

# Sections



## Part I: Brain

### Section 1:

Pathology-Based Diagnoses:  
Malformations, Trauma, and Stroke

### Section 2:

Pathology-Based Diagnoses:  
Neoplasms, Cysts, and Disorders

### Section 3:

Anatomy-Based Diagnoses



## Part II: Spine

### Section 1:

Normal Anatomy and Congenital Disorders

### Section 2:

Trauma and Hemorrhage

### Section 3:

Degenerative Diseases and Arthritides

### Section 4:

Infection and Inflammatory Disorders

### Section 5:

Neoplasms, Cysts, and Other Masses

### Section 6:

Peripheral Nerve and Plexi

# TABLE OF CONTENTS



- 2 **Introduction to Imaging**  
Miral D. Jhaveri, MD and Palmi Shah, MD

## Part I: Brain

### SECTION 1: PATHOLOGY-BASED DIAGNOSES: MALFORMATIONS, TRAUMA, AND STROKE

#### CONGENITAL MALFORMATIONS

- 10 **Congenital Malformations Overview**  
A. James Barkovich, MD
- BRAIN MALFORMATIONS**
- 14 **Chiari 1**  
Susan I. Blaser, MD, FRCPC and Anne G. Osborn, MD, FACR
- 15 **Chiari 2**  
Susan I. Blaser, MD, FRCPC and Kevin R. Moore, MD
- 16 **Callosal Dysgenesis**  
Charles Raybaud, MD, FRCPC and Anne G. Osborn, MD, FACR
- 17 **Lipoma**  
A. James Barkovich, MD
- 18 **Dandy-Walker Continuum**  
Susan I. Blaser, MD, FRCPC
- 19 **Septooptic Dysplasia**  
A. James Barkovich, MD
- 20 **Heterotopic Gray Matter**  
Charles Raybaud, MD, FRCPC
- 21 **Polymicrogyria**  
A. James Barkovich, MD
- 22 **Schizencephaly**  
Blaise V. Jones, MD

#### NEUROCUTANEOUS SYNDROMES

- 23 **von Hippel-Lindau Syndrome**  
Anne G. Osborn, MD, FACR and Gilbert Vézina, MD
- 24 **Neurofibromatosis Type 1**  
Gilbert Vézina, MD and Anne G. Osborn, MD, FACR
- 25 **Neurofibromatosis Type 2**  
Gilbert Vézina, MD
- 26 **Tuberous Sclerosis Complex**  
Gilbert Vézina, MD and Anne G. Osborn, MD, FACR
- 27 **Sturge-Weber Syndrome**  
Gilbert Vézina, MD and Anne G. Osborn, MD, FACR
- 28 **Hereditary Hemorrhagic Telangiectasia**  
Anne G. Osborn, MD, FACR and Charles Raybaud, MD, FRCPC

- 29 **Lhermitte-Duclos Disease**  
Anne G. Osborn, MD, FACR and P. Ellen Grant, MD
- 30 **Li-Fraumeni Syndrome**  
Gilbert Vézina, MD

#### TRAUMA

- PRIMARY EFFECTS OF CNS TRAUMA**
- 31 **Introduction to CNS Imaging, Trauma**  
Anne G. Osborn, MD, FACR
- Acute Subdural Hematoma**  
Anne G. Osborn, MD, FACR and Bronwyn E. Hamilton, MD
- 38 **Subacute Subdural Hematoma**  
Anne G. Osborn, MD, FACR and Bronwyn E. Hamilton, MD
- 39 **Chronic Subdural Hematoma**  
Anne G. Osborn, MD, FACR
- 40 **Epidural Hematoma, Classic**  
Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA
- 41 **Epidural Hematoma, Variant**  
Anne G. Osborn, MD, FACR
- 42 **Abusive Head Trauma**  
Gary L. Hedlund, DO and Anne G. Osborn, MD, FACR
- 43 **Traumatic Subarachnoid Hemorrhage**  
Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA
- 44 **Cerebral Contusion**  
Anne G. Osborn, MD, FACR
- 45 **Diffuse Axonal Injury**  
Anne G. Osborn, MD, FACR
- 46 **Subcortical Injury**  
Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA
- SECONDARY EFFECTS OF CNS TRAUMA**
- 47 **Intracranial Herniation Syndromes**  
Anne G. Osborn, MD, FACR
- 48 **Traumatic Cerebral Ischemia/Infarction**  
Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA
- 49 **Brain Death**  
Anne G. Osborn, MD, FACR
- 50 **Second Impact Syndrome**  
Anne G. Osborn, MD, FACR
- 51 **Traumatic Intracranial Arterial Dissection**  
Anne G. Osborn, MD, FACR
- 52 **Traumatic Carotid Cavernous Fistula**  
Anne G. Osborn, MD, FACR and Perry P. Ng, MBBS (Hons), FRANZCR

# TABLE OF CONTENTS

53	<b>Chronic Traumatic Encephalopathy</b> <i>Anne G. Osborn, MD, FACP</i>	92	<b>Extracranial Vertebral Artery Dissection</b> <i>Lubdha M. Shah, MD</i>		
<b>VASCULAR ANATOMY AND STROKE</b>					
<b>VASCULAR ANATOMY</b>					
54	<b>Intracranial Arteries Overview</b> <i>Anne G. Osborn, MD, FACP</i>	93	<b>Adult Hypoxic Ischemic Injury</b> <i>Karen L. Salzman, MD and Lubdha M. Shah, MD</i>		
60	<b>Intracranial Venous System Overview</b> <i>Anne G. Osborn, MD, FACP</i>	94	<b>Hypotensive Cerebral Infarction</b> <i>Anne G. Osborn, MD, FACP and Bronwyn E. Hamilton, MD</i>		
68	<b>Stroke Overview</b> <i>Karen L. Salzman, MD</i>	95	<b>Childhood Stroke</b> <i>Anne G. Osborn, MD, FACP and Blaise V. Jones, MD</i>		
<b>NONTRAUMATIC INTRACRANIAL HEMORRHAGE</b>					
74	<b>Evolution of Intracranial Hemorrhage</b> <i>Karen L. Salzman, MD and Ulrich Rassner, MD</i>	96	<b>Acute Cerebral Ischemia-Infarction</b> <i>Anne G. Osborn, MD, FACP and Edward P. Quigley, III, MD, PhD</i>		
75	<b>Spontaneous Nontraumatic Intracranial Hemorrhage</b> <i>Karen L. Salzman, MD and Laurie A. Loevner, MD</i>	97	<b>Subacute Cerebral Infarction</b> <i>Karen L. Salzman, MD and Sheri L. Harder, MD, FRCPC</i>		
76	<b>Hypertensive Intracranial Hemorrhage</b> <i>Karen L. Salzman, MD and Laurie A. Loevner, MD</i>	98	<b>Chronic Cerebral Infarction</b> <i>Sheri L. Harder, MD, FRCPC and Anne G. Osborn, MD, FACP</i>		
<b>ATHEROSCLEROSIS AND CAROTID STENOSIS</b>					
77	<b>Arteriolosclerosis</b> <i>Karen L. Salzman, MD</i>	99	<b>Multiple Embolic Cerebral Infarctions</b> <i>Karen L. Salzman, MD</i>		
78	<b>Intracranial Atherosclerosis</b> <i>Anne G. Osborn, MD, FACP</i>	100	<b>Fat Emboli Cerebral Infarction</b> <i>Karen L. Salzman, MD</i>		
79	<b>Extracranial Atherosclerosis</b> <i>Karen L. Salzman, MD and Bronwyn E. Hamilton, MD</i>	101	<b>Lacunar Infarction</b> <i>Karen L. Salzman, MD and Ulrich Rassner, MD</i>		
<b>NONATHEROMATOUS VASCULOPATHY</b>					
80	<b>Moyamoya</b> <i>Anne G. Osborn, MD, FACP and Anna Illner, MD</i>	102	<b>Cerebral Hyperperfusion Syndrome (CHS)</b> <i>Anne G. Osborn, MD, FACP</i>		
81	<b>Primary Arteritis of the CNS</b> <i>Anne G. Osborn, MD, FACP</i>	103	<b>Dural Sinus Thrombosis</b> <i>Anne G. Osborn, MD, FACP</i>		
82	<b>Miscellaneous Vasculitis</b> <i>Anne G. Osborn, MD, FACP</i>	104	<b>Cavernous Sinus Thrombosis/Thrombophlebitis</b> <i>Anne G. Osborn, MD, FACP</i>		
83	<b>Reversible Cerebral Vasoconstriction Syndrome</b> <i>Karen L. Salzman, MD and Perry P. Ng, MBBS (Hons), FRANZCR</i>	105	<b>Cortical Venous Thrombosis</b> <i>Anne G. Osborn, MD, FACP and Bronwyn E. Hamilton, MD</i>		
84	<b>Vasospasm</b> <i>Karen L. Salzman, MD and Perry P. Ng, MBBS (Hons), FRANZCR</i>	106	<b>Deep Cerebral Venous Thrombosis</b> <i>Anne G. Osborn, MD, FACP and Bronwyn E. Hamilton, MD</i>		
85	<b>Systemic Lupus Erythematosus</b> <i>Karen L. Salzman, MD and Gary M. Nesbit, MD</i>	<b>SUBARACHNOID HEMORRHAGE AND ANEURYSMS</b>			
86	<b>Cerebral Amyloid Angiopathy (CAA)</b> <i>Karen L. Salzman, MD and Bronwyn E. Hamilton, MD</i>	107	<b>Subarachnoid Hemorrhage and Aneurysms Overview</b> <i>Anne G. Osborn, MD, FACP</i>		
87	<b>CADASIL</b> <i>Karen L. Salzman, MD and Ulrich Rassner, MD</i>	109	<b>Aneurysmal Subarachnoid Hemorrhage</b> <i>Anne G. Osborn, MD, FACP</i>		
88	<b>Behçet Disease</b> <i>Karen L. Salzman, MD</i>	110	<b>Perimesencephalic Nonaneurysmal Subarachnoid Hemorrhage (pnSAH)</b> <i>Anne G. Osborn, MD, FACP</i>		
89	<b>Susac Syndrome</b> <i>Karen L. Salzman, MD and Jeffrey S. Anderson, MD, PhD</i>	111	<b>Convexal Subarachnoid Hemorrhage (cSAH)</b> <i>Anne G. Osborn, MD, FACP</i>		
90	<b>Fibromuscular Dysplasia</b> <i>Karen L. Salzman, MD and Perry P. Ng, MBBS (Hons), FRANZCR</i>	112	<b>Saccular Aneurysm</b> <i>Anne G. Osborn, MD, FACP and Perry P. Ng, MBBS (Hons), FRANZCR</i>		
91	<b>Extracranial Internal Carotid Artery Dissection</b> <i>Rebecca S. Cornelius, MD, FACP</i>	113	<b>Vertebobasilar Dolichoectasia</b> <i>Anne G. Osborn, MD, FACP</i>		
		114	<b>Atherosclerotic Vascular Disease (ASVD) Fusiform Aneurysm</b> <i>Anne G. Osborn, MD, FACP</i>		
<b>VASCULAR MALFORMATIONS</b>					
115	<b>Vascular Malformations Overview</b> <i>Anne G. Osborn, MD, FACP</i>				

# TABLE OF CONTENTS

- 117 **Arteriovenous Malformation**  
Anne G. Osborn, MD, FACP and Perry P. Ng, MBBS (Hons), FRANZCR
- 118 **Dural Arteriovenous Fistula**  
Anne G. Osborn, MD, FACP and Perry P. Ng, MBBS (Hons), FRANZCR
- 119 **Developmental Venous Anomaly**  
Anne G. Osborn, MD, FACP
- 120 **Cavernous Malformation**  
Anne G. Osborn, MD, FACP
- 121 **Capillary Telangiectasia**  
Anne G. Osborn, MD, FACP

## SECTION 2: PATHOLOGY-BASED DIAGNOSES: NEOPLASMS, CYSTS, AND DISORDERS

### NEOPLASMS

- 124 **Neoplasms Overview**  
Anne G. Osborn, MD, FACP
- ASTROCYTOMAS**
- 128 **Low-Grade Diffuse Astrocytoma**  
Karen L. Salzman, MD
- 129 **Anaplastic Astrocytoma**  
Karen L. Salzman, MD
- 130 **Pilocytic Astrocytoma**  
Karen L. Salzman, MD and Chang Yueh Ho, MD
- 131 **Glioblastoma**  
Karen L. Salzman, MD
- 132 **Gliomatosis Cerebri**  
Karen L. Salzman, MD

### NONASTROCYTIC GLIOMAS

- 133 **Oligodendrogioma**  
Karen L. Salzman, MD
- 134 **Anaplastic Oligodendrogioma**  
Karen L. Salzman, MD
- 135 **Infratentorial Ependymoma**  
Anne G. Osborn, MD, FACP and Majda M. Thurnher, MD
- 136 **Subependymoma**  
Karen L. Salzman, MD
- 137 **Typical Choroid Plexus Papilloma**  
Anne G. Osborn, MD, FACP and Chang Yueh Ho, MD

### NEURONAL AND MIXED NEURONAL-GLIAL TUMORS

- 138 **Ganglioglioma**  
Karen L. Salzman, MD
- 139 **Dysembryoplastic Neuroepithelial Tumor (DNET)**  
Karen L. Salzman, MD and Laurie A. Loewner, MD
- 140 **Central Neurocytoma**  
Karen L. Salzman, MD

### PINEAL AND GERM CELL TUMORS

- 141 **Pineocytoma**  
Karen L. Salzman, MD and Laurie A. Loevner, MD

- 142 **Pineal Parenchymal Tumor of Intermediate Differentiation (PPTID)**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP
- 143 **Germinoma**  
Anne G. Osborn, MD, FACP and Majda M. Thurnher, MD

### MISCELLANEOUS PRIMARY TUMORS

- 144 **Medulloblastoma**  
Anne G. Osborn, MD, FACP and Majda M. Thurnher, MD
- 145 **Hemangioblastoma**  
Karen L. Salzman, MD and John H. Rees, MD
- 146 **Primary CNS Lymphoma**  
Karen L. Salzman, MD
- 147 **Intravascular (Angiocentric) Lymphoma**  
Karen L. Salzman, MD
- 148 **Leukemia**  
Karen L. Salzman, MD and Miral D. Jhaveri, MD

### METASTATIC TUMORS AND REMOTE EFFECTS OF CANCER

- 149 **Parenchymal Metastases**  
Anne G. Osborn, MD, FACP
- 150 **Miscellaneous Intracranial Metastases**  
Anne G. Osborn, MD, FACP
- 151 **Metastatic Intracranial Lymphoma**  
Karen L. Salzman, MD
- 152 **Paraneoplastic Syndromes and Limbic Encephalitis**  
Karen L. Salzman, MD

### TREATMENT-RELATED EFFECTS

- 153 **Radiation and Chemotherapy**  
Miral D. Jhaveri, MD and Karen L. Salzman, MD
- 154 **Pseudoprogression (PsP)**  
Karen L. Salzman, MD
- 155 **Pseudoresponse**  
Karen L. Salzman, MD

### PRIMARY NONNEOPLASTIC CYSTS

- 156 **Primary Nonneoplastic Cysts Overview**  
Anne G. Osborn, MD, FACP
- 160 **Arachnoid Cyst**  
Anne G. Osborn, MD, FACP
- 161 **Colloid Cyst**  
Anne G. Osborn, MD, FACP
- 162 **Dermoid Cyst**  
Chang Yueh Ho, MD
- 163 **Epidermoid Cyst**  
Anne G. Osborn, MD, FACP and Gregory L. Katzman, MD, MBA
- 164 **Hippocampal Sulcus Remnant Cysts**  
Chang Yueh Ho, MD
- 165 **Enlarged Perivascular Spaces**  
Anne G. Osborn, MD, FACP
- 166 **Pineal Cyst**  
Anne G. Osborn, MD, FACP
- 167 **Choroid Plexus Cyst**  
Anne G. Osborn, MD, FACP

# TABLE OF CONTENTS

168	<b>Porencephalic Cyst</b> <i>Anne G. Osborn, MD, FACP and Gregory L. Katzman, MD, MBA</i>	194	<b>CLIPPERS</b> <i>Anne G. Osborn, MD, FACP</i>
<b>INFECTIOUS, INFLAMMATORY, AND DEMYELINATING DISEASE</b>			
<b>INFECTIONS</b>			
169	<b>CNS Infectious Disease Overview</b> <i>Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP</i>	195	<b>Inherited Metabolic Disorders Overview</b> <i>A. James Barkovich, MD</i>
171	<b>Meningitis</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	199	<b>Leigh Syndrome</b> <i>A. James Barkovich, MD</i>
172	<b>Abscess</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	200	<b>MELAS</b> <i>Susan I. Blaser, MD, FRCPC</i>
173	<b>Ventriculitis</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	201	<b>Kearns-Sayre Syndrome</b> <i>Susan I. Blaser, MD, FRCPC</i>
174	<b>Empyema</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	202	<b>Mucopolysaccharidoses</b> <i>Susan I. Blaser, MD, FRCPC</i>
175	<b>Herpes Encephalitis</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	203	<b>Metachromatic Leukodystrophy (MLD)</b> <i>Anna Illner, MD and Anne G. Osborn, MD, FACP</i>
176	<b>HHV-6 Encephalitis</b> <i>Miral D. Jhaveri, MD</i>	204	<b>Fabry Disease</b> <i>Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP</i>
177	<b>West Nile Virus Encephalitis</b> <i>Miral D. Jhaveri, MD and Laurie A. Loevner, MD</i>	205	<b>X-Linked Adrenoleukodystrophy</b> <i>Susan I. Blaser, MD, FRCPC and Anne G. Osborn, MD, FACP</i>
178	<b>Miscellaneous Encephalitis</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	206	<b>Canavan Disease</b> <i>P. Ellen Grant, MD</i>
179	<b>Cerebellitis</b> <i>Miral D. Jhaveri, MD</i>	207	<b>Alexander Disease</b> <i>Anna Illner, MD</i>
180	<b>Tuberculosis</b> <i>Miral D. Jhaveri, MD and Sheri L. Harder, MD, FRCPC</i>	208	<b>Neurodegeneration With Brain Iron Accumulation (NBIA)</b> <i>Chang Yueh Ho, MD and Anne G. Osborn, MD, FACP</i>
181	<b>Neurocysticercosis</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>	209	<b>Pantothenate Kinase-Associated Neurodegeneration (PKAN)</b> <i>Anna Illner, MD</i>
182	<b>Lyme Disease</b> <i>Miral D. Jhaveri, MD and Laurie A. Loevner, MD</i>	210	<b>Huntington Disease</b> <i>James M. Provenzale, MD</i>
183	<b>Acquired HIV Encephalitis</b> <i>Miral D. Jhaveri, MD and James M. Provenzale, MD</i>	211	<b>Wilson Disease</b> <i>Anne G. Osborn, MD, FACP and James M. Provenzale, MD</i>
184	<b>Acquired Toxoplasmosis</b> <i>Miral D. Jhaveri, MD and James M. Provenzale, MD</i>	<b>ACQUIRED TOXIC/METABOLIC/DEGENERATIVE DISORDERS</b>	
185	<b>Acquired CMV</b> <i>Miral D. Jhaveri, MD and Yoshimi Anzai, MD, MPH</i>	212	<b>Acquired Toxic/Metabolic Disorders Overview</b> <i>Miral D. Jhaveri, MD and Karen L. Salzman, MD</i>
186	<b>Fungal Infections</b> <i>Anne G. Osborn, MD, FACP</i>	<b>TOXIC, METABOLIC, NUTRITIONAL, SYSTEMIC DISEASES WITH CNS MANIFESTATIONS</b>	
187	<b>Cryptococcosis</b> <i>Yoshimi Anzai, MD, MPH</i>	216	<b>Adult Hypoglycemia</b> <i>Miral D. Jhaveri, MD and John H. Rees, MD</i>
188	<b>Progressive Multifocal Leukoencephalopathy (PML)</b> <i>Miral D. Jhaveri, MD and Yoshimi Anzai, MD, MPH</i>	217	<b>Thyroid Disorders</b> <i>Miral D. Jhaveri, MD</i>
189	<b>Immune Reconstitution Inflammatory Syndrome (IRIS)</b> <i>Miral D. Jhaveri, MD</i>	218	<b>Parathyroid Disorders</b> <i>Miral D. Jhaveri, MD</i>
190	<b>HIV/AIDS, Miscellaneous Manifestations</b> <i>Miral D. Jhaveri, MD</i>	219	<b>Fahr Disease</b> <i>Miral D. Jhaveri, MD and Gregory L. Katzman, MD, MBA</i>
<b>DEMYELINATING DISORDERS</b>			
191	<b>Multiple Sclerosis</b> <i>Miral D. Jhaveri, MD</i>	220	<b>Alcoholic Encephalopathy</b> <i>Miral D. Jhaveri, MD</i>
192	<b>Neuromyelitis Optica</b> <i>Miral D. Jhaveri, MD</i>	221	<b>Hepatic Encephalopathy</b> <i>Miral D. Jhaveri, MD</i>
193	<b>Acute Disseminated Encephalomyelitis (ADEM)</b> <i>Miral D. Jhaveri, MD and Jeffrey S. Anderson, MD, PhD</i>		

# TABLE OF CONTENTS

- 222 **Acute Hypertensive Encephalopathy, Posterior Reversible Encephalopathy Syndrome (PRES)**  
Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP  
223 **Chronic Hypertensive Encephalopathy**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
224 **Idiopathic Intracranial Hypertension**  
Miral D. Jhaveri, MD  
225 **Carbon Monoxide Poisoning**  
Yoshimi Anzai, MD, MPH  
226 **Drug Abuse**  
Miral D. Jhaveri, MD  
227 **Osmotic Demyelination Syndrome**  
Miral D. Jhaveri, MD and Sheri L. Harder, MD, FRCPC  
228 **Mesial Temporal Sclerosis**  
Miral D. Jhaveri, MD and Kevin R. Moore, MD  
229 **Status Epilepticus**  
Miral D. Jhaveri, MD and Karen L. Salzman, MD  
230 **Transient Global Amnesia (TGA)**  
Anne G. Osborn, MD, FACP

## DEMENTIAS AND DEGENERATIVE DISORDERS

- 231 **Normal Aging Brain**  
Miral D. Jhaveri, MD and Sheri L. Harder, MD, FRCPC  
232 **Alzheimer Disease**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
233 **Vascular Dementia**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
234 **Frontotemporal Lobar Degeneration**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
235 **Dementia With Lewy Bodies**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
236 **Creutzfeldt-Jakob Disease (CJD), Classic**  
Miral D. Jhaveri, MD and Karen L. Salzman, MD  
237 **Creutzfeldt-Jakob Disease (CJD), Variants**  
Anne G. Osborn, MD, FACP  
238 **Parkinson Disease**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
239 **Multiple System Atrophy**  
Miral D. Jhaveri, MD  
240 **Posterior Cortical Atrophy**  
Anne G. Osborn, MD, FACP  
241 **Corticobasal Degeneration**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
242 **Progressive Supranuclear Palsy (PSP)**  
Miral D. Jhaveri, MD and James M. Provenzale, MD  
243 **Amyotrophic Lateral Sclerosis (ALS)**  
Miral D. Jhaveri, MD and Lubdha M. Shah, MD  
244 **Wallerian Degeneration**  
Miral D. Jhaveri, MD and Lubdha M. Shah, MD  
245 **Spinocerebellar Ataxias**  
Anne G. Osborn, MD, FACP  
246 **Crossed Cerebellar Diaschisis**  
Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP  
247 **Hypertrophic Olivary Degeneration**  
Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP

## SECTION 3: ANATOMY-BASED DIAGNOSES

### VENTRICLES AND CISTERNS

- 250 **Ventricles and Cisterns Overview**  
Miral D. Jhaveri, MD  
256 **Cavum Septi Pellucidi (CSP)**  
Miral D. Jhaveri, MD and Anne G. Osborn, MD, FACP  
257 **Intraventricular Obstructive Hydrocephalus**  
Miral D. Jhaveri, MD  
258 **Extraventricular Obstructive Hydrocephalus**  
Miral D. Jhaveri, MD  
259 **Aqueductal Stenosis**  
Miral D. Jhaveri, MD and Kevin R. Moore, MD  
260 **Normal Pressure Hydrocephalus**  
Miral D. Jhaveri, MD  
261 **CSF Shunts and Complications**  
Miral D. Jhaveri, MD and Kevin R. Moore, MD

### SELLA AND PITUITARY

- 262 **Sella and Pituitary Overview**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP  
266 **Pituitary Anomalies**  
Karen L. Salzman, MD and Kevin R. Moore, MD  
267 **Pituitary Microadenoma**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP  
268 **Pituitary Macroadenoma**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP  
269 **Pituitary Apoplexy**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP  
270 **Rathke Cleft Cyst**  
Karen L. Salzman, MD and Anne G. Osborn, MD, FACP  
271 **Craniopharyngioma**  
Karen L. Salzman, MD and John H. Rees, MD  
272 **Empty Sella**  
Luke N. Ledbetter, MD and Anne G. Osborn, MD, FACP  
273 **Pituitary Hyperplasia**  
Luke N. Ledbetter, MD and Anne G. Osborn, MD, FACP  
274 **Lymphocytic Hypophysitis**  
Karen L. Salzman, MD

### CEREBELLOPONTINE ANGLE AND INTERNAL AUDITORY CANAL (CPA-IAC)

- 275 **CPA-IAC Overview**  
H. Ric Harnsberger, MD  
279 **Epidermoid Cyst, CPA-IAC**  
H. Ric Harnsberger, MD  
280 **Arachnoid Cyst, CPA-IAC**  
H. Ric Harnsberger, MD  
281 **Bell's Palsy**  
H. Ric Harnsberger, MD  
282 **Trigeminal Neuralgia**  
H. Ric Harnsberger, MD  
283 **Hemifacial Spasm**  
H. Ric Harnsberger, MD  
284 **Vestibular Schwannoma**  
H. Ric Harnsberger, MD

# TABLE OF CONTENTS

- 285 **Nonvestibular Schwannoma**  
*Nicholas A. Koontz, MD and Anne G. Osborn, MD, FACR*  
286 **Meningioma, CPA-IAC**  
*H. Ric Harnsberger, MD*  
287 **Metastases, CPA-IAC**  
*H. Ric Harnsberger, MD*

## SKULL, SCALP, AND MENINGES

- 288 **Skull, Scalp, and Meninges Overview**  
*Karen L. Salzman, MD*

## NONNEOPLASTIC DISORDERS

- 292 **Intracranial Hypotension**  
*Anne G. Osborn, MD, FACR*  
293 **Skull Base CSF Leak**  
*Patricia A. Hudgins, MD, FACR*  
294 **Intracranial Idiopathic Inflammatory Pseudotumor**  
*H. Ric Harnsberger, MD*  
295 **IgG4-Related Disease**  
*Anne G. Osborn, MD, FACR*  
296 **Fibrous Dysplasia**  
*Anne G. Osborn, MD, FACR and Miral D. Jhaveri, MD*  
297 **Paget Disease**  
*Anne G. Osborn, MD, FACR and Miral D. Jhaveri, MD*  
298 **Thick Skull**  
*Anne G. Osborn, MD, FACR and Miral D. Jhaveri, MD*  
299 **Langerhans Cell Histiocytosis, Skull and Brain**  
*Anne G. Osborn, MD, FACR and Gary L. Hedlund, DO*  
300 **Neurosarcoid**  
*Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA*  
301 **Trichilemmal Cyst**  
*Anne G. Osborn, MD, FACR*

## NEOPLASMS

- 302 **Meningioma**  
*Anne G. Osborn, MD, FACR and Majda M. Thurnher, MD*  
303 **Atypical and Malignant Meningioma**  
*Anne G. Osborn, MD, FACR and Majda M. Thurnher, MD*  
304 **Calvarial Hemangioma**  
*Anne G. Osborn, MD, FACR and Gregory L. Katzman, MD, MBA*  
305 **Myeloma**  
*Anne G. Osborn, MD, FACR and Miral D. Jhaveri, MD*  
306 **Skull and Meningeal Metastases**  
*Anne G. Osborn, MD, FACR and Miral D. Jhaveri, MD*

## EYE, ORBIT, AND OPTIC NERVE

### OVERVIEW

- 307 **Orbit Overview**  
*H. Christian Davidson, MD*

### NONNEOPLASTIC DISORDERS

- 311 **Optic Neuritis**  
*H. Christian Davidson, MD*  
312 **Thyroid Ophthalmopathy**  
*H. Christian Davidson, MD*

- 313 **Orbital Idiopathic Inflammatory Pseudotumor**  
*H. Christian Davidson, MD*

## NEOPLASMS

- 314 **Optic Pathway Glioma**  
*Deborah R. Shatzkes, MD*  
315 **Optic Nerve Sheath Meningioma**  
*Deborah R. Shatzkes, MD*

## Part II: Spine

### SECTION 1: NORMAL ANATOMY AND CONGENITAL DISORDERS

#### ANATOMY

- 318 **Normal Spine Anatomy**  
*Jeffrey S. Ross, MD*  
324 **Approach to Spine and Spinal Cord Development**  
*Kevin R. Moore, MD*

### MALFORMATIONS, CONGENITAL DISORDERS, AND SCOLIOSIS

- 332 **Myelomeningocele**  
*Kevin R. Moore, MD*  
333 **Dorsal Dermal Sinus**  
*Kevin R. Moore, MD*  
334 **Simple Coccygeal Dimple**  
*Kevin R. Moore, MD*  
335 **Tethered Spinal Cord**  
*Kevin R. Moore, MD*  
336 **Klippel-Feil Spectrum**  
*Kevin R. Moore, MD*  
337 **Dural Dysplasia**  
*Kevin R. Moore, MD*  
338 **Neurofibromatosis Type 1**  
*Kevin R. Moore, MD*  
339 **Neurofibromatosis Type 2**  
*Jeffrey S. Ross, MD*  
340 **Achondroplasia**  
*Bryson Borg, MD*  
341 **Kyphosis**  
*Kevin R. Moore, MD*  
342 **Scoliosis**  
*Kevin R. Moore, MD*  
343 **Degenerative Scoliosis**  
*Jeffrey S. Ross, MD*

### SECTION 2: TRAUMA AND HEMORRHAGE

- 346 **Central Spinal Cord Syndrome**  
*Bryson Borg, MD and Jeffrey S. Ross, MD*  
347 **Posttraumatic Syrinx**  
*Jeffrey S. Ross, MD*  
348 **Spinal Cord Contusion-Hematoma**  
*Bryson Borg, MD and Jeffrey S. Ross, MD*  
349 **Spontaneous Epidural Hematoma**  
*Jeffrey S. Ross, MD*  
350 **Subdural Hematoma**  
*Jeffrey S. Ross, MD*

# TABLE OF CONTENTS

- 351 Subarachnoid Hemorrhage  
*Jeffrey S. Ross, MD*

## SECTION 3: DEGENERATIVE DISEASES AND ARTHRIDES

### SPINE DEGENERATIONS

- 354 Nomenclature of Degenerative Disc Disease  
*Jeffrey S. Ross, MD*
- 358 Degenerative Disc Disease  
*Jeffrey S. Ross, MD*
- 359 Disc Bulge  
*Jeffrey S. Ross, MD*
- 360 Cervical Intervertebral Disc Herniation  
*Jeffrey S. Ross, MD*
- 361 Thoracic Intervertebral Disc Herniation  
*Jeffrey S. Ross, MD*
- 362 Lumbar Intervertebral Disc Herniation  
*Jeffrey S. Ross, MD*
- 363 Intervertebral Disc Extrusion, Foraminal  
*Jeffrey S. Ross, MD*
- 364 Cervical Facet Arthropathy  
*Jeffrey S. Ross, MD*
- 365 Lumbar Facet Arthropathy  
*Jeffrey S. Ross, MD*
- 366 Schmorl Node  
*Jeffrey S. Ross, MD and Kevin R. Moore, MD*
- 367 Scheuermann Disease  
*Jeffrey S. Ross, MD and Kevin R. Moore, MD*
- 368 Acquired Lumbar Central Stenosis  
*Jeffrey S. Ross, MD*
- 369 Congenital Spinal Stenosis  
*Jeffrey S. Ross, MD*
- 370 Cervical Spondylosis  
*Jeffrey S. Ross, MD*
- 371 Diffuse Idiopathic Skeletal Hyperostosis (DISH)  
*Jeffrey S. Ross, MD*
- 372 Ossification of Posterior Longitudinal Ligament (OPLL)  
*Jeffrey S. Ross, MD*

### SPONDYLOLISTHESIS AND SPONDYLOLYSIS

- 373 Spondylolisthesis  
*Jeffrey S. Ross, MD*
- 374 Spondylolysis  
*Jeffrey S. Ross, MD*

### INFLAMMATORY, CRYSTALLINE, AND MISCELLANEOUS ARTHRITIDES

- 375 Adult Rheumatoid Arthritis  
*Jeffrey S. Ross, MD*
- 376 Calcium Pyrophosphate Dihydrate Deposition (CPPD)  
*Jeffrey S. Ross, MD*
- 377 Ankylosing Spondylitis  
*Jeffrey S. Ross, MD*

## SECTION 4: INFECTION AND INFLAMMATORY DISORDERS

### INFECTIONS

- 380 Pathways of Spread of Infection  
*Jeffrey S. Ross, MD*
- 384 Spinal Meningitis  
*Lubdha M. Shah, MD*
- 385 Tuberculous Osteomyelitis  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*
- 386 Paraspinal Abscess  
*Lubdha M. Shah, MD*
- 387 Epidural Abscess  
*Lubdha M. Shah, MD*
- 388 Subdural Abscess  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 389 Viral Myelitis  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 390 HIV Myelitis  
*Lubdha M. Shah, MD*
- 391 Opportunistic Infections  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*

### INFLAMMATORY AND AUTOIMMUNE DISORDERS

- 392 Acute Transverse Myelopathy  
*Jeffrey S. Ross, MD*
- 393 Idiopathic Acute Transverse Myelitis  
*Kevin R. Moore, MD*
- 394 Multiple Sclerosis  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 395 Neuromyelitis Optica  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*
- 396 Acute Disseminated Encephalomyelitis (ADEM)  
*Jeffrey S. Ross, MD*
- 397 Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP)  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 398 Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)  
*Jeffrey S. Ross, MD*
- 399 Sarcoidosis  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*
- 400 Subacute Combined Degeneration  
*Lubdha M. Shah, MD*
- 401 Paraneoplastic Myelopathy  
*Jeffrey S. Ross, MD*

## SECTION 5: NEOPLASMS, CYSTS, AND OTHER MASSES

### NEOPLASMS

- 404 Spread of Neoplasms  
*Jeffrey S. Ross, MD*

### EXTRADURAL

- 408 Blastic Osseous Metastases  
*Bryson Borg, MD*

# TABLE OF CONTENTS

- 409 **Lytic Osseous Metastases**  
*Bryson Borg, MD*
- 410 **Hemangioma**  
*Bryson Borg, MD*
- 411 **Lymphoma**  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*
- 412 **Leukemia**  
*Lubdha M. Shah, MD*
- 413 **Plasmacytoma**  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 414 **Multiple Myeloma**  
*Lubdha M. Shah, MD*
- 
- INTRADURAL EXTRAMEDULLARY**
- 415 **Schwannoma**  
*Bryson Borg, MD and Kevin R. Moore, MD*
- 416 **Meningioma**  
*Bryson Borg, MD and Jeffrey S. Ross, MD*
- 417 **Neurofibroma**  
*Bryson Borg, MD and Kevin R. Moore, MD*
- 418 **Metastases, CSF Disseminated**  
*Bryson Borg, MD*
- 
- INTRAMEDULLARY**
- 419 **Astrocytoma**  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 420 **Classic Ependymoma**  
*Kevin R. Moore, MD*
- 421 **Myxopapillary Ependymoma**  
*Kevin R. Moore, MD*
- 422 **Spinal Cord Metastases**  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*
- 
- NEOPLASMS AND TREATMENT-RELATED EFFECTS**
- 423 **Radiation Myelopathy**  
*Kevin R. Moore, MD*
- 424 **Postirradiation Vertebral Marrow**  
*Kevin R. Moore, MD*
- 425 **Anterior Lumbar Radiculopathy**  
*Kevin R. Moore, MD*
- 
- NONNEOPLASTIC CYSTS AND TUMOR MIMICS**
- 
- CYSTS**
- 426 **CSF Flow Artifact**  
*Lubdha M. Shah, MD and Kevin R. Moore, MD*
- 427 **Perineural Root Sleeve Cyst**  
*Kevin R. Moore, MD*
- 
- NONNEOPLASTIC MASSES AND TUMOR MIMICS**
- 428 **Epidural Lipomatosis**  
*Julia R. Crim, MD*
- 429 **Normal Fatty Marrow Variants**  
*Julia R. Crim, MD*
- 430 **IgG4-Related Disease/Hypertrophic Pachymeningitis**  
*Jeffrey S. Ross, MD*

## VASCULAR AND SYSTEMIC DISORDERS

### VASCULAR LESIONS

- 431 **Vascular Anatomy**  
*Jeffrey S. Ross, MD*
- 437 **Type 1 Vascular Malformation (dAVF)**  
*Jeffrey S. Ross, MD*
- 438 **Spinal Cord Infarction**  
*Jeffrey S. Ross, MD*

### SPINAL MANIFESTATIONS OF SYSTEMIC DISEASES

- 439 **Osteoporosis**  
*Lubdha M. Shah, MD and Jeffrey S. Ross, MD*

## SECTION 6: PERIPHERAL NERVE AND PLEXI

- 442 **Normal Plexus and Nerve Anatomy**  
*Kevin R. Moore, MD*
- 448 **Superior Sulcus Tumor**  
*Kevin R. Moore, MD*
- 449 **Thoracic Outlet Syndrome**  
*Kevin R. Moore, MD*
- 450 **Muscle Denervation**  
*Julia R. Crim, MD*
- 451 **Brachial Plexus Traction Injury**  
*Kevin R. Moore, MD*
- 452 **Idiopathic Brachial Plexus Neuritis**  
*Julia R. Crim, MD and Kevin R. Moore, MD*
- 453 **Hypertrophic Neuropathy**  
*Kevin R. Moore, MD*
- 454 **Femoral Neuropathy**  
*Kevin R. Moore, MD*
- 455 **Ulnar Neuropathy**  
*Kevin R. Moore, MD*
- 456 **Suprascapular Neuropathy**  
*Julia R. Crim, MD*
- 457 **Median Neuropathy**  
*Kevin R. Moore, MD*
- 458 **Common Peroneal Neuropathy**  
*Kevin R. Moore, MD*
- 459 **Tibial Neuropathy**  
*Julia R. Crim, MD*