

# CURRENT

Practice Guidelines in  
Inpatient Medicine

2018-2019

JACOB A. DAVID

Mc  
Graw  
Hill  
Education

**LANGGE**<sup>®</sup>

a LANGE medical book

---

# **CURRENT Practice Guidelines in Inpatient Medicine 2018–2019**

**Jacob A. David, MD, FAAFP**

Associate Program Director

Ventura County Medical Center Family Medicine Residency Program

Clinical Instructor, Family Medicine, UCLA David Geffen School of Medicine

Ventura, California



New York Chicago San Francisco Athens London Madrid  
Mexico City Milan New Delhi Singapore Sydney Toronto

[mebooksfree.com](http://mebooksfree.com)

Copyright © 2018 by McGraw-Hill Education. All rights reserved. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

ISBN: 978-1-26-001223-1

MHID: 1-26-001223-9

The material in this eBook also appears in the print version of this title: ISBN: 978-1-26-001222-4, MHID: 1-26-001222-0.

eBook conversion by codeMantra  
Version 1.0

All trademarks are trademarks of their respective owners. Rather than put a trademark symbol after every occurrence of a trademarked name, we use names in an editorial fashion only, and to the benefit of the trademark owner, with no intention of infringement of the trademark. Where such designations appear in this book, they have been printed with initial caps.

McGraw-Hill Education eBooks are available at special quantity discounts to use as premiums and sales promotions or for use in corporate training programs. To contact a representative, please visit the Contact Us page at [www.mhprofessional.com](http://www.mhprofessional.com).

### Notice

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required. The authors and the publisher of this work have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication. However, in view of the possibility of human error or changes in medical sciences, neither the authors nor the publisher nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they disclaim all responsibility for any errors or omissions or for the results obtained from use of the information contained in this work. Readers are encouraged to confirm the information contained herein with other sources. For example and in particular, readers are advised to check the product information sheet included in the package of each drug they plan to administer to be certain that the information contained in this work is accurate and that changes have not been made in the recommended dose or in the contraindications for administration. This recommendation is of particular importance in connection with new or infrequently used drugs.

### TERMS OF USE

This is a copyrighted work and McGraw-Hill Education and its licensors reserve all rights in and to the work. Use of this work is subject to these terms. Except as permitted under the Copyright Act of 1976 and the right to store and retrieve one copy of the work, you may not decompile, disassemble, reverse engineer, reproduce, modify, create derivative works based upon, transmit, distribute, disseminate, sell, publish or sublicense the work or any part of it without McGraw-Hill Education's prior consent. You may use the work for your own noncommercial and personal use; any other use of the work is strictly prohibited. Your right to use the work may be terminated if you fail to comply with these terms.

THE WORK IS PROVIDED "AS IS." MCGRAW-HILL EDUCATION AND ITS LICENSORS MAKE NO GUARANTEES OR WARRANTIES AS TO THE ACCURACY, ADEQUACY OR COMPLETENESS OF OR RESULTS TO BE OBTAINED FROM USING THE WORK, INCLUDING ANY INFORMATION THAT CAN BE ACCESSED THROUGH THE WORK VIA HYPERLINK OR OTHERWISE, AND EXPRESSLY DISCLAIM ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. McGraw-Hill Education and its licensors do not warrant or guarantee that the functions contained in the work will meet your requirements or that its operation will be uninterrupted or error free. Neither McGraw-Hill Education nor its licensors shall be liable to you or anyone else for any inaccuracy, error or omission, regardless of cause, in the work or for any damages resulting therefrom. McGraw-Hill Education has no responsibility for the content of any information accessed through the work. Under no circumstances shall McGraw-Hill Education and/or its licensors be liable for any indirect, incidental, special, punitive, consequential or similar damages that result from the use of or inability to use the work, even if any of them has been advised of the possibility of such damages. This limitation of liability shall apply to any claim or cause whatsoever whether such claim or cause arises in contract, tort or otherwise.

This book is dedicated to the VCMC Family Medicine family, and  
to Ken and Karen, who helped with homework.

*This page intentionally left blank*

# Contents

*Contributors ix*

*Preface xiii*

## **1. CARDIOVASCULAR**

*Jacob A. David, Michael D. Ramirez and Kristin H. King*

- Adult Life Support 1
- ST-Elevation Myocardial Infarction 2
- Non-ST-Elevation Myocardial Infarction 5
- Congestive Heart Failure 8
- Atrial Fibrillation 14
- Supraventricular Tachycardia 18
- Infective Endocarditis 23
- Valvular Heart Disease 29

## **2. VASCULAR**

*Zachary Zwolak and James Rohlfing*

- Venous Thromboembolism 33
- Peripheral Arterial Disease 38

## **3. PULMONARY**

*Zachary Zwolak and James Rohlfing*

- Pneumonia 45
- COPD Exacerbation 55
- Idiopathic Pulmonary Fibrosis 63

## **4. NEUROLOGY**

*Tipu V. Khan, Seth Alkire and Samantha Chirunomula*

- Acute Ischemic Stroke 65
- Acute Hemorrhagic Stroke 70
- Bacterial Meningitis 72
- Encephalitis 73
- Transverse Myelitis 75
- ICU Delirium 76
- ICU Agitation 77
- ICU Pain Management 78

## **5. GASTROENTEROLOGY**

*Jacob A. David and John Paul Kelada*

- Upper GI Bleeding 79
- Ascites 82
- Hepatic Encephalopathy 84
- Alcoholic Hepatitis 85
- Clostridium Difficile* Infection 85
- Infectious Diarrhea 86

Acute Pancreatitis 88  
Acute Liver Failure 90  
Inflammatory Bowel Disease 92  
Bowel Preparation For Colonoscopy 96

## **6. INFECTIOUS DISEASE**

*Neil Jorgensen and Marina Morie*

Sepsis and Septic Shock 97  
Skin and Soft Tissue Infections 101  
Diabetic Foot Infections 110  
Influenza 118  
Vertebral Osteomyelitis 122  
Prosthetic Joint Infections 128  
Candidiasis 135  
Outpatient Parenteral Antibiotic Therapy 141  
New Fever in the Critically Ill Adult 142  
Antibiotic Stewardship Programs 149

## **7. HEMATOLOGY**

*Tipu V. Khan, Seth Alkire and Samantha Chirumula*

Blood Transfusion: Indications by Clinical Setting 151  
Platelet Transfusion: Indications by Clinical Setting 152  
Immune Thrombocytopenic Purpura 153  
Thrombotic Thrombocytopenic Purpura 154  
Heparin-Induced Thrombocytopenia 155  
Sickle Cell Disease: Vaso-Occlusive Crisis 157  
Sickle Cell Disease: Acute Chest Syndrome 158

## **8. RENAL**

*Kristi M. Schoeld*

Acute Kidney Injury 161

## **9. ENDOCRINE**

*Kristi M. Schoeld and Paul Opore-Addo*

Hypothyroidism 165  
Hyperthyroidism 167  
Hyperglycemia 172  
Hyperglycemic Crisis: Diabetic Ketoacidosis and Hyperosmolar Hyperglycemic Syndrome 175

## **10. PERIOPERATIVE CONSIDERATIONS**

*David Araujo*

Assessing Perioperative Cardiovascular Risk 181  
Perioperative Anticoagulation 183  
Antimicrobial Prophylaxis for Surgery 185

**11. PREVENTION OF COMPLICATIONS***Jacob A. David and Kristi M. Schoeld*

- Venous Thromboembolism Prophylaxis 189  
Pressure Ulcers 190  
Catheter-Related Bloodstream Infections 190  
Catheter-Related Urinary Tract Infections 191  
Acute Kidney Injury 191  
Choosing Wisely – Society of Hospital Medicine 195

**12. END-OF-LIFE CARE***Leslie-Lynn Pawson and Heather Nennig*

- The Palliative Care Intervention 197

*Index* 205



*This page intentionally left blank*

# Contributors

## **Seth Alkire, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 4: Neurology*

*Chapter 7: Hematology*

## **David Araujo, MD**

Program Director, Ventura County Medical Center Family Medicine Residency Program

Associate Clinical Professor, UCLA David Geffen School of Medicine  
Ventura, California

*Chapter 1: Cardiovascular*

*Chapter 10: Perioperative Considerations*

## **Samantha Chirunomula, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 4: Neurology*

*Chapter 7: Hematology*

## **Jacob A. David, MD, FAAFP**

Associate Program Director

Ventura County Medical Center Family Medicine Residency Program  
Clinical Instructor

UCLA David Geffen School of Medicine

Ventura, California

*Chapter 1: Cardiovascular*

*Chapter 5: Gastroenterology*

*Chapter 11: Prevention of Complications*

## **Neil Jorgensen, MD**

Core Faculty, Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 6: Infectious Disease*

## **John Paul Kelada, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 5: Gastroenterology*

**Tipu V. Khan, MD, FAAFP**

Core Faculty, Ventura County Family Medicine Residency Program  
Assistant Clinical Professor of Medicine, UCLA David Geffen School of Medicine  
Ventura, California

*Chapter 4: Neurology*

*Chapter 7: Hematology*

**Kristin H. King, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 1: Cardiovascular*

**Marina Morie, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 6: Infectious Disease*

**Heather Nennig, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 12: End-of-Life Care*

**Paul Opare-Addo, MD, MPH**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 9: Endocrine*

**Leslie-Lynn Pawson, MD**

Assistant Clinical Professor, Family Medicine, UCLA David Geffen School of  
Medicine

Core Faculty, Ventura County Medical Center Family Medicine Residency Program

Director of Palliative Care, Ventura County Medical Center

Ventura, California

*Chapter 12: End-of-Life Care*

**Michael D. Ramirez, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 1: Cardiovascular*

**James Rohlfing, MD**

Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 2: Vascular*

*Chapter 3: Pulmonary*

**Kristi M. Schoeld, MD**

Assistant Clinical Professor of Medicine UCLA David Geffen School of Medicine  
Core Faculty, Ventura County Medical Center Family Medicine Residency Program  
Ventura, California

*Chapter 8: Renal*

*Chapter 9: Endocrine*

*Chapter 11: Prevention of Complications*

**Zachary Zwolak, DO, FAAFP**

Core Faculty, Ventura County Medical Center Family Medicine Residency Program  
Clinical Instructor, UCLA David Geffen School of Medicine  
Ventura, California

*Chapter 2: Vascular*

*Chapter 3: Pulmonary*

*This page intentionally left blank*

# Preface

*CURRENT: Practice Guidelines in Inpatient Medicine, 2018–2019* digests evidence-based guidelines into salient point-of-care applications, enabling physicians, nurse practitioners, physician assistants, and medical students to incorporate the advice of major professional societies and government agencies into the care of hospitalized adults. Each section outlines the initial assessment, acute management, and subsequent care for conditions commonly encountered in the hospital, putting relevant information at the busy clinician's fingertips.

The author is grateful to the contributors, a select group of teaching faculty and resident physicians from the Ventura County Medical Center Family Medicine Residency Program, for conferring their expertise. Their knowledge of medicine and commitment to excellent care for all is inspiring, and will be the principal reason for any success the book enjoys.

Acutely ill patients deserve consistent, high-quality care informed by the guidelines summarized in *CURRENT: Practice Guidelines in Inpatient Medicine, 2018–2019*. However, no guideline encompasses every scenario, and no handbook obviates the need for clinical training and critical analysis of the available evidence. The clinician's experience and judgment and the patient's unique circumstances and preferences will at times supersede the recommendations found herein. Though painstaking efforts have been made to accurately represent these recommendations and to find and correct errors and omissions, inaccuracies may remain. If you care to suggest an improvement or correct an error, please e-mail at [EditorialServices@mheducation.com](mailto:EditorialServices@mheducation.com).

Jacob A. David, MD, FAAFP

*This page intentionally left blank*

# Cardiovascular

Jacob A. David  
Michael D. Ramirez  
Kristin H. King

# 1

## ADULT LIFE SUPPORT

### Adult Basic Life Support and Cardiopulmonary Resuscitation (CPR)

1. Unresponsive, no pulse, and not breathing
  - a. Activate emergency response
  - b. Obtain defibrillator; when available, attach and activate
  - c. Begin CAB resuscitation (compressions, airway, breathing)
    - i. Compressions: 100/min, 2 inches depth, allow recoil, minimize interruptions
    - ii. Airway: Head tilt, chin lift; jaw thrust if trauma
    - iii. Breathing: Compressions only; if second trained rescuer available, 30:2 ratio; with advanced airway, 8–10 breaths per minute
  - d. Every 2 minutes, reassess, rotate compressors, and resume compressions promptly

### Adult Advanced Cardiac Life Support

1. Cardiac arrest
  - a. Activate emergency response
  - b. Begin CPR while obtaining rhythm assessment
  - c. Non-shockable rhythm (asystole, pulseless electrical activity)
    - i. CPR 2-minute cycles
    - ii. Give epinephrine every 3–5 minutes
    - iii. Reassess for shockable rhythm at end of each CPR cycle
    - iv. Treat reversible causes
  - d. Shockable rhythm (ventricular fibrillation, pulseless ventricular tachycardia)
  - e. Shock
  - f. Resume CPR immediately, 2-minute cycles
  - g. Reassess for shockable rhythm at end of each CPR cycle; shock if appropriate



- h. Give epinephrine every 3–5 minutes
  - i. Consider amiodarone or lidocaine if no ROSC after epinephrine and shock
  - j. Treat reversible causes
2. ROSC: Begin postarrest care

**Source:**

1. Neumar RW, Shuster M, Callaway CW, et al. Part 1: Executive summary. 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132 (18 Suppl 2):S315–S367. [[http://circ.ahajournals.org/content/132/18\\_suppl\\_2/S315](http://circ.ahajournals.org/content/132/18_suppl_2/S315)]

## ST-ELEVATION MYOCARDIAL INFARCTION

**Initial Assessment (ESC 2012)**

1. Draw serum markers routinely, but do not wait for results to initiate reperfusion therapy

**Acute Medical Management**

1. Antiplatelet therapy (ACC/AHA 2013, ESC 2012, NICE 2013)
  - a. Give aspirin (162–325 mg) at presentation
  - b. If treating with PCI, give a loading dose of an ADP-receptor inhibitor (clopidogrel 600 mg, prasugrel<sup>1</sup> 60 mg, or ticagrelor 180 mg)<sup>2</sup> as early as possible
  - c. If treating with fibrinolytics, give a loading dose of clopidogrel (300 mg; 75 mg if >75 years of age) with aspirin
2. Beta blockers
  - a. ACC/AHA: If hypertensive or having ongoing ischemia, give beta blocker at time of presentation, unless contraindicated
3. Oxygen
  - a. ESC: Give supplemental oxygen to treat hypoxia (SaO<sub>2</sub> <95%), breathlessness, or acute heart failure
4. Analgesics
  - a. ESC: Give IV opioids to relieve pain
5. Anticoagulation (ACC/AHA 2013, ESC 2012, NICE 2013)
  - a. If patient will receive primary PCI, give anticoagulation with unfractionated heparin (UFH), enoxaparin, or bivalirudin<sup>3</sup>; a glycoprotein IIb/IIIa inhibitor (abciximab, eptifibatide, tirofiban) may be added to UFH

<sup>1</sup>Do not administer prasugrel to patients with a history of prior stroke or TIA.

<sup>2</sup>ESC guidelines favor prasugrel or ticagrelor over clopidogrel. ACC/AHA does not state a preference.

<sup>3</sup>ESC guidelines favor bivalirudin or enoxaparin to unfractionated heparin. ACC/AHA does not state a preference.

- b. If patient will receive fibrinolytics, give anticoagulation until hospital discharge (minimum 48 hours, up to 8 days) or until revascularization is performed; options include UFH (titrated to a PTT of 1.5–2.0 times control), enoxaparin (IV bolus followed in 15 minutes by subcutaneous injection), or fondaparinux (initial IV dose followed in 24 hours by subcutaneous therapy)

### **Coronary Reperfusion Therapy**

1. PCI (ACC/AHA 2013, ESC 2012, NICE 2013)
  - a. Initiate reperfusion therapy (PCI, if experienced operators are available in a timely fashion) to all eligible patients within 12 hours of symptom onset; it remains beneficial up to at least 24 hours if there is evidence of ongoing ischemia
  - b. Primary PCI is preferable to fibrinolysis if performed by an experienced team within 120 minutes of first medical contact
  - c. Primary PCI is indicated in all patients with STEMI and cardiogenic shock or severe acute heart failure
  - d. In PCI for STEMI, use either a bare-metal or drug-eluting stent; use a bare-metal stent in patients with high bleeding risk, inability to comply with 1 year of dual antiplatelet therapy, or upcoming invasive procedure
  - e. In comatose patients, use therapeutic hypothermia
2. Fibrinolytic therapy (ACC/AHA 2013, ESC 2012, NICE 2013)
  - a. If timely PCI is not available, give fibrinolytic therapy within 30 minutes of hospital arrival, unless contraindicated; it is most useful if ischemic symptoms started within the past 12 hours, and is a reasonable choice between 12 and 24 hours if there is evidence of ongoing ischemia or a large area of myocardium at risk
  - b. Transfer to PCI-capable center
  - c. ACC/AHA: Transfer for urgent PCI if fibrinolysis fails
  - d. ESC: Transfer all patients after fibrinolysis; rescue PCI is indicated immediately when fibrinolysis has failed

### **Management After Stabilization**

1. Antiplatelet therapy (ACC/AHA 2016, ESC 2012)
  - a. Continue aspirin 81 mg indefinitely
  - b. After PCI for ACS, give dual antiplatelet therapy<sup>4</sup> for 1 year
    - i. ESC: “Up to 12 months,” with strict minimum of 1 month for bare-metal stent and 6 months for drug-eluting stent
    - ii. ACC/AHA: “Discontinuation after 6 months may be reasonable” if high bleeding risk; “>1 year may be reasonable” if low bleeding risk
  - c. After fibrinolytic therapy, continue dual antiplatelet therapy for at least 14 days and up to 1 year

<sup>4</sup>ESC guidelines favor prasugrel or ticagrelor over clopidogrel for dual antiplatelet therapy. ACC/AHA lists three options: clopidogrel 75 mg daily, prasugrel 10 mg daily, or ticagrelor 90 mg BID.

- d. ESC: If anticoagulation is otherwise indicated (i.e., for atrial fibrillation (AF)), give it in addition to antiplatelet therapy
2. Beta blockers (ACC/AHA 2013, ESC 2012)
  - a. Initiate oral beta blockers in the first 24 hours, unless heart failure, evidence of a low output state, or other contraindications
3. Renin-angiotensin-aldosterone system inhibitors (ACC/AHA 2013, ESC 2012)
  - a. Administer ACE inhibitor (or angiotensin receptor blocker, if intolerant of ACE) within the first 24 hours if anterior infarction, heart failure, or ejection fraction  $\leq 40\%$
  - b. Give an aldosterone antagonist to patients who are already receiving an ACE inhibitor and beta blocker, and whose ejection fraction is  $\leq 40\%$  and either have symptomatic heart failure or diabetes mellitus, unless contraindicated
4. Lipid-lowering agents (ACC/AHA 2013, ESC 2012)
  - a. Start or continue high-intensity statin therapy, unless contraindicated
  - b. Obtain a fasting lipid panel; ESC: Remeasure LDL after 1 month to ensure LDL  $< 70$  mg/dL
5. Implantable cardioverter-defibrillator therapy (ACC/AHA 2013, ESC 2012)
  - a. ICD therapy is indicated before discharge in patients who develop sustained VT/VF more than 48 hours after STEMI, unless the arrhythmia is due to ischemia, reinfarction, or metabolic abnormalities
  - b. If LVEF is initially reduced, reevaluate LVEF to assess candidacy for ICD therapy
6. Post-ACS risk assessments (ACC/AHA 2013, ESC 2012)
  - a. If patient did not undergo coronary angiography, or in patients with multi-vessel disease, perform noninvasive testing for ischemia before discharge

**Sources:**

1. ACC/AHA 2013: O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction. *J Am Coll Cardiol*. 2013 Jan 29;61(4). [<https://www.guideline.gov/summaries/summary/39429?>]
2. ESC 2012: Steg PG, James SK, Atar D, et al. ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J*. 2012 Oct;33(20):2569–2619. [<https://www.guideline.gov/summaries/summary/39353?>]
3. NICE 2013: National Clinical Guideline Centre. Myocardial infarction with ST-segment elevation. The acute management of myocardial infarction with ST-segment elevation. National Institute for Health and Care Excellence (NICE); 2013 Jul. 28 p. [<https://www.guideline.gov/summaries/summary/47019?>]

- c. For adults >50 years old or immunocompromised, add ampicillin IV 2 g q4 hours<sup>3</sup>
- d. If allergic to beta-lactams
  - i. Replace ceftriaxone with moxifloxacin IV 400 mg q24 hours
  - ii. Replace ampicillin with trimethoprim-sulfamethoxazole 5 mg/kg (trimethoprim component) IV q6–12 hours
- 4. Give corticosteroids: 0.15 mg/kg dexamethasone q6 hours for 2–4 days; ideally, give 10–20 minutes before or at least concomitant with initiation of antibiotic therapy

#### **Management After Stabilization (IDSA 2004)**

1. Diagnose bacterial meningitis based on CSF profile
  - a. Opening pressure: 200–500 mm H<sub>2</sub>O
  - b. WBC: 1000–5000 with 80%–95% neutrophils
  - c. CSF glucose: <40 mg/dL
2. Tailor antibiotic therapy based on CSF Gram stain if possible
3. Follow blood and CSF cultures and tailor antibiotic/antiviral therapy to target isolated pathogens

#### **Source:**

1. IDSA 2004: Tunkel A R, Hartman BJ, Kaplan SL, et al. Practice guidelines for the management of bacterial meningitis. Clin Infect Dis. 2004;39(9):1267–1284. [<https://academic.oup.com/cid/article-lookup/39/9/1267>]

## ENCEPHALITIS

#### **Initial Assessment (IDSA 2008)**

1. Suspect acute encephalitis in patients with fever, headache, altered level of consciousness, behavioral changes, focal neurologic signs, and seizures
2. Perform laboratory workup including:
  - a. CBC
  - b. Creatinine
  - c. Transaminases
  - d. PT/INR, PTT
  - e. Chest X ray
  - f. Neuroimaging (MRI preferred over CT, but do not delay imaging to obtain MRI)
3. Lumbar puncture with CSF culture (see Table 4-2 for interpretation parameters)

<sup>3</sup>Primarily to provide coverage for *Listeria* infection.

### Acute Medical Management (IDSA 2008)

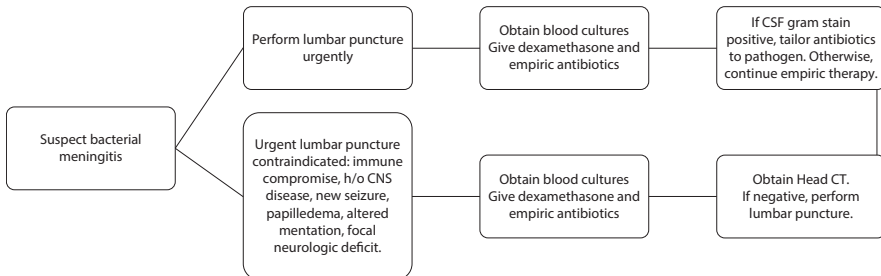
1. Start empiric acyclovir immediately if viral encephalitis suspected
  - a. 10 mg/kg IV q8 hours in children and adults with normal renal function
  - b. 20 mg/kg IV q8 hours in neonates
2. Give appropriate therapy for presumed bacterial meningitis if clinically indicated (see Figure 4-1 for initial management)
3. If there are clinical clues suggestive of rickettsial or ehrlichial infection during the appropriate season, add doxycycline to empiric regimen

### Management After Stabilization (IDSA 2008)

1. Once pathogen has been identified, select a treatment specifically for that pathogen
2. Consider acute disseminated encephalomyelitis in all patients; if suspicion is high, treat with high-dose IV corticosteroids (i.e., methylprednisolone, 1 g IV daily for at least 3–5 days)

**TABLE 4-2**

TYPICAL CSF PARAMETERS FOR VARIOUS INFECTIONS			
	Bacterial	Viral	Fungal/TB
<b>Color</b>	Turbid	Clear	Clear
<b>Opening pressure</b>	High	Normal or mildly increased	High
<b>Glucose</b>	Low	Low	Normal
<b>Serum: CSF glucose ratio</b>	<0.4	>0.6	<0.4
<b>Protein</b>	High	Normal	Normal to elevated
<b>WBC count</b>	>500	<1000	100–500
<b>WBC differential</b>	Predominantly PMNs	Increased lymphocytes	Increased lymphocytes



**FIGURE 4-1.** Initial management of bacterial meningitis. (From IDSA 2004; with permission.)

3. Perform plasma exchange in individuals who respond poorly to corticosteroids

**Source:**

1. IDSA 2008: Tunkel AR, Glaser CA, Bloch KC, et al. The management of encephalitis: clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis.* 2008;47(3):303–327. [<https://academic.oup.com/cid/article/47/3/303/313455>]

## TRANSVERSE MYELITIS

### Initial Assessment

1. Determine underlying etiology (AAN 2011)
  - a. Idiopathic
    - i. Usually there is a preceding GI, respiratory, or systemic illness (*Curr Neurol Neurosci Rep.* 2006)
  - b. Secondary
    - i. MS, para-infectious myelitis, lupus, Guillain-Barré syndrome, other systemic diseases
    - ii. Often the initiating complaint of a new MS diagnosis
    - iii. If it involves three or more vertebral segments, often due to neuromyelitis optica
2. Workup: Exclude compressive cord lesion
  - a. Lumbar puncture
    - i. Elevated CSF WBC of  $>10$  cells/mm<sup>3</sup>
    - ii. Get oligoclonal bands, DRL, IgG index, cytology, and routine spinal studies
  - b. MRI with and without gadolinium of the entire spine and brain
  - c. Serum: NMO-IgG
  - d. Diagnosis requires either pleocytosis of CSF or elevated IgG index or gadolinium enhancement on MRI
  - e. Other workup
    - i. TSH, auto-immune labs such as ANA/RF, ESR, CRP, rule out vascular myelopathies, metabolic and nutritional myelopathies, neoplasm, and radiation myelitis
3. Type
  - a. Acute complete (ACTM)
  - b. Acute partial (APTM)
    - i. Higher risk of transition to MS; may be up to 90% in those with abnormal brain MRI

### Acute Medical Management (AAN 2011)

1. Give high-dose burst steroids for 3–5 days

- a. Methylprednisolone 1000 mg daily
- b. Dexamethasone 200 mg daily
2. Longer steroid treatment may be needed, tailored to the patient's disease activity and guided by expert consultation
3. If motor impairment is present, consider plasma exchange: Five treatments of 1.1–1.5 plasma volumes every other day for 10 days
4. If severe TM, consider cyclophosphamide 800–1200 mg/m<sup>2</sup> once

### Chronic Medical Management

1. Consider chronic immunomodulatory therapy for patients with recurrent disease
  - a. Azathioprine: 150–200 mg/daily
  - b. Methotrexate: 15–20 mg/week
  - c. Mycophenolate: 2–3 g/day

### Management After Stabilization

1. Relapse higher with APTM
2. Idiopathic TM usually has at least a partial recovery but may take 1–6 months (J Child Neurol. 2003); ensure good PT/OT
3. Rapid onset or infectious causes tend to yield a prolonged (over years) recovery or permanent disability

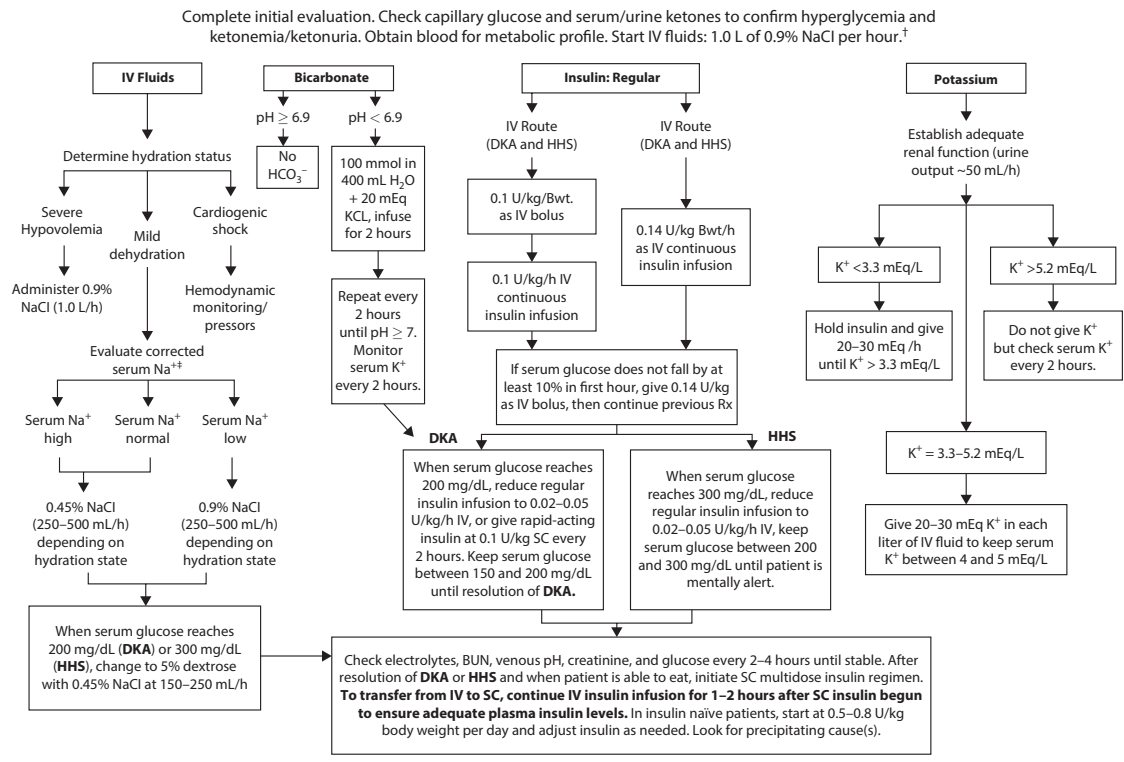
### Sources:

1. Scott TF, Frohman EM, De Seze J, et al. Evidence-based guideline: clinical evaluation and treatment of transverse myelitis. *Neurology*. 2011;77(24):2128–2134. [<http://www.neurology.org/content/77/24/2128.full.html>]
2. Krishnan C, Kaplin AI, Pardo CA, et al. Demyelinating disorders: update on transverse myelitis. *Curr Neurol Neurosci Rep*. 2006;6(3):236–243. [<https://www.ncbi.nlm.nih.gov/pubmed?term=16635433>]
3. Defrense P, Hollenberg H, Husson B, et al. Acute transverse myelitis in children: clinical course and prognostic factors. *J Child Neurol*. 2003;18(6):401–406. [<https://www.ncbi.nlm.nih.gov/pubmed/12886975>]

## ICU DELIRIUM

### Identification (SCCM 2013)

1. Risk factors for delirium (SCCM 2013)
  - a. Preexisting dementia
  - b. History of hypertension
  - c. History of alcoholism
  - d. High severity of illness at admission
  - e. Comatose
2. Monitor all ICU patients routinely for delirium using a validated tool such as CAM-ICU or ICDSC



**FIGURE 9-1.** Protocol for management of adult patients with DKA or HHS. DKA diagnostic criteria: blood glucose 250 mg/dl, arterial pH 7.3, bicarbonate 15 mEq/l, and moderate ketonuria or ketonemia. HHS diagnostic criteria: serum glucose >600 mg/dl, arterial pH >7.3, serum bicarbonate >15 mEq/l, and minimal ketonuria and ketonemia.

<sup>†</sup>15–20 ml/kg/h;

<sup>\*</sup>Serum Na should be corrected for hyperglycemia (for each 100 mg/dl glucose 100 mg/dl, add 1.6 mEq to sodium value for corrected serum value).

Abbreviations: Bwt, body weight; IV, intravenous; SC, subcutaneous.