Aghaei Hakak, MD

Department of Epilepsy
Razavi Hospital
Mashad, Iran

Mohammad Mehran Poorsina, MD

Department of Epilepsy
Shefa Neuroscience Research Center
Tehran, Iran

Fatemeh Fadaei

Department of Epilepsy
Pars Hospital
Tehran, Iran



Contents

Chapter 1: Anatomy	1
Frontal lobes	1
Temporal lobes	1
Occipital lobes	1
Parietal lobes	3
Limbic system anatomy	3
Structure of the hippocampus	4
Hippocampal Anatomy	4
Hippocampal head.....	5
Hippocampal body	5
Hippocampal tail	5
Amygdala	5
References.....	6
References of the figures.....	6

Chapter 2: Imaging Techniques.....	9
Introduction	9
T2-Weighted images.....	9
FLAIR images	9
T1-weighted inversion recovery measurements	10
T1-weighted three dimensional measurements	11
Proton magnetic resonance spectroscopy	12
T2 relaxometry	14
References.....	15

Chapter 3: Hippocampal and Para- hippocampal Disorders	17
Terminology	17
Grading of HS severity	17
How can we find the epileptogenic zone?	18
Indications of MRI in focal seizure.....	18
MRI findings.....	18
Signal alteration in hippocampus.....	18

Hippocampal atrophy	21
Loss of internal architecture.....	22
Bilateral hippocampal sclerosis	25
Hippocampal malrotation.....	25
Hippocampal sclerosis in the normal population	25
Dual pathology	26
Amygdala sclerosis	28
Hippocampal dysplasia	28
Parahippocampal gyrus abnormalities	28
Case presentations.....	31
Case 1: Pre and post operative MRI from a patient with left sided hippocampal sclerosis	31
Case 2: Left sided MTS as a classic case in MRI.....	33
Case 3: Left MTS, fully controlled after operation.....	34
Case 4: Urbach–Wiethe disease presented with focal seizure.....	35
Case 5: Right sided MTS as a classic case in MRI.....	37
Case 6: Right MTS with total treatment after surgery	38
Case 7: Classic case of right HS.....	39
Case 8: Left MTS presented as long lasting seizure till middle age	40
Case 9: Left side MTS presented with sleep seizure and totally controlled after operation..	41
Teaching Points	42
References.....	43

Chapter 4: Disorders of Cortical Development	45
Malformations due to abnormal neuronal and glial proliferation	45
Decreased proliferation / Increased apoptosis (Microcephaly)	45
Microlissencephaly / Microcephaly with Simplified Gyral Pattern	45
Abnormal proliferation and Increased proliferation / (Normal cell type).....	48
Megalencephaly.....	48
Focal cortical dysplasia	48
Focal cortical dysplasia with balloon cells (FCD type IIb).....	49
Cortical hamartomas of tuberous sclerosis.....	55
Hemimegalencephaly	60
Malformation due to abnormal neuronal migration.....	63
Lissencephaly type I, II, agyria, pachygyria, subcortical band heterotopia.....	63
Definitions.....	63
MRI findings in Lissencephaly type I	63

MRI findings in Pachygyria	63
Lissencephaly Type II (Cobblestone Lissencephaly)	66
Band heterotopia “double cortex”	66
MRI findings	66
Heterotopia	70
Subependymal heterotopia	70
Focal subcortical heterotopia	74
Abnormal cortical organization	74
Schizencephaly	74
MRI findings	74
Polymicrogyria (PMG)	78
MRI findings	79
PMG Syndromes	81
Bilateral perisylvian PMG (congenital bilateral perisylvian syndrome)	81
Bilateral frontal PMG	82
Bilateral frontoparietal PMG	82
Bilateral parasagittal parieto-occipital PMG	82
Bilateral generalized PMG	82
Non-balloon cell cortical dysplasia (Focal cortical dysplasia of Taylor without balloon)	85
Case presentations	88
Case 1: Tumefactive focal Cortical Dysplasia	88
Case 2: Dual lesion with cortical dysplasia and hippocampal sclerosis	89
Case 3: Intractable seizure originated from left temporal lobe, proved case of hippocampal dysplasia/sclerosis	90
Case 4: Left posterior temporal lobe FCD admitted by status epilepticus state	91
Case 5: Focal seizure originated from occipital lobe with subependymal heterotopia	92
Case 6: Temporal lobe seizure due to FCD	93
Case 7: Band Heterotopia with Lennox-Gastaut presentation	94
Case 8: FCD presented by uncontrolled status epilepticus lead to emergency surgery with partial control after operation	96
Case 9: A successful case of large FCD operation	116
Case 10: A case of Ts presented with refractory seizure	117
Case 11: Tiny subependymal Heterotopia presented with two different types of seizure	118
Case 12: diffuse lissencephalic changes presented with “Lennox Gastaut” syndrome	119
References	120

Chapter 5: Neoplasms.....	105
Ganglioglioma.....	105
MRI findings.....	105
Dysembryoplastic Neuroepithelial Tumor (DNET or DNT).....	107
MRI findings.....	107
Differential diagnoses of temporal lobe lesions.....	107
Differential diagnosis of slow growing cortical tumors from balloon cell FCDT	109
Meningioma	109
Hypothalamic hamartoma	110
MRI findings.....	110
Temporal lobe tumors in children	111
Case presentations	
Case 1: Classic case of DNET presented as focal seizure	112
Case 2: DNET presented with focal seizure and psychiatric manifestations.....	114
Case 3: Low grade Glioma presented as long lasting focal seizure	115
Case 4: Low grade Glioma presented with focal seizure	116
Case 5: Oligodendroglioma presented with focal seizure	118
Case 6: WHO Glioma grade I presented with seizure.....	119
Case 7: Low grade astrocytoma presented as focal seizure for 15 years	121
Case 8: Frontal lobe Ganglioglioma presented with focal seizure.....	122
Case 9: Classic case of Ganglioglioma presented with focal seizure	123
Case 10: Focal seizure due to right temporal mass pre and post operative study	124
Teaching Points	125
References.....	126
 Chapter 6: Vascular Anomalies	 129
Cerebral arterio-venous malformations (AVMs)	129
MRI findings.....	130
Cavernous angiomas.....	130
MRI findings.....	131
Venous angioma or developmental venous anomaly	132
Technical points and application of SWI in vascular anomalies.....	132
Case presentations	
Case 1: Cavernomatosis with focal seizure presentation.....	133
Case 2: Single cavernoma presented as a focal seizure	134

Case 3: Dual lesion presented as focal seizure, Cavernoma and ipsilateral HS	135
Case 4: Dual lesion presented as focal seizure, AVM and ipsilateral HS	137
Case 5: Dual lesion as Cavernoma with focal gliosis presented with focal seizure	139
Teaching Points	141
References	142
Chapter 7: Post Traumatic Epilepsy	143
MRI finding	143
Post war syndrome	146
Case presentations	148
Case 1: Post war penetrating trauma with intractable seizure	148
Case 2: Intractable seizure in post-war case with foreign body	149
Case 3: Dual lesion with post traumatic gliosis and ipsilateral HS	151
Case 4: Post traumatic, post war brain damage with intractable seizure and successful operation	151
Case 5: post war penetrating trauma with frontal seizures	153
References	155
Chapter 8: MRI and Pediatric Seizure	157
Technical aspects in pediatric MRI	157
Optional techniques	157
Application of DWI sequence in the Neurometabolic disorders	158
Metabolic disorders mainly presented with seizure	158
Classification of Epilepsy syndromes due to inborn errors of metabolism	159
MRS findings in neurometabolic disorders	162
Non-specific findings	162
Specific findings	162
Perinatal infarction	162
Ulegyria	162
Case presentations	164
Case 1: History of dermatological disorder and seizure in a proved case of "Sjogren Larsson syndrome" with typical MRS peak	164
Case 2: A12-month-old boy with epilepsy diagnosed as GM2 Gangliosidosis (Sandhoff disease)	166
Case 3: Hypoglycemic occipital lobe syndrome presented with symptomatic occipital lobe epilepsy	168

Case 4: Mitochondrial disorders; MELAS syndrome presented with seizure.....	170
Case 5: Leigh syndrome with hepatic encephalopathy after Valproic acid IV therapy for control of acute seizure.....	172
Case 6: Focal seizure in an early infant due to ischemic stroke.....	174
Case 7: Biotinidase deficiency presented with intractable seizure.....	176
Case 8: Canavan disease with hypotonia and seizure	178
Case 9: Seizure and neurodevelopmental regression due to Glutaric aciduria type I.....	180
Case 10: Seizure in Kearns-Sayre syndrome(KSS).....	182
Teaching Points.....	184
References.....	185
Chapter 9: Other Causes of Focal Seizure	187
Common central nervous system infections and epilepsy	187
Viral infections.....	187
Herpes encephalitis.....	187
MRI findings.....	187
MRI findings in other types of viral infections.....	188
Bacterial infections.....	189
MRI findings.....	190
MR Spectroscopy	191
Tuberculosis	192
MRI findings	192
Tuberculoma.....	192
Fungal infections.....	193
Parasitic infections.....	193
Helminthic infections.....	193
Inflammatory process.....	194
Rasmussen.....	194
MRI finding	194
Diagnostic criteria for RE	194
Epilepsy with cerebro-vascular diseases.....	195
Location and Seizures.....	196
MRI findings.....	197
Status epilepticus.....	197
MRI findings.....	197
Sturge-Weber syndrome	197
MRI finding	197

Case presentations.....	199
Case 1: Small focal Gliosis as the source of seizure with total cure after operation...	199
Case 2: CJD presented as cognitive deterioration and myoclonic seizure.....	200
Case 3: Seizure in neonate with diagnosis of Herpes encephalitis	202
Case 4: Seizure in immune compromised patient with superimposed Toxoplasmosis.....	203
Case 5: Sturge Weber syndrome presented with seizure	204
Case 6: Neglected anterior encephalocele presented with refractory seizure	205
Case 7: Intractable seizure and sequel of previous herpes encephalitis with hemiparasis...	207
References.....	209
 Chapter 10: MRI Interpretation	 213
How to report the MRI in epileptic cases	213
Signal abnormality of hippocampus or normal findings.....	213
Hippocampal volume loss or head rotation.....	214
Normal variation of hippocampal shape or volume loss.....	214
Normal variations related to gyral and sulcal configuration or cortical malformation	215
Incomplete myelination and correct sequence or cortical malformation in infants...	216
CSF collections.....	216
Developmental venous malformations	218
Focal cortical dysplasia versus brain tumor	219
Hippocampus signal increase due to sclerosis or mass	221
Dual pathology	222
Developmental malformations	223
Hemispheric changes as Hemimegalencephaly versus hemiatrophy	226
Transient lesion	227
Encephalocele.....	227
Teaching Points.....	228
Suggested readings.....	229
 Chapter 11: Neuropsychiatric evaluations in epilepsy surgery.....	 231
Introduction	231
Neuropsychiatric aspects of epilepsy surgery	231
Neuropsychological assessment in epilepsy surgery	233
References.....	235
 Index.....	 236