Updated and expanded second edition of the singular review source for neurocritical care boards, this book contains multiple-choice questions that cover the breadth of topics tested on the boards with answers and rationales for self-study. The book has been completely and thoroughly revised to reflect the requirements for initial certification or recertification in neurocritical care with the latest findings from the most recent clinical trials in vascular neurology, neurocritical care, and critical care medicine incorporated. Organized to reflect the training curriculum and exam blueprint, the second edition now contains 740 questions addressing both neuroscience critical care and general critical care core knowledge. Detailed explanations are provided for each question along with references for further study. Case questions with angiograms, EEG and monitoring waveforms, CT perfusion scans, and other images allow candidates to familiarize themselves with these tools that form a significant part of the exam.

This book is an excellent resource not only for board preparation but for topical review for residents and fellows from all disciplines of medicine rotating in the neurocritical care unit, as it is easy to read, concise, and portable with case examples and imaging to further guide education. Trainees taking the surgical or medicine critical care boards will also find it useful for its coverage of the neurocritical care component of their board curriculums.

KEY FEATURES:
- Second edition of the first dedicated review book available for neurocritical care boards
- Over 90 brand-new questions added to ensure coverage of the full range of topics tested on boards and essential to training in neurocritical care
- Revised and updated questions, answers, and references to reflect current science and practice
- Comprehensive high-yield review of both neurological and general critical care topics
- New chapter on critical care EEG and more image-based case questions to augment learning
- Digital access to the ebook for review on any device

Recommended Shelving Category: Neurology

ISBN: 978-0-8261-2359-6
Neurocritical Care Board Review
Questions and Answers

Second Edition

Editors

Asma Zakaria, MD
Neurointensivist
Division of Medical Critical Care Services
Inova Fairfax Hospital;
Assistant Professor
Department of Medicine
Virginia Commonwealth University
Falls Church, Virginia

Pouya Tahsili-Fahadan, MD
Neurointensivist
Division of Medical Critical Care Services
Inova Fairfax Hospital;
Assistant Professor
Department of Medicine
Virginia Commonwealth University
Falls Church, Virginia;
Adjunct Assistant Professor
Department of Neurology
Johns Hopkins University
Baltimore, Maryland
To Mimi and Ayza, who sacrificed their mama time for this project.
To Bülemt, for teaching me patience and picking up the slack where I faltered.
To my parents for always being there.
AZ

To my wife, Noushin, who has accepted me as I am. I promise to cook for you forever!
To my children, Jasmine and Darius.
To my mother and my father, Sharareh and Dr. Hossein Tahsili Fahadan.
PTF
# Contents

**Contributors** ix  
**Preface** xiii  

*Share Neurocritical Care Board Review: Questions and Answers, Second Edition*

## PART I. NEUROLOGIC DISEASE STATES: PATHOLOGY, PATHOPHYSIOLOGY, AND THERAPY

1. CNS Ischemia and Hemorrhage 3  
   Réza Behrouz

2. Subarachnoid Hemorrhage and Vascular Malformations 17  
   Bülent Yapiciljar and Asma Zakaria

3. Neurotrauma 35  
   Anand Kaul and Scott R. Shepard

4. Seizures and Epilepsy 51  
   Grant M. Warmouth, Carolina B. Maciel, and Giridhar P. Kalamangalam

5. Critical Care EEG 79  
   Hiba A. Haider

6. Neuromuscular Medicine 93  
   Suur Biliciler, Justin Kwan, Cecile L. Phan, and Mithila Vullaganti

7. CNS Infections 103  
   Doris Kung and Rohini Samudralwar

8. Toxic–Metabolic Disorders 119  
   Elissa K. Fory

9. Inflammatory and Demyelinating Diseases 131  
   Carlos Perez, Shivika Chandra, and Flavia Nelson

10. Neuroendocrine Disorders 143  
    Matthew Flaherty, Howard J. Fan, and Anh Nguyen

11. Neuro-Oncology 153  
    Keith Kerr, Yoshua Esquenazi, and Nitin Tandon

12. Encephalopathies 165  
    Corey E. Goldsmith

13. Clinical Syndromes in Neurocritical Care 183  
    Howard J. Fan and Asma Zakaria
14. Perioperative Neurosurgical Care  201
   Brett Simpson, Yoshua Esquenazi, and Nitin Tandon

15. Pharmacology and Practical Use of Medications in Neurocritical Care  209
   Monica Lee, Elizabeth Franco, and Teresa A. Allison

PART II. GENERAL CRITICAL CARE: PATHOLOGY, PATHOPHYSIOLOGY, AND THERAPY

16. Cardiovascular Disorders  237
   Mehul Desai

17. Respiratory Disorders  263
   Aditya Kasarabada

18. Renal Disorders  281
   Sumeska Thavarajah and Daphne H. Knicely

19. Endocrine Disorders  295
   Farah Meah, Mary Ann Emanuele, Lily Agrawal, Nicholas Emanuele, and Alaleh Mazhari

20. Infectious Diseases  319
   Salia Farrokh and Pouya Tahsili-Fahadan

21. Acute Hematological Disorders  333
   Soo J. Park and Aaron M. Goodman

22. Acute Gastrointestinal and Genitourinary Disorders  349
   Philip M. Sommer and Asad Latif

23. Diagnosis of Brain Death  363
   Subhashini Ramesh

24. General Trauma and Burns  371
   Sasha D. Adams, Nori L. Bradley, and Amy R. Alger

25. Ethical and Legal Aspects of Critical Care Medicine  385
   Nasiya Ahmed

26. Principles of Research in Critical Care  395
   Suur Biliciler and Justin Kwan

27. Procedural Skills and Monitoring  403
   Jing Wang, George W. Williams, and Laith Altaweel

28. Clinical Cases  423
   Asma Zakaria, Bülent Yapicilar, and Pouya Tahsili-Fahadan

Index  441

©Springer Publishing Company
Contributors

Sasha D. Adams, MD, FACS  Associate Professor, Acute Care Surgery, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Lily Agrawal, MD  Professor of Medicine, Endocrinology Section, VA Hospital, Hines, Illinois

Nasiya Ahmed, MD  Assistant Professor, Department of Internal Medicine, Division of Geriatric and Palliative Medicine, University of Texas Health Science Center at Houston, Houston, Texas

Amy R. Alger, MD, FACS  Assistant Professor, Trauma and Critical Care Surgery, Department of Surgery, Duke University Medical Center, Durham, North Carolina

Teresa A. Allison, PharmD, BCPS, BCCCP  Clinical Pharmacy Specialist, Neurosciences, Memorial Hermann –Texas Medical Center, Department of Pharmacy, Houston, Texas

Laith Altaweel, MD  Neurometabolicist, Division of Medical Critical Care Services, Inova Fairfax Hospital, Falls Church, Virginia

Réza Behrouz, DO, FAAN  Associate Professor, Department of Neurology, School of Medicine, University of Texas Health Science Center at San Antonio, San Antonio, Texas

Suur Biliciler, MD  Associate Professor, Neurology, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Nori L. Bradley, MD, MSc, FRCSC  Intensivist, Department of Critical Care Medicine, Medical Director, Organ Donation, Royal Columbian Hospital, New Westminster, British Columbia, Canada

Shivika Chandra, MD  Department of Neurology, University of Texas Health Science Center at Houston, Houston, Texas

Mehul Desai, MD  Associate Director of Adult ECMO, Medical Critical Care Services, Inova Heart and Vascular Institute, Fairfax, Virginia

Mary Ann Emanuele, MD  Professor of Medicine, Loyola University Medical Center, Endocrinology Division, Maywood, Illinois

©Springer Publishing Company
Nicholas Emanuele, MD  Professor of Medicine, Loyola University Medical Center and Chief, Endocrinology Section, VA Hospital, Hines, Illinois

Yoshua Esquenazi, MD  Assistant Professor, Department of Neurosurgery, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Howard J. Fan, MD  Neurointensivist, Dignity Health Neuroscience Institute of Northern California, Mercy San Juan Hospital, Carmichael, California

Salia Farrokh, PharmD, BCPS, BCCCP  Clinical Pharmacy Specialist, Neuro Intensive Care, Johns Hopkins Hospital, Baltimore, Maryland

Matthew Flaherty, MD  Neurointensivist, Neurocritical Care, Stroke of Arizona, Phoenix, Arizona

Elissa K. Fory, MD  Neurologist, Bloomfield Hills, Michigan

Elizabeth Franco, PharmD  ICU/ED Clinical Pharmacy Specialist, CHI St Luke’s Health –The Woodlands Hospital, Woodlands, Texas

Corey E. Goldsmith, MD  Assistant Professor of Neurology, Department of Neurology, Baylor College of Medicine, Houston, Texas

Aaron M. Goodman, MD  Assistant Professor of Medicine, Department of Medicine, Division of Blood and Marrow Transplantation, Moores Cancer Center, University of California San Diego, La Jolla, California

Hiba A. Haider, MD  Assistant Professor of Neurology, Division of Epilepsy, Emory University School of Medicine, Atlanta, Georgia

Giridhar P. Kalamangalam, MD, DPhil  Associate Professor, Department of Neurology, University of Florida, Gainesville, Florida

Aditya Kasarabada, MD, MPH, FCCP  Critical Care Attending, Medical Critical Care Services, Inova Fairfax Medical Campus, Falls Church, Virginia

Anand Kaul, MD  Resident, Department of Neurosurgery, Temple University, Philadelphia, Pennsylvania

Keith Kerr, MD  Chief Resident Physician, Department of Neurosurgery, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Daphne H. Knicely, MD  Assistant Professor of Medicine, Associate Director for Nephrology Fellowship Program, Division of Nephrology, Johns Hopkins University School of Medicine, Baltimore, Maryland

Doris Kung, DO  Assistant Professor, Neurology, Baylor College of Medicine, Houston, Texas

© Springer Publishing Company
Justin Kwan, MD  Associate Professor, Neurology, Department of Neurology, Temple University, Lewis Katz School of Medicine, Philadelphia, Pennsylvania

Asad Latif, MD, MPH  Assistant Professor, Department of Anesthesiology and Critical Care Medicine, Division of Adult Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

Monica Lee, PharmD, BCCCP  Emergency Department Clinical Pharmacy Specialist, Houston Methodist West Hospital, Houston, Texas

Carolina B. Maciel, MD  Assistant Professor, Department of Neurology, University of Florida, Gainesville, Florida

Alaleh Mazhari, DO, FACE  Associate Professor of Medicine, Loyola University Medical Center, Endocrinology Division, Maywood, Illinois

Farah Meah, DO  Assistant Professor of Medicine, Endocrinology Section, VA Hospital, Hines, Illinois

Flavia Nelson, MD  Associate Professor of Neurology, Director, Multiple Sclerosis Division, University of Minnesota Twin Cities, Department of Neurology, Minneapolis, Minnesota

Anh Nguyen, MD  Neurointensivist, Houston Methodist Neurological Institute, Houston, Texas

Soo J. Park, MD  Hematology/Oncology Fellow, Department of Medicine, Division of Hematology-Oncology, Moores Cancer Center, University of California San Diego, La Jolla, California

Carlos Perez, MD  Child Neurology Fellow, Department of Pediatrics, Division of Child and Adolescent Neurology, University of Texas Health Science Center at Houston, Houston, Texas

Cecile L. Phan, MD  Clinical Associate Professor, Division of Neurology, Department of Medicine, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alberta, Canada

Subhashini Ramesh, MD  Neurointensivist, Division of Medical Critical Care Services, Inova Fairfax Hospital, Falls Church, Virginia

Rohini Samudralwar, MD  Assistant Professor, Department of Neurology, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Scott R. Shepard, MD  Assistant Professor, Department of Neurosurgery, University of Texas Health Science Center at Houston, Houston, Texas

© Springer Publishing Company
Brett Simpson, MD  Resident Physician, Department of Neurosurgery, McGovern Medical School, University of Texas Health Science Center at Houston, Houston, Texas

Philip M. Sommer, MD  Clinical Instructor, Department of Anesthesiology, Perioperative Care, and Pain Medicine, New York University Langone Health, New York, New York

Pouya Tahsili-Fahadan, MD  Neurointensivist, Division of Medical Critical Services, Inova Fairfax Hospital; Assistant Professor, Department of Medicine, Virginia Commonwealth University, Falls Church, Virginia; Adjunct Assistant Professor, Department of Neurology, Johns Hopkins University, Baltimore, Maryland

Nitin Tandon, MD  Professor, Department of Neurosurgery, McGovern Medical School, University of Texas Health Science Center; Director, Epilepsy Surgery Program, Texas Epilepsy Neural Technologies and NeuroInformatics Institute, Houston, Texas

Sumeska Thavarajah, MD  Assistant Professor of Medicine, Clinic Director for the Bayview Nephrology Clinic, Division of Nephrology, Johns Hopkins University School of Medicine, Baltimore, Maryland

Mithila Vullaganti, MD  Assistant Professor, Neurology, Department of Neurology, Tufts Medical Center, Boston, Massachusetts

Jing Wang, PhD  Physician Assistant, Division of Medical Critical Care Services, Inova Fairfax Hospital, Falls Church, Virginia

Grant M. Warmouth, MD  Staff Neurophysiologist, American Neuromonitoring Associates, St. Louis, Missouri

George W. Williams, MD  Associate Professor, Departments of Anesthesiology and Neurosurgery, Division of Neurocritical Care, University of Texas Health Science Center at Houston, Houston, Texas

Bülent Yapicilar, MD  Neurosurgeon, Nova Neuroscience, Vienna, Virginia

Asma Zakaria, MD  Neurointensivist, Division of Medical Critical Care Services, Inova Fairfax Hospital; Assistant Professor, Department of Medicine, Virginia Commonwealth University, Falls Church, Virginia

©Springer Publishing Company
Since its recognition as a subspecialty in 2005, the neurocritical care community has significantly grown. An increasing number of hospitals across the United States provide subspecialized neurocritical care, and fellowship-trained neurointensivists are in demand more than ever. The first neurocritical care board examination was administered in 2007 by the United Council for Neurologic Subspecialties (UCNS) to assess competency in all aspects of neurocritical care. *Neurocritical Care Board Review, First Edition: Questions and Answers* was the first neurocritical care board review book and was warmly welcomed by both practicing and future neurointensivists. So far, almost 70 programs have received accreditation for fellowship training in neurocritical care, and more than 1,300 providers from different backgrounds and disciplines, including emergency medicine, general and vascular neurology, pediatrics, internal medicine, intensive care, and anesthesiology, as well as vascular and trauma surgeons and neurosurgeons have been certified as neurocritical care diplomats.

Recent advances in neurocritical care and requirements for board preparation demanded a new edition. *Neurocritical Care Board Review, Second Edition: Questions and Answers* underwent complete and thorough revision to reflect the reviews and comments from the first edition and feedback from our colleagues across different specialties and institutions. In keeping with the original intent of this book, we approached physicians from various medical and surgical specialties to author chapters based on the board curriculum, frequently encountered challenges or consults, and what they believed to be an appropriate level of understanding that an intensivist should have on a given topic. The chapters are named and arranged in a similar format to the board curriculum to allow for easy review and organization when studying for the boards. The question-and-answer (Q&A) format kept in the second edition allows the reader to perform thorough self-assessment prior to taking the exam. Several new questions have been added to each chapter. The answers are detailed and cover the majority of the board syllabus with updated references for additional reading. Recent advances in acute treatment of ischemic stroke and general critical care have revolutionized the field, and we have tried to incorporate these findings into this edition.

*Neurocritical Care Board Review, Second Edition: Questions and Answers* is intended to be a comprehensive study guide and self-assessment tool for candidates sitting for both initial certification and recertification in neurocritical care. In addition, trainees taking the surgical or medicine critical care boards will also find it useful as it covers the neurocritical care component of their board curriculums. *Neurocritical Care Board Review, Second Edition: Questions and Answers* is an easy-to-read, concise yet comprehensive, and portable learning resource not only for board preparation, but also for medical students, residents, and fellows rotating in the neurocritical care unit. Nurses, advance practice providers, and non-neurointensivist physicians who participate in the care of neurocritical care patients will also find.
this book to be an easy guide to the management of many frequently encountered issues, with case examples and imaging to further guide their education.

In June 2018, the American Board of Medical Specialties (ABMS) adopted a new subspecialty certification in neurocritical care involving the American Board of Psychiatry and Neurology (ABPN), American Board of Anesthesia (ABA), American Board of Emergency Medicine (ABEM), and American Board of Neurosurgery (ABNS). While the UCNS “recertification” and “initial certification” examinations are scheduled to be held in December 2018 and 2019, respectively, the new neurocritical care subspecialty offered by ABMS will allow for “uniformity in the training and skill sets of neurointensivists through ACGME-accredited fellowship training.” We encourage all candidates to visit www.abms.org, www.neurocriticalcare.org, and www.ucns.org to peruse eligibility criteria as well as information regarding examination registration, format, and content.

Assembling this book has been a labor of love for us, and we hope that the readers of this book will also enjoy it and learn from it. All credit goes to our co-authors and colleagues, as well as our mentors, especially Drs. Diringer, Geocadin, and Powner. For those of you taking the Neurocritical Care Boards, we hope it serves its purpose of being a quick and easy self-assessment tool, reference, and guide. Good luck and we would love to hear your feedback!

Asma Zakaria, MD
Pouya Tahsili-Fahadan, MD
Inova Fairfax Hospital
Falls Church, Virginia
Share

Neurocritical Care Board Review: Questions and Answers, Second Edition
CNS Ischemia and Hemorrhage

RÉZA BEHROUZ

Questions

1. A 58-year-old man with long-standing hypertension has acute onset of right hemiplegia and aphasia 6 hours prior to his arrival in the ED. He is obtunded, with a dense left gaze deviation, and the left pupil is 6 mm and poorly reactive to light, while the right is 4 mm and reacts to light. The patient vomits and is subsequently intubated and then taken to CT scan, where he is found to have a large left hemisphere hypodensity with mass effect and uncal herniation. Of the following steps, which is most proven to lead to a good outcome?
   A. Osmotherapy with 23.4% saline
   B. Increase respiratory rate (RR) to 24
   C. Decompressive hemicraniectomy
   D. Administer intravenous (IV) alteplase
   E. Elevate head of bed to 30°

2. A 68-year-old man presents with acute onset left hemiparesis and headache. His symptoms started approximately 2.5 hours prior to arrival to the ED. His blood pressure (BP) on presentation was 218/110 mmHg. An emergent CT of the head shows an 18-mL intracerebral hemorrhage. His International Normalized Ratio (INR) is 1.0 and his platelet count is 112 cells/μL. Which of the following is true in his case?
   A. Lowering of systolic BP is associated with a better functional recovery
   B. Hemostatic medications (such as recombinant factor VII) mitigate hemorrhage volume growth and therefore improve outcomes
   C. Due to his thrombocytopenia, platelet transfusion is indicated
   D. All of the above are true

3. A 78-year-old man with hypertension, tobacco use, and hyperlipidemia presents with an episode of transient aphasia lasting 30 minutes and difficulty with right arm coordination. He is examined 1 hour later and found with no deficits. An MRI shows no acute stroke. Carotid duplex suggests 70% to 90% stenosis of the proximal left internal carotid artery at the bulb. He has no history of coronary artery disease (CAD), and his ECG is normal. The best option for stroke prevention in this patient is:
   A. High-dose statin therapy
   B. Aspirin
   C. Carotid stenting
   D. Carotid endarterectomy

© Springer Publishing Company
4. A 54-year-old man with hypertension and hyperlipidemia experiences acute right hemiparesis and aphasia. He was last seen normal approximately 5 hours ago by his wife. In the ED, his blood pressure (BP) is 184/98 mmHg. His National Institutes of Health Stroke Scale (NIHSS) is 18. A noncontrast CT shows no abnormal hypodensity, but a “dense middle cerebral artery (MCA) sign” on the left. His International Normalized Ratio (INR) is 0.9 and his platelet count is 225 cells/μL. What is the best next step in his care?

A. Administer intravenous (IV) alteplase as soon as possible
B. Prepare for endovascular treatment of left MCA occlusion
C. Obtain a CT perfusion scan to assess for viable tissue
D. Lower his systolic pressure to less than 140 mmHg immediately

5. A 21-year-old woman presents with brief right facial sensory loss and mild right upper extremity incoordination. Her symptoms resolve without any residual deficit. The MRI shows no infarct, but the magnetic resonance angiography (MRA) suggests high-grade right-middle cerebral artery stenosis. An angiogram confirms the stenosis and reveals extensive hypertrophy and collateralization in the lenticulostriate vessels. Her blood pressure (BP) is 135/65, and her lipid profile reveals a total cholesterol of 236 and a low-density lipoprotein of 112. The best option for subsequent management of this patient is:

A. High-dose statin therapy
B. Aspirin
C. Endovascular stenting of the right-middle cerebral artery (MCA)
D. Surgical bypass of the right MCA

6. A 72-year-old woman with a history of coronary artery disease (CAD) presents with acute onset of left hemiparesis, which started 2 hours ago. In the ED, her blood pressure (BP) is 184/98 mmHg. Noncontrast CT of the head shows a 15-mL right basal ganglia intracerebral hemorrhage (ICH). Upon reviewing her medications list, the nurse notices that she is on aspirin 325 mg on a daily basis. The patient confirms this. Which one of the following is true in her case?

A. Since she has been on an antiplatelet agent, platelet transfusion is indicated
B. Since she has been on an antiplatelet agent, administration of DDAVP is indicated
C. Platelet transfusion will have no benefit on outcomes in this patient
D. Platelet transfusion will act as an antidote to aspirin and reverse its effect

7. An 85-year-old woman with mild dementia but no significant vascular disease presents to the ED within 1 hour of abrupt onset of nausea and altered mental status. Her blood pressure (BP) is 135/76, heart rate (HR) 104, respiratory rate (RR) 16, and temperature 36.8°C. Her exam is notable for dense left hemineglect. Her motor exam is limited by her neglect but appears normal. A CT scan of the brain shows a 4-cm right parietal intracerebral hemorrhage (ICH). Which of the following treatments could significantly worsen her outcome?

A. Placement of an intraventricular catheter to measure intracranial pressure (ICP)
B. Surgical evacuation of the hematoma within 4 hours
C. Prophylactic seizure therapy with levetiracetam
D. Early nutrition support with tube feeds

8. A 45-year-old man with poorly controlled hypertension presents with new onset ataxia and dysarthria with a systolic blood pressure (BP) of 225/115. A noncontrast head CT shows a 4-cm right cerebellar hemisphere hemorrhage with compression of the fourth ventricle and dilation of the lateral and third ventricles. The next best step in management is:

A. Target mean arterial pressure (MAP) of less than 100 mmHg with labetalol push and nicardipine drip
B. Insert intraventricular drain and normalize intracranial pressure (ICP)
C. Surgical evacuation of the cerebellar hematoma
D. Perform a cerebral angiogram to evaluate for aneurysm

9. A 35-year-old man with poorly controlled hypertension presents to the ED with acute dysarthria. His initial blood pressure (BP) is 175/110. A noncontrast head CT shows a 1-cm pontine hemorrhage. He is placed on a nicardipine drip, but before his BP responds, he becomes obtunded and a follow-up CT shows significant hematoma expansion to involve 3 cm of the mid pons. He is intubated and moved to the ICU with a Glasgow Coma Scale (GCS) score of 6. Upon arrival to the ICU, the nursing staff comments that this patient has a poor prognosis and asks you to discuss do-not-resuscitate (DNR) status with the family. The most appropriate next step is to:
A. Explain to the family that the patient will likely not survive to a functional status and they should consider no cardiopulmonary resuscitation (CPR) if he worsens overnight
B. Call an ethics consult to evaluate elements of the case for futility of care
C. Notify the family of the severity of the injury, but strongly urge them to allow CPR and full code status for the next 24 hours
D. Notify the case manager that the patient will likely need long-term care, and plan for early tracheotomy and a gastrostomy tube

10. A 60-year-old woman has a severe headache followed by left hemiplegia. She is brought to the ED and a noncontrast head CT shows a 15-mL right thalamic hemorrhage with intraventricular extension, including within the third and fourth ventricles. Her blood pressure (BP) is 187/100, heart rate (HR) is 20, respiratory rate (RR) is 20, and temperature is 37.2°C. She is awake and cooperative but is slowly becoming more lethargic. Her BP is cautiously lowered with labetalol to a mean arterial pressure (MAP) of 120 mmHg. She has an intraventricular drain placed that allows intracranial pressure (ICP) monitoring and cerebrospinal fluid (CSF) drainage. Which of the following therapies has been shown to reduce disability in this patient?
A. Intraventricular tissue plasminogen activator (tPA)
B. Intraventricular recombinant factor VII
C. Active aspiration of the intraventricular blood
D. None of the above

11. A 23-year-old woman is postpartum day 2 from a normal vaginal delivery for which she received an epidural anesthetic, which was a “wet tap” with spinal leak. She is scheduled to be discharged home but has a lingering headache and mild nausea, which has been attributed to a spinal headache. She then has a generalized seizure and becomes difficult to arouse. Her sclera are injected. She is intubated and taken for noncontrast CT, which shows diffuse cerebral edema with multiple dilated vessels in the vertex. There are two small cortical hemorrhages, one 1 cm in the left frontal region, and the other 6 mm in the right parietal region. What is the likely diagnosis?
A. Ruptured arteriovenous malformation (AVM)
B. Ruptured left middle cerebral artery (MCA) aneurysm
C. Cerebral venous thrombosis
D. Brainstem infarction

12. For the same patient, what is the best initial management?
A. Heparin drip
B. Interventional thrombolysis
C. Mannitol
D. Hemicraniectomy
13. A 45-year-old woman is an unrestrained passenger in a motor vehicle accident where she sustains a blow to the right side of her head. Other than a brief loss of consciousness and head pain, she has no deficits. She has a negative noncontrast head CT in an ED after the event and is discharged home. Over the next several weeks, she notices diplopia, tearing, chemosis, conjunctival injection, and a pulsating sensation of the left eye, prompting further evaluation. Upon seeing her in your office, the most useful diagnostic test is:

A. Brain MRI with contrast  
B. Cerebral angiogram  
C. Optic nerve sheath ultrasound  
D. Formal visual field assessment

14. A 24-year-old woman who has given birth to a healthy infant 2 weeks ago presents with headache and personality change per her husband. Symptoms began the last evening and progressed. She states that her blood pressure (BP) was poorly controlled during and after pregnancy and she is currently on labetalol 200 mg twice daily. This regimen was started after she was hospitalized for 2 days 1 week ago with a diagnosis of preeclampsia. She has been experiencing “migraine” headaches since the birth of her child and has been using her usual sumatriptan frequently. On exam, her BP is 188/112 mmHg. She is alert and fully oriented, but complains of a severe frontal headache. A CT of the head shows a 20-mL right frontal intracerebral hemorrhage (ICH) and subarachnoid blood in the right Sylvian fissure. What is the best course of action in her case?

A. Start heparin immediately for cerebral venous thrombosis  
B. Lower BP and obtain CT angiography  
C. Administer subcutaneous sumatriptan to control the headache and obtain CT angiography  
D. Start an antiepileptic medication and magnesium

15. A 26-year-old nurse has frequent nausea and vomiting during pregnancy. After an episode of vomiting, she becomes aphasic and has difficulty moving her right arm. She is brought to the ED, where her symptoms begin to improve, but on exam, she remains impaired in language fluency and has a right-arm drift. Initial CT is normal, but subsequent MRI shows an infarction in the left insula and precentral gyrus. She undergoes magnetic resonance angiogram (MRA) of the neck, which shows a 6-cm dissection of the carotid artery originating from the carotid bulb. The lumen is reduced in diameter to approximately 70%. She has been improving with no further symptoms. The best treatment at this point is:

A. Endovascular stenting  
B. Aspirin  
C. Warfarin  
D. Endarterectomy

16. Which of the following statements regarding blood pressure (BP) management in stroke patients is true?

A. There is significant class-specific evidence for the superiority of calcium channel blockers in stroke patients over other BP–reducing medications  
B. Stopping BP medications in hospitalized acute stroke patients leads to worse outcomes  
C. Careful BP lowering in the hospital was demonstrated to lead to better outcomes in the Scandinavian Candesartan Acute Stroke Trial (SCAST)  
D. Two-drug therapy is indicated as an initial strategy in patients with an observed BP of 160/100
17. A 93-year-old man presents with acute onset left hemiparesis and hemineglect. Symptoms started 40 minutes ago and have not changed. His blood pressure (BP) is 178/88 mmHg. CT of the head is unremarkable. He has a history of atrial fibrillation and takes warfarin. His International Normalized Ratio (INR) in the ED is 1.6. His wife states that he had a stroke 4 months ago. Which one of the following is true in this patient?
   A. Intravenous (IV) tissue plasminogen activator (tPA) is contraindicated due to his advanced age
   B. IV tPA is contraindicated due to his elevated INR
   C. IV tPA is not contraindicated in this patient
   D. IV tPA is contraindicated due to a recent stroke

18. A 60-year-old woman with hypertension but no prior stroke or other cerebrovascular disorders presents to the hospital via emergency medical service (EMS) after being found down by her son. Her son had dinner with her the evening before and she said goodnight to him around 11 p.m. He saw her walking normally from her bedroom at 8 a.m., but they did not talk. At 10 a.m., she called him at work and was difficult to understand so he came home and found her on the floor. It is now 11:30 a.m. Her blood pressure (BP) is 175/100, heart rate (HR) is 74 and regular, and temperature is 36.9°C. The patient has a right gaze with dense left hemiplegia. CT of the brain shows blurring of the gray–white junction in the right middle cerebral artery (MCA) territory, but no definite hypodensity. Her National Institutes of Health (NIH) Stroke Scale is calculated to be 22. The right MCA is hyperdense. Is this patient a candidate for thrombolysis?
   A. No, her last-known normal was the prior evening, which is outside the tissue plasminogen activator (tPA) window
   B. No, her last-known normal was 8 a.m., which is outside the approved 3-hour window for tPA
   C. Yes, her time of onset was 10 a.m., which is within the approved 3-hour window for tPA
   D. Yes, her last-known normal was 8 a.m., which is within the 4.5-hour window for tPA

19. A 76-year-old woman with a history of atrial fibrillation presents with sudden onset of left hemiparesis and hemineglect. The CT shows a 33-mL right parietal intracerebral hemorrhage (ICH). She is taking dabigatran. The last dose of this medication was 4 hours ago. What is the best treatment for this patient in view of anticoagulation-related ICH?
   A. Fresh frozen plasma
   B. Prothrombin complex concentrate
   C. Idarucizumab
   D. Intravenous vitamin K

20. An 89-year-old woman who lives alone has acute onset of left hemiparesis and dysarthria. She is brought to the ED, receives intravenous (IV) tissue plasminogen activator (tPA), and improves to her baseline despite evidence of a 3-cm infarction in the right insula on MRI. The MRI otherwise shows age-appropriate atrophy without a significant amount of white matter disease. During her evaluation, she is found to be in atrial fibrillation. What regimen should be recommended for secondary stroke prevention?
   A. Aspirin
   B. Aspirin plus clopidogrel
   C. Warfarin
   D. Amiodarone without anticoagulation

21. In which scenario is anticonvulsant therapy recommended?
   A. Prophylaxis in ischemic stroke patients with large cortical infarctions
   B. Prophylaxis in hemorrhagic lobar stroke patients with significant edema
   C. Prophylaxis in ischemic stroke patients, posthemicraniectomy

© Springer Publishing Company
22. A 31-year-old woman with no significant medical problems experienced a severe headache while jogging. She went to the ED and was alert but had a severe, throbbing headache and no focal neurologic symptoms. Her blood pressure (BP) was 173/105, and noncontrast head CT was normal. She went home from the ED, and the following day, she experienced aphasia while speaking to a friend on the phone. She returned to the ED, where her symptoms resolved, but a repeat CT scan showed a small, distal, right parietal convexity subarachnoid hemorrhage (SAH). Lumbar puncture (LP) was normal with no inflammation. Cerebral angiography showed no aneurysm or arteriovenous malformation (AVM), but multiple areas of vasoconstriction. She was treated with fluids, and an extensive autoimmune workup was negative. On follow-up imaging 3 months later, one would expect to find:

A. Complete resolution of the vasoconstriction  
B. Mycotic aneurysms  
C. Hypertrophy of the lenticulostriates  
D. Diffuse white matter disease

23. A 49-year-old woman with no significant past medical history is staying at a hotel on a business trip abroad when she has acute onset of dysarthria and left-sided weakness with sensory loss. She is found to have a moderate-sized right-middle cerebral artery (MCA) infarction on MRI, but no sign of large vessel disease. Her hypercoagulable workup is negative, ECG and telemetry are normal, and transthoracic echocardiogram is normal, but transesophageal echocardiogram shows a right-to-left shunt across a patent foramen ovale during the Valsalva maneuver. The patient is very interested in “fixing the problem” and would like to have the patent foramen ovale (PFO) closed. The most appropriate next step in management is:

A. Refer the patient to a cardiologist for PFO closure  
B. Start combination of aspirin and clopidogrel  
C. Start anticoagulation immediately  
D. Obtain lower extremity venous Doppler

24. A 73-year-old woman with hyperlipidemia and hypertension experiences a 30-minute episode of dysarthria and right-side weakness. She comes to the ED and is fully recovered. Her initial blood pressure (BP) is 163/102. CT is normal, and ECG shows normal sinus rhythm. What is her ABCD2 score, and should she be admitted to the hospital?

A. 3, no admission required  
B. 4, no admission required  
C. 4, admission required  
D. 5, admission required

25. A 69-year-old man has chest pain and is found to have an aortic dissection requiring emergent surgical repair. Postoperatively, he is noted to be paraplegic. Which of the following strategies is worthwhile in this patient?

A. Reduction of mean arterial pressure (MAP) to target less than 100 mmHg  
B. Placement of a lumbar drain  
C. Avoid bypass methods during surgery for distal reperfusion  
D. Prolong ICU sedation to avoid oxygen consumption


## ANSWERS

1. **The answer is C.** Hemicraniectomy is a life-saving remedy in the setting of massive hemispheric infarct. The results of the HAMLET–DESTINY–DECIMAL pooled analysis of hemicraniectomy versus medical management provide strong evidence for this therapy. A total of 93 patients were included in the pooled analysis. More patients in the decompressive surgery group than in the control group had a modified Rankin Score (mRS) less than or equal to 4 (75% vs. 24%; pooled absolute risk reduction 51%), an mRS 3 (43% vs. 21%; 23%), and survived (78% vs. 29%; 50%); with numbers needed to treat of two for survival with mRS 4, four for survival with mRS 3, and two for survival irrespective of functional outcome. In this scenario, the patient is an ideal candidate for surgery based on his age and the early nature of the edema. Osmotherapy is an important temporizing measure to reduce edema for 2 to 6 hours, but it is not the best answer as it is not a therapy that has been subjected to a large, randomized trial to show better outcomes in the absence of definitive management. Similarly, raising the head of the bed or increasing the respiratory rate will produce a decrease in intracranial pressure (ICP) but will not be expected to provide sufficient benefit to lead to a better outcome. Intra-arterial thrombolysis would be poorly tolerated in a patient with a large hypodensity on CT and signs of herniation. It would most likely worsen the patient’s outcome based on analysis of the PROACT II trial.


2. **The answer is A.** The Intensive Blood Pressure Reduction in Acute Cerebral Hemorrhage (INTERACT 2) trial showed significantly better functional recovery on an ordinal analysis of scores on the modified Rankin scale (odds ratio for greater disability, 0.87; 95% confidence interval, 0.77 to 1.00; *p* = .04). In ATACH-2 trial, risk of death or disability at 3 months did not differ between intensive (goal 110–139 mmHg) versus standard (goal 140–179 mmHg) systolic blood pressure lowering within 4.5 hours of symptom onset. B is incorrect since the Factor Seven for Acute Hemorrhagic Stroke (FAST) trial showed that although hemostatic therapy with recombinant activated factor VII reduced hematoma growth in patients with acute intracerebral hemorrhage (ICH), it did not improve survival or functional outcomes. C is incorrect because platelet count of 110 cells/μL does not meet the criteria for severe thrombocytopenia, for which platelet transfusion is indicated based on the American Heart Association guidelines.


3. **The answer is D.** This patient has suffered a transient ischemia attack (TIA) of the left hemisphere. The high-grade (70%) stenosis found in the ipsilateral carotid artery (ICA) places this patient at approximately 26% risk of stroke in 2 years, according to the North American Symptomatic Carotid Endarterectomy Trial (NASCET). The addition of aspirin or statin therapy is appropriate, but they are not sufficient to exclude revascularization, which remains the best option and offers the most relative risk reduction of the choices provided (65% for endarterectomy vs. approximately 20% for aspirin and approximately 30%–35% for statins). Carotid stenting and endarterectomy are comparable methods to achieve revascularization, and choosing the right option depends on the patient’s comorbidities. In a patient with a high risk of perioperative myocardial infarction, stenting would be preferable. This
patient has no such risk from the information given. Furthermore, in the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST), patients older than 70 years had less risk of stroke with endarterectomy than stenting. In this case, endarterectomy is the best option. Considerations such as location of the plaque, risk of cranial nerve palsies, and cosmetic scarring should be kept in mind, but in this case, the lesion is easily accessible with surgery.


4. The answer is B. IV alteplase is not indicated as he is outside of the window for this medication. He is still within the 6 hours window of endovascular intervention. Based on the severity of his deficit and a left “dense MCA sign” that correlated with his symptoms, we know that the culprit lesion is a left MCA occlusion. In the interest of time—since only 1 hour is left to closure of endovascular window—CT perfusion will be of little benefit. Lowering of BP is not indicated in this particular scenario. D is incorrect; there is no such target for ischemic stroke.


5. The answer is D. This patient presents with classic angiographic findings of Moyamoya disease. Statin therapy has no proven role in Moyamoya disease and based on this patient’s age, it is highly unlikely that the angiographic results represent atherosclerosis. Aspirin therapy is a reasonable consideration but should not be carried out in the long term without surgical management because of the risk of the hypertrophied vessels rupturing and causing a basal ganglia hemorrhage. Endovascular stenting is contraindicated and results in rapid restenosis. Surgical management with superficial temporal artery bypass to the MCA (also called extracranial–intracranial (EC–IC bypass) is effective and associated with a lower risk of ischemia and hemorrhage.


6. The answer is C. The Platelet Transfusion in Cerebral Haemorrhage (PATCH) trial was a randomized, open-label, phase 3 trial that showed platelet transfusion seems inferior to standard care for people taking antiplatelet therapy before ICH. In fact, participants who received platelet transfusion had more serious adverse events during their hospital stay than those who were not transfused. DDAVP has not shown to be of benefit in patients with ICH and antiplatelet use prior to that.


7. The answer is B. The Surgical Trial in Intracerebral Hemorrhage (STICH) trial showed no benefit to surgical evacuation of ICH and subsequent trials of early evacuation showed worse outcomes. In particular, this patient is likely to have cerebral amyloid angiopathy, and surgery carries a significant risk of adjacent tissue hemorrhage. Although surgery remains controversial in most cases, isolated craniectomy without hematoma evacuation would be worthwhile to consider in a patient with impending herniation from supratentorial ICH. There is no evidence that prophylactic seizure therapy improves outcomes, although in the case of levetiracetam, there is also no evidence of worsening outcomes. Early nutritional support has been shown to improve outcomes. An intraventricular catheter for monitoring ICP is indicated if the Glasgow Coma Scale score (GCS) is less than 8 and has not been observed to worsen outcomes.


8. The answer is C. According to the guidelines of the American Heart Association, patients with cerebellar hemorrhage who are deteriorating neurologically or who have brainstem compression and/or hydrocephalus from ventricular obstruction should undergo surgical removal of the hemorrhage as soon as possible, and that initial treatment of these patients with ventricular drainage rather than surgical evacuation is not recommended. Cerebral angiogram is a worthwhile diagnostic test, but it should be performed after the craniectomy.


9. The answer is C. This patient has a potentially devastating hemorrhage in a region of the brain that could lead to permanent disability. Nonetheless, based on his intracerebral hemorrhage (ICH) score, his 30-day mortality risk is only 26%. The use of DNR orders in the ICU varies significantly by institution. In a meta-analysis of ICU prognosis, factors such as gender, GCS, ICH volume, intraventricular hemorrhage (IVH), age, midline shift, uncial herniation, cisternal effacement, location of the hemorrhage, and glucose level were all considered as prognostic factors, but DNR status was the only variable that significantly predicted mortality. Furthermore, in this study DNR orders were implemented and care withdrawn on average at 2 days. This suggests that DNR orders worsen patient outcome, especially when implemented early. It is important to involve family members in the decision-making process, but unless a patient has a preexisting DNR order or long-standing, well-known wishes to not receive aggressive care, DNR orders should be postponed for at least 24 hours.


10. The answer is D. Clot Lysis Evaluation of Accelerated Resolution of Intraventricular Hemorrhage III (CLEAR III) was a randomized, double-blinded, placebo-controlled, multiregional trial that showed that in patients with intraventricular hemorrhage (IVH) and a routine extra-ventricular drain, irrigation with alteplase did not substantially improve functional outcomes at the modified Rankin Score (mRS) 3 cutoff compared with irrigation with saline. Answers B and C are unrealistic.


11. The answer is C. Cerebral venous thrombosis is a difficult diagnosis to make based on non-contrast head CT and requires a high degree of suspicion. A contrast-enhanced CT will often reveal the thrombosis more readily, and if suspected, this is a rare indication for contrast-enhanced CT in acute stroke. The CT findings include dilated cortical veins, cortical subarachnoid blood, and dense-appearing cerebral sinuses. With contrast, the dense sinus sign becomes the so-called empty delta sign and is present in about one third of cases. CT remains normal in many cases. A number of patients who lack typical vascular risk factors are at risk for venous thrombosis, such as pregnant women; patients with
hematological, oncological, and autoimmune diseases; and patients with head trauma or recent intrathecal or spinal procedures. The findings of scleral injection make venous insufficiency very likely. Ruptured AVM or aneurysm would be expected to produce more obvious signs of subarachnoid blood in a patient who deteriorates rapidly and is preceded with a much more severe headache. A brainstem infarction should not produce cortical hemorrhages.


12. The answer is A. In most patients with cerebral venous thrombosis, there is an excellent response to heparin infusion. This treatment should be continued even in the presence of small cortical bleeds. Bleeding in cerebral venous thrombosis is caused by high venous pressure, and thus adequate anticoagulation is necessary to manage the underlying problem. The other treatments listed are reasonable considerations in a patient who does not respond to intravenous (IV) heparin. Osmotherapy can cause dehydration and venous constriction and worsen the thrombotic situation, but it has a role when attempts at reducing intracranial pressure (ICP) have failed or are not available, including lumbar drainage, acetazolamide, and optic nerve fenestration. Hemicraniectomy should be considered when all other options at relieving ICP have failed and herniation is a concern.


13. The answer is B. The presentation is typical of a carotid–cavernous fistula. This abnormal communication between the carotid artery and the cavernous sinus often arises from trauma, but can occur spontaneously, and should be suspected in any patient with unexplained chemosis, especially if it involves any degree of ophthalmoplegia. The contents of the cavernous sinus include cranial nerves III and IV, which are compressed by the enlarging fistula and cause ophthalmoplegia. Treatment is typically endovascular occlusion of the fistula.


14. The answer is B. Cerebral venous thrombosis is a possibility, but given the sequence of events such as a history of poorly controlled BP and postpartum overuse of triptans, the most likely diagnosis is postpartum angiopathy (PPA). The most common presentation of PPA is cerebral hemorrhage. Lowering the BP carefully and obtaining a CT angiogram will provide details on the underlying cause of the patient’s hemorrhage. A is wrong because one should not start heparin indiscriminately until an unequivocal diagnosis of cerebral venous thrombosis is made. The other two choices are incorrect. Administration of triptans in the face of elevated and history of uncontrolled BP is contraindicated. Choice D is not a valid answer.


15. The answer is B. In the Cervical Artery Dissection in Stroke Study (CADISS), a randomized, end-point blinded study of 250 patients showed no difference in efficacy of antiplatelet and anticoagulant drugs at preventing stroke and death in patients with symptomatic carotid and vertebral artery dissection. In this pregnant woman, warfarin would not be desirable because of teratogenicity. Surgical options for management of dissection exist, but are quite rare and typically reserved for ligation when endovascular and medical management are not possible. Endovascular repair has become more frequent, and while prospective data for its efficacy and safety are lacking, it is commonly used when a patient does not respond to initial medical management or has intracranial extension of the dissection, neither of which are present in this scenario.

16. The answer is D. Two-drug therapy is indicated as an initial strategy in patients with an observed BP of 160/100. According to the Joint National Committee (JNC) 7 guidelines, patients with BP greater than 160 systolic or greater than 100 diastolic are considered stage 2 hypertension, and initial therapy with two-drug classes is recommended. BP goals and strategies remain controversial, and increasing evidence suggests there is little to be gained by either permissive hypertension or modest lowering of BP acutely. In the SCAST, careful blood pressure lowering had no effect on outcome, and in the Continue or Stop Post-Stroke Antihypertensives Collaborative Study (COSSACS) trial, neither continuing nor stopping BP medications in hospitalized stroke patients had an effect on outcomes. There is good evidence for secondary stroke prevention with a number of classes of antihypertensive medications. While calcium channel blockers are a reasonable strategy, there is no reason to choose this class over thiazide diuretics, angiotensin converting enzyme (ACE) inhibitors, or angiotensin receptor blockers. Thiazide diuretics remain the first line of recommendation in JNC 7.


17. The answer is C. IV tPA is not contraindicated in this patient. Age is not an exclusionary factor for administration of IV tPA, so long as the patient is 18 and older. His International Normalized Ratio (INR) is 1.7; he would exclude if his INR was greater than 1.7. His stroke was more than 3 months ago.


18. The answer is D. Determining eligibility for thrombolysis depends on establishing a “last known well” time in most cases, unless the stroke onset is directly observed. The 10 a.m. phone call cannot be used as a last known normal since the patient was not observed between 8 a.m. and 10 a.m. to be well. Nonetheless, the clinician should use all available information to make this determination and consider each scenario in the context of both history and imaging. The CT suggests an acute stroke, so it is reasonable to assume that the stroke is only a few hours old. Furthermore, the son’s report of his mother walking at 8 a.m. is sufficient to establish that she was well at 8 a.m. even though she did not speak. If a patient has isolated aphasia or dysarthria, this might not be enough information, but in a patient with an obvious MCA infarction, it is safe to assume that she would not have been able to walk normally if this stroke was in evolution at 8 a.m. Finally, the window for thrombolysis has been expanded to 4.5 hours based on the European Cooperative Acute Stroke Study III (ECASS III) trial. Patients older than 80 years, those with NIH Stroke Scale score greater than 25, and those with diabetes and prior stroke were excluded in this trial. This patient has none of these exclusions, so she qualifies for the extended time window.


© Springer Publishing Company
19. The answer is C. The patient has suffered ICH due to dabigatran. This drug is not reversed by vitamin K, and fresh frozen plasma and prothrombin complex concentrate are unlikely to be effective. The only proven treatment for hemorrhage due to dabigatran is the monoclonal antibody fragment idarucizumab, which binds dabigatran with an affinity that is 350 times higher than that observed for thrombin. In a prospective cohort study of 90 patients, idarucizumab completely reversed the anticoagulant effect of dabigatran within minutes.


20. The answer is C. Although the risk of major intracranial hemorrhage (ICH) increases with advanced age, the risk of ischemic stroke from atrial fibrillation increases as well and remains significantly greater than the risk of ICH. A prospective trial of 973 patients older than 75 years assigned to warfarin versus aspirin for atrial fibrillation found that ischemic strokes were more than twice as common in the aspirin group (44 events vs. 21 in warfarin group), but that major bleeds were equivalent (three in the warfarin group and four in the aspirin group). Warfarin in this population produced a 52% relative risk reduction in ischemic stroke with no significant increase in risk of major hemorrhage. The combination of aspirin plus clopidogrel for stroke prevention produced a modest improvement in ischemic stroke in the Atrial Fibrillation Clopidogrel Trial with Irbesartan for Prevention of Vascular Events (ACTIVE-A) trial, but a similar increase in bleeding risk equating to no net benefit.


21. The answer is D. There is no data to support the use of prophylactic anticonvulsants in stroke patients. Furthermore, even in patients who are at an elevated risk of poststroke seizure, such as the scenarios listed in choices A to C, there is no evidence that preventing seizure improves outcomes. In ischemic stroke patients, current guidelines support the use of anticonvulsants only if a patient has a clinically definite seizure. It is reasonable to use anticonvulsants for a period of time and consider gradual discontinuation once the patient has become seizure free.


22. The answer is A. The patient most likely has reversible cerebral vasoconstriction syndrome (RCVS). This is an underdiagnosed entity that causes thunderclap headache and can easily be mistaken for primary central nervous system (CNS) angitis and delayed cerebral ischemia from SAH. It is also known as “pseudovasculitis” because the findings on angiography so closely mimic vasculitis. RCVS is associated with a number of drugs, as well as exertion, pregnancy, and other headache types. A number of treatments have been used, but none are well established by trial data. The disease is self-limited but can be complicated by seizure and cerebral ischemia in up to 20% of patients. The clinical picture is not consistent with endocarditis, so mycotic aneurysms would be unlikely. The hypertrophy of lenticulostriates is a result of Moyamoya disease, which affects only the proximal vessels, whereas this patient had diffuse disease on initial imaging. While white matter infarctions are possible, they are rare, and often limited only to a single region, not diffuse.


© Springer Publishing Company
23. **The answer is D.** This patient has a cryptogenic stroke. PFO is more prevalent in patients with cryptogenic stroke than in the general population, but based on the results of the CLOSURE study, there is no benefit to PFO closure with the device used in that trial. Results of two recent trials, patent foramen oval closure or anticoagulation vs. antiplatelets after stroke (CLOSE) and patent foramen oval closure or antiplatelet therapy for cryptogenic stroke (REDUCE), show that in patients with recent stroke and PFO with an associated atrial septal aneurysm or moderate to large aunts, PFO closure in addition to antiplatelet one with an increased risk of peri-procedural complications including, atrial fibrillation. However, before any medical or surgical decision is made, lower extremity Doppler or magnetic resonance venography (MRV) is necessary to rule out deep vein thrombosis (DVT) as a source of paradoxical embolus. In the absence of a lower extremity DVT, anticoagulation is not indicated. There is no evidence that dual antiplatelet therapy is superior to monotherapy in patients with PFO without evidence of lower extremity DVT.


24. **The answer is D.** The ABCD2 system is a method for determining 2-, 7-, 30-, and 90-day stroke risk. Hospitals, EDs, and insurers are using it as a guide for decisions on admission versus outpatient evaluation. “A” stands for age: a patient gets one point for age greater than or equal to 60. “B” stands for blood pressure (BP): a patient gets one point if either the systolic BP is greater than or equal to 140 mmHg, or the diastolic BP is greater than or equal to 90 mmHg. “C” stands for clinical criteria: a patient gets one point for isolated speech impairment without weakness, and two points for unilateral weakness. “D” stands for diabetes: a patient gets one point if he or she is diabetic. The second “D” stands for duration: a patient gets one point for an episode of 10 to 59 minutes, and two points for an episode greater than or equal to 60 minutes. This patient scores a five, based on the description. Although different organizations use various cutoffs for decision making, a score of four or five results in a 2-day stroke risk of 4.1%, which justifies hospital admission.


25. **The answer is B.** Spinal cord infarction remains a poorly studied condition, but among the available strategies, two are worthwhile based on data from case series. First, the placement of a lumbar drain reduces intrathecal pressures and allows for increased cord perfusion. MAP should not be lowered for the same reason. Second, the use of distal bypass during surgery to restore cord perfusion in segments disrupted by grafting seems to improve outcomes. This strategy is likely best accomplished by monitoring somatosensory evoked potentials (SSEP’s) during aortic repair and opting for bypass when the SSEP’s show poor signal transmission. Prolonging ICU sedation may lead to other complications such as critical illness polyneuropathy (CIP) or myonecrosis and is not supported by any data.