

TABLE OF CONTENTS

Coagulation and Thrombotic Disorders I 1

Coagulation and Thrombotic Disorders I Panel 3

Coagulation Assays in Critical Care

By Keri S. Kim, Pharm.D., MS CTS, FNCS, BCPS

Introduction 7
 Coagulation Assays: Methods and Considerations 8
 Clinical Application of Coagulation Assays in Critical Care 17
 Conclusion 19
 References 19
 Self-Assessment Questions 23

Reversal of Anticoagulants, Antiplatelets, and Fibrinolytics

By Jessica Grandoni, Pharm.D., BCPS; and Poorvi Shah, Pharm.D., BCCCP

Introduction 27
 Clinical Evidence and Guidance for Antithrombotic Reversal 29
 Anticoagulants 30
 Application Concepts 39
 Conclusion 40
 References 40
 Self-Assessment Questions 44

Coagulation and Thrombotic Disorders II 49

Coagulation and Thrombotic Disorders II Panel 51

Acute GI Bleeding

By Whitney Gibson Medford, Pharm.D., BCCCP; and Uyen T. Diep, Pharm.D., BCCCP

Introduction 55
 Upper GI Bleeding 55
 Lower GI Bleeding 70
 Considerations for Resuming Antiplatelet or Anticoagulant Therapy 76
 Conclusion 77
 References 78
 Self-Assessment Questions 88

Pulmonary Embolism

By Lauren A. Igneri, Pharm.D., FCCM, BCPS, BCCCP

Introduction 93

Pathogenesis and Pathophysiology 95
 Clinical Presentation 97
 Diagnosis of PE 97
 Initial Management of PE 104
 Thrombolytic Therapy 111
 Endovascular Management of PE 115
 Surgical Management of PE 117
 Mechanical Circulatory Support 117
 Conclusion 117
 References 118
 Self-Assessment Questions 121

Coagulation and Thrombotic Disorders III 125

Coagulation and Thrombotic Disorders III Panel 127

Acquired Hematologic Dysfunction, Part I

By Kathryn E. Dane, Pharm.D., BCPS

Overview of Thrombotic Microangiopathies 131
 Pathophysiology and Clinical Classifications 131
 Presentation 133
 Diagnosis 134
 Treatment 136
 Overview of Drug-Induced Hemolysis 145
 Conclusion 147
 References 147
 Self-Assessment Questions 151

Acquired Hematologic Dysfunction, Part II

By Alexandra Warner, Pharm.D., BCOP; and Chris Droege, Pharm.D., FCCM, FCCP, FASHP, BCCCP

Thrombocytopenia in the ICU 155
 Drug-Induced Thrombocytopenia 160
 Uremia 168
 Methemoglobinemia 170
 Conclusion 174
 References 174
 Self-Assessment Questions 179

Coagulation and Thrombotic Disorders IV 185

Coagulation and Thrombotic Disorders IV Panel 187

Interactive Case: Anticoagulation Management of Atrial Fibrillation

By Jenna M. Holzhausen, Pharm.D., BCPS

Interactive Case: Anticoagulation Management of Atrial Fibrillation	192
Hyperlink to Activity	192
Self-Assessment Questions	196

Interactive Case: DVT Treatment in Obesity

By Marc McDowell, Pharm.D., BCPS

Interactive Case: DVT Treatment in Obesity	200
Hyperlink to Activity	200
Self-Assessment Questions	203

Recorded Webcast: Device-Related Antithrombotic Therapy

By Sarah Adie, Pharm.D., BCCP

Recorded Webcast: Device-Related Antithrombotic Therapy	208
Hyperlink to Activity	208
Self-Assessment Questions	210

9. K.G.'s vital signs after resuscitation and pharmacologic support include blood pressure 110/75 mm Hg, heart rate 90 beats/minute, and respiratory rate 20 breaths/minute. Which one of the following diagnostic modalities is best to recommend for K.G.?
- Sengstaken-Blakemore tube to stabilize bleeding varices in preparation for endoscopy
 - Diagnostic endoscopy within 6 hours of presentation followed by CT angiography (CTA)
 - Emergency surgery to identify bleed location and provide devascularization
 - Endoscopy within 12 hours of presentation for possible mechanical therapy

Questions 10 and 11 pertain to the following case.

C.P., a 56-year-old man, has a medical history of cirrhosis (Model for End-Stage Liver Disease [MELD] score 19 and Child-Pugh class B status) with known varices. He has been in the ICU for 48 hours and is currently receiving pantoprazole 40 mg intravenously twice daily, octreotide 50 mcg/hour, norepinephrine 1 mcg/kg/minute, and vasopressin 0.03 units/hour. Endoscopy revealed esophageal varices, which were subsequently banded, and no further bleeding was noted. Four hours after his return to the ICU, C.P.'s vital signs include blood pressure 80/50 mm Hg, heart rate 130 beats/minute, respiratory rate 22 breaths/minute, and temperature 38°C. Laboratory test results include Hgb 5.9 g/dL, INR 4, Plt 125,000/mm³, SCr 3.0 mg/dL, and BUN 45 mg/dL.

10. Which one of the following is best to recommend adding to C.P.'s pharmacotherapy?
- Ceftriaxone 1 g intravenously daily for 7 days
 - Clarithromycin 500 mg by mouth every 12 hours and metronidazole 500 mg by mouth every 8 hours for 10 days
 - Ciprofloxacin 500 mg by mouth once daily or norfloxacin 400 mg daily for 7 days
 - Doxycycline 500 mg by mouth every 6 hours, metronidazole 500 mg by mouth every 8 hours, and bismuth 300 mg by mouth every 6 hours for 14 days
11. According to available data, which one of the following is best to recommend next for C.P.?
- No further intervention is necessary; vital signs and laboratory findings show his condition is stable.
 - He needs immediate surgery for possible splenectomy and placement of esophageal banding.
 - He should be placed on the liver transplant list and continued on current pharmacotherapy until he receives a match.
 - Transjugular intrahepatic portosystemic shunting (TIPS) should be performed to reduce portal hypertension and further stabilize his variceal bleeding.

Questions 12–15 pertain to the following case.

S.H. is a 42-year-old man with a medical history of deep vein thrombosis (diagnosed in 2003), coronary artery disease with percutaneous coronary intervention (in 2020), gastroesophageal reflux disease, atrial fibrillation, and hypertension. He presents with hypotension, tachycardia, and bright red blood per rectum. S.H.'s presumed diagnosis is an LGIB. The GI team is consulted, and he is transferred to the ICU on norepinephrine 0.6 mcg/kg/minute, vasopressin 0.04 units/minute, pantoprazole 8 mg/hour, and octreotide 50 mcg/hour.

12. Which one of the following diagnostic modalities is best to recommend for S.H.?
- CTA is preferred because it has high diagnostic yield, sensitivity, and specificity.
 - Colonoscopy within 12 hours is preferred because of its ability to locate bleeding source and provide therapeutic intervention(s).
 - Colonoscopy is preferred because it has shown efficacy similar to CTA regarding ability to locate a definitive bleeding source, in addition to tissue sampling.
 - Video capsule endoscopy (VCE) is preferred because it is noninvasive, can examine the entire bowel, and produces high diagnostic yield.
13. S.H. is diagnosed with diverticular LGIB. Which one of the following pharmacologic therapies is best to recommend for S.H.?
- Vasopressin order should be changed to titratable, and nitroglycerin should be added to minimize the risk of ischemic events.
 - Pantoprazole continuous infusion can be changed to twice-daily intravenous push according to available literature. Pantoprazole can be discontinued after 24 hours of therapy.
 - Pantoprazole and octreotide can be continued; however, *H. pylori* is common in LGIB and empiric treatment should be initiated, including amoxicillin and metronidazole.
 - Pantoprazole and octreotide play no role in the treatment of LGIB and should be discontinued.
14. For his diverticular LGIB, which one of the following non-pharmacologic therapies is best to recommend for S.H.?
- Endoscopic band ligation is superior to clipping and is first line for diverticular bleeding.
 - Transcatheter arterial embolization (TAE) is preferred to band ligation and clipping.
 - Injection sclerotherapy in combination with thermal coagulation is less invasive than other modalities and should be used first.
 - Surgical intervention offers the most definitive treatment for LGIB.