CONTENTS

1. **The History of Cerebral Vasospasm** 1
Milo A Hollingworth, Ketan R Bulsara

2. **Definitions and Epidemiology of Vasospasm** 4
Hardik Amin, David M Greer

3. **Recent Topics and Advances in the Molecular Mechanisms Contributing to Cerebral Vasospasm in Subarachnoid Hemorrhage** 8
Robert J Claycomb, Kevin N Sheth

Endothelin-1 8; Neuroinflammation and Host Defense 9; Antioxidants and Scavengers of Free Radicals 10; Tenascin-C and Platelet-Derived Growth Factor 10; Inhibition of HMG-CoA Reductase 10; Vasodilators 11; Antiepileptic Drugs 11

4. **The Pathophysiology and Pathology of Cerebral Vasospasm Following Subarachnoid Hemorrhage** 16
David Y Hwang, Anita J Huttner

Anatomic Considerations 16; Morphological Alterations in Cerebral Arteries after Subarachnoid Hemorrhage 17; Pathophysiology of Vasospasm 17

5. **Imaging of Vasospasm: The Role of Magnetic Resonance Imaging in Subarachnoid Hemorrhage-Related Vasospasm** 23
Amit Mahajan, Michele H Johnson

Pathophysiology 23; Techniques and Sequences 24; Magnetic Resonance Perfusion Imaging 24; Limitations of Magnetic Resonance Imaging 26; Hyperacute Magnetic Resonance Imaging Protocol 27; Role of Magnetic Resonance Imaging in Patients with Subarachnoid Hemorrhage 27; Perfusion Imaging 30; Vessel Wall Imaging 30

6. **Imaging of Vasospasm: CT, CTA and CTP Correlated with Digital Subtracted Angiography in Cerebral Vasospasm** 32
Ajay Malhotra, Michele H Johnson

Use of CT, Contrast CT and CTA as Noninvasive Techniques along with TCD and DSA to Identify Probability, Extent and Severity of Vasospasm 33; Technical Features and Scan Acquisition 34; Image Interpretation of Computed Tomography Angiography in Vasospasm 35; Accuracy of Computed Tomography Angiography for Identification and Stratification of Cerebral Vasospasm 38; Computed Tomography Perfusion in Cerebral Vasospasm 38; Limitations, Pitfalls and Problems 40

7. **Imaging of Vasospasm: Transcranial Doppler Ultrasound Imaging: Detecting Intracerebral Arterial Vasospasm** 43
Jonathan D Kirsch, Michele H Johnson, Leslie M Scoutt

Subarachnoid Hemorrhage and Vasospasm Detection 43; Technique 44; Doppler Ultrasound Physics 45; Biosafety 47; Doppler Evaluation of Vasospasm 48; Other Applications of Transcranial Doppler Imaging 52

8. Medical Management of Vasospasm **55**
Evie Marcolini, Emily J Gilmore

Defining the Problem 55; Monitoring and Triggers 55; Triggers for Intervention 56; Hemodynamic Augmentation 57; Calcium Channel Blockers 58; Magnesium 58; Endothelin Receptor Antagonists 58; Statins 58; Nitric Oxide 58; Fever Control 59; Hyponatremia 59; Adrenal Insufficiency 59

9. Electroencephalogram Monitoring of Vasospasm **62**
Nicolas Gaspard, Emily J Gilmore, Lawrence J Hirsch

Cellular Basis of Electroencephalogram Activity 62; Modifications of Brain Metabolism and Electroencephalogram Activity Secondary to Ischemia 62; Electroencephalogram Studies in Patients with Aneurysmal Subarachnoid Hemorrhage 63; Continuous Electroencephalogram Monitoring for Ischemia Detection 63; Quantitative Electroencephalogram Analysis with the Fast Fourier Transform 64; Artifacts and the use of Intracortical Electroencephalogram 67; Other Confounding Factors and the Need for Multimodality Monitoring 67; Continuous Electroencephalogram for the Monitoring of Treatment 68; Future Developments 68

10. Anesthesia for Neurointerventional Surgery **70**
Keith J Ruskin

Anesthetic Management 70; Radiation Protection 73

11. Practical Microsurgical and Endovascular Treatment of Vasospasm **75**
Ryan A Grant, Ketan R Bulsara, Charles C Matouk

Pathogenesis of Cerebral Vasospasm 75; Medical Prevention and Treatment of Cerebral Vasospasm 76

12. Special Populations **85**
Lauren A Beslow, Jonathan D Kirsch

A. Pediatric Subarachnoid Hemorrhage 85
Lauren A Beslow

B. Sickle Cell Disease 86
Jonathan D Kirsch

***Appendix:* Clinical Protocols** **89**

Subarachnoid Hemorrhage Protocol 89
Vasospasm Protocol 91
Abbreviations 92

Index *95*