

Review of Surgery for
ABSITE AND **BOARDS**

SECOND EDITION



EDITOR Christian de Virgilio

ASSOCIATE EDITOR Areg Grigorian

ASSISTANT EDITORS Patrick T. Delaplain | Michael D. Sgroi

ELSEVIER

Review of Surgery for **ABSITE and Boards**

SECOND EDITION

Editor

Christian de Virgilio, MD, FACS

Chair, Department of Surgery, Harbor-UCLA Medical Center, Torrance, California

Co-Chair, College of Applied Anatomy, Professor of Surgery, UCLA School of Medicine, Los Angeles, California

Associate Editor

Areg Grigorian, MD

Resident in Surgery, Department of Surgery, University of California, Irvine, Orange, California

Assistant Editors

Patrick T. Delaplain, MD

Resident in Surgery, Department of Surgery, University of California, Irvine, Orange, California

Michael D. Sgroi, MD

Resident in Surgery, Department of Surgery, University of California, Irvine, Orange, California

ELSEVIER

Table of Contents

Cover image

Title page

Copyright

Dedication

Contributors

Foreword

Preface

Acknowledgments

Part I. Patient Care

1. Abdomen—General

2. Abdomen—Hernia

3. Abdomen—Biliary

4. Abdomen—Liver

5. Abdomen—Pancreas

6. Abdomen—Spleen

7. Alimentary Tract—Esophagus

8. Alimentary Tract—Stomach

9. Alimentary Tract—Small Bowel

10. Alimentary Tract—Large Intestine

11. Alimentary Tract—Anorectal

12. Breast

13. Endocrine

14. Skin and Soft Tissue

15. Surgical Critical Care

16. Trauma

17. Vascular—Arterial

18. Vascular—Venous

19. Vascular—Access

20. Transplant

21. Thoracic Surgery

22. Pediatric Surgery

23. Plastic Surgery

24. Genitourinary

25. Gynecology

26. Head and Neck

27. Nervous System

Part II. Medical Knowledge

28. Anesthesia

29. Fluids, Electrolytes, and Acid-Base Balance

30. Immunology

31. Infection and Antimicrobial Therapy

32. Nutrition and Metabolism

33. Oncology and Tumor Biology

34. Pharmacology

35. Preoperative Evaluation and Perioperative Care

36. Transfusion and Disorders of Coagulation

37. Wound Healing

Copyright

ELSEVIER

1600 John F. Kennedy Blvd.
Ste 1800
Philadelphia, PA 19103-2899

REVIEW OF SURGERY FOR ABSITE AND BOARDS, SECOND EDITION ISBN: 978-0-323-35642-8
Copyright © 2018 by Elsevier, Inc. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: www.elsevier.com/permissions.

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

With respect to any drug or pharmaceutical products identified, readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of practitioners, relying on their own experience and knowledge of their patients, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Previous edition copyrighted 2010.

Library of Congress Cataloging-in-Publication Data

Names: de Virgilio, Christian, author. | Grigorian, Areg, author. | Delaplain, Patrick T., author. | Sgroi, Michael D., author.

Title: Review of surgery for ABSITE and boards / Christian de Virgilio, Areg Grigorian, Patrick T. Delaplain, Michael D. Sgroi.

Other titles: Review of surgery for American Board of Surgery In-Training Examination and boards

Description: Second edition. | Philadelphia, PA : Elsevier, [2018] | Includes bibliographical references.

Identifiers: LCCN 2016049211 | ISBN 9780323356428 (pbk.)

Subjects: | MESH: Surgical Procedures, Operative | Clinical Medicine | Critical Care | Specialty Boards | Examination Questions

Classification: LCC RD37.2 | NLM WO 18.2 | DDC 617.0076--dc23 LC record available at

<https://lccn.loc.gov/2016049211>

Executive Content Strategist: Michael Houston

Content Development Specialist: Angie Breckton

Publishing Services Manager: Deepthi Unni

Senior Project Manager: Beula Christopher

Design Direction: Renee Duenow

Printed in United States of America.

Last digit is the print number: 9 8 7 6 5 4 3 2 1



Dedication

To my parents Miguel and Kerstin, both in their 80s and still working, who have always inspired me to aim high, and to surgical residents everywhere who motivate me to always keep learning.

Christian de Virgilio

To Dr. de Virgilio and my surgical mentors, thank you for teaching me. And to my physician wife, Rebecca, thank you for always supporting me.

Areg Grigorian

Contributors

Christine Dauphine, MD, FACS, Vice Chair, Surgical Education, Harbor-UCLA Medical Center, Associate Professor of Surgery, David Geffen School of Medicine at UCLA, Los Angeles, California

Patrick T. Delaplain, MD, Resident in Surgery, Department of Surgery University of California, Irvine, Orange, California

Christian de Virgilio, MD, FACS

Chair, Department of Surgery, Harbor-UCLA Medical Center, Torrance, California
Co-Chair, College of Applied Anatomy Professor of Surgery, UCLA School of Medicine, Los Angeles, California

Fuad Elkhoury, MD, Department of Urology, University of California, Los Angeles, Los Angeles, California

Areg Grigorian, MD, Resident in Surgery, Department of Surgery, University of California, Irvine, Orange, California

Dennis Kim, MD, FRCSC, FACS, Associate Clinical Professor of Surgery, Vice Chair, College of Applied Anatomy, David Geffen School of Medicine at UCLA, Harbor-UCLA Medical Center, Torrance, California

Jerry Kim, MD, General Surgery Resident, Harbor-UCLA Medical Center, Torrance, California

Steven Lee, MD, FACS, FAAP, Chief, Pediatric Surgery, Associate Program Director, Surgery Residency, Harbor-UCLA Medical Center, Professor of Clinical Surgery and Pediatrics, David Geffen School of Medicine at UCLA, Los Angeles, California

Hossein Masoomi, MD, Plastic Surgery Fellow, Division of Plastic Surgery at University of Texas, Houston, Texas

Junko Ozao-Choy, MD

Assistant Chief of Breast and Melanoma, Division of Surgical Oncology, Harbor-UCLA Medical Center, Torrance, California
Assistant Professor of Surgery, David Geffen School of Medicine at UCLA, Los Angeles, California

Beverley A. Petrie, MD, FACS, FASCRS, Professor of Surgery, David Geffen School of Medicine at UCLA, Executive Vice Chair, Department of Surgery, Assistant Chief, Division of Colon and Rectal Surgery, Harbor-UCLA Medical Center, Torrance, California

Samuel Schwartz, MD, Vascular Surgery Fellow, Massachusetts General Hospital, Boston, Massachusetts

Alexander C. Schwed, MD, Surgical Resident, Department of Surgery, Harbor-UCLA Medical Center, Torrance, California

Michael D. Sgroi, MD, Resident in Surgery, Department of Surgery, University of California, Irvine, Orange, California

Foreword

Dr. Christian de Virgilio and his collaborators have successfully produced the second edition of their now famous book, *Review of Surgery for ABSITE and Boards*. This publication provides a unique resource for residents taking the ABSITE and the American Board of Surgery qualifying examination and for practicing physicians who are facing the challenge of recertification. The book, originally the product of a Harbor- UCLA Medical Center educational effort conceived and developed by the senior author, is a great resource for younger and older physicians who embrace the art and science of surgery. In this era of constant change, lifelong learning has become one of the most important components of continued professional development. The nearly 1000 carefully edited questions are arranged in logical sections and provide an introduction to the realistic problems surgeons face. The well-constructed answers and accompanying references deliver a natural follow-up to the introductory questions and establish the basis for learning that moves the needle of knowledge in the right direction. Thus this text both prepares the reader to take an examination and provides a great learning experience. In this sense, residents preparing for the exam and practicing surgeons preparing for re-examination not only dramatically increase their chances of successfully passing the exam but also actually learn about the topics in question. This book was made possible by the work and dedication of many faculty members at Harbor-UCLA who should be congratulated. To me, their efforts reflect both the pursuit of excellence, one of the tenets of the American College of Surgeons, and the overall dedication of surgeons to this sacred profession.

Carlos A. Pellegrini, MD, FACS, FRCS(I)(Hon), *President American College of Surgeons 2013–2014, Chief Medical Officer, UW Medicine, Seattle, Washington*

Preface

We are most excited about the second edition of *Review of Surgery for ABSITE and Boards* designed to help students of surgery prepare for the American Board of Surgery In-Training (ABSITE), the American Board of Surgery (ABS) Qualifying (written) Examinations (QE), and for ABS recertification. The original inspiration for the book stemmed from a surgery review program we developed at Harbor-UCLA Medical Center. The intention of the review was to stimulate the residents to read, improve performance on the ABSITE, and enhance their likelihood of passing the ABS examinations on the first try. Based on the feedback we received from the first edition, we were pleased to hear that the book proved to be a valuable resource for all three of these examinations. With that in mind, we have strived to maintain a strong clinical focus for this second edition.

In this second edition, there are some exciting updates and changes. We have added three new members to our editorial team, Drs. Areg Grigorian, Patrick Delaplain, and Michael Sgroi. All three are surgical residents at UC Irvine and were handpicked because of their outstanding track record in test-taking and question writing and their demonstrated strong interest in surgical education. We have also added numerous surgical educators from Harbor-UCLA Medical Center, so as to broaden our expertise. Our editorial team reviewed each question for both accuracy and for clinical relevance. We attempted to eliminate questions with “all of the following are true except,” given that such questions rarely appear on examinations. We have aligned the chapters in such a way that they are now even more in sync with the topics covered by the ABSITE and the ABS QE. We have added new chapters and significantly updated each section, so as to provide the reader with the most updated literature and evidence-based, clinical information. As with the original version, we believe that the greatest value of this book lies in the robust explanations provided for why the correct answer is right and why the incorrect answers are wrong. We hope that this helps the reader in developing his or her test-taking skills and expands his or her knowledge beyond one simple fact.

As with any review book (this one included), it is important to emphasize that studying surgery by simply reviewing a series of practice questions is not sufficient. No amount of review can or should replace the importance of regular reading of a major surgical textbook. A recent multi-institutional study lends support to this. Daily reading, reading geared toward both patient care and ABSITE, and reading from a textbook are associated with better ABSITE performance.*

As with the first edition, we believe that the ideal way to prepare for the ABSITE and ABS QE is to create a year-round reading program. Read a chapter in a major surgical textbook (such as by Cameron, Sabiston, Schwartz, or Greenfield), and then answer the questions in our review book. Pay special attention to the robust responses provided in the back of each section. Then go to the selected references and read further on the topic. As we have cautioned before, the reader must be cognizant of the fact that no textbook or review book has all the answers. Some answers may be controversial. If you disagree with a question, or think you found an error, we'd love to hear back from you. My email is cdevirgilio@labiomed.org.

As a former residency program director in surgery at Harbor-UCLA, and now as Department Chair, I have always advocated that knowledge provides an invaluable tool to the surgeon. Good luck in your pursuit of knowledge. On behalf of my coeditors, I hope you find this review book useful.

* Kim, J., Kim, D., & Kaji, A., et al. (2015). Reading habits of general surgery residents and association with American board of surgery in-training examination performance. *JAMA Surg*, 150(9), 882-889.

Acknowledgments

We would like to acknowledge the efforts of Elsevier for the timely preparation and publication of this review book, in particular Michael Houston, Executive Content Strategist, who initiated the development of this book, and supported it throughout production, and the contributions made by Angie Breckon, Content Development Specialist. In addition, we would like to thank the surgery faculty and residents at Harbor-UCLA and UC Irvine Medical Centers who assisted in the production and inspiration of this project.

PART I

Patient Care

OUTLINE

1. Abdomen—General
2. Abdomen—Hernia
3. Abdomen—Biliary
4. Abdomen—Liver
5. Abdomen—Pancreas
6. Abdomen—Spleen
7. Alimentary Tract—Esophagus
8. Alimentary Tract—Stomach
9. Alimentary Tract—Small Bowel
10. Alimentary Tract—Large Intestine
11. Alimentary Tract—Anorectal
12. Breast
13. Endocrine
14. Skin and Soft Tissue
15. Surgical Critical Care
16. Trauma
17. Vascular—Arterial
18. Vascular—Venous
19. Vascular—Access
20. Transplant
21. Thoracic Surgery
22. Pediatric Surgery
23. Plastic Surgery
24. Genitourinary
25. Gynecology
26. Head and Neck
27. Nervous System

Abdomen – General

Michael D. Sgroi, Areg Grigorian, and Christian de Virgilio

Questions

1. A 74-year-old male presents to your clinic hoping to have his reducible umbilical hernia repaired secondary to increasing but intermittent pain and discomfort. Two days before his clinic visit, he had been discharged from the hospital for unstable angina for which he underwent balloon angioplasty with placement of a bare metal coronary artery stent (BMS). When should his surgery be scheduled?
 - A. 2 weeks
 - B. 1 month
 - C. 2 months
 - D. 6 months
 - E. 1 year
2. Which of the following is true regarding abdominal incisions and the prevention of incisional hernias?
 - A. A 3:1 suture:wound length is the current recommended closure length.
 - B. There is no difference in hernia occurrence between a running closure and an interrupted closure.
 - C. A slowly absorbable monofilament suture is preferred in the closure of the fascia in a running fashion.
 - D. Prophylactic use of mesh after open aortic aneurysm surgery is not efficacious.
 - E. A 1-cm bite between each stitch is the recommended distance during abdominal closure.
3. A 55-year-old obese male presents to the hospital for his bariatric sleeve gastrectomy procedure. His comorbidities include diabetes and hypertension, and he states he was diagnosed with “walking pneumonia” 2 weeks ago and placed on antibiotics, which he has finished. Which of the following would not be of benefit if the SCIP measures for preoperative and postoperative care are followed?
 - A. Placing the patient on an insulin sliding scale in an effort to keep glucose levels between 80 to 120 mg/dL
 - B. Clipping the patient’s abdominal hair with an electric shaver before operating
 - C. Administering anticoagulation on postoperative day 1
 - D. Administering antibiotics within 1 hour of surgery
 - E. Discontinuing antibiotics by postoperative day 1
4. A 32-year-old female who is 24 weeks pregnant presents to the emergency department with an acute onset of abdominal pain, fever, and vomiting. She states the pain woke her up in the middle of the night with sudden onset of epigastric pain that is now diffuse. She has no vaginal bleeding and fetal monitoring demonstrates normal vitals for the fetus. Upon physical exam, the patient has diffuse tenderness with guarding throughout the abdomen, worse in the epigastric region. Pelvic examination is normal. She has a leukocytosis of 15,000 cells/L. Abdominal x-ray series shows some dilated bowel loops but no other findings. What is your next step in management of this patient?
 - A. Abdominal ultrasound
 - B. CT scan of the abdomen/pelvis with contrast
 - C. Admit and observe with serial abdominal exams

- D. Exploratory laparotomy
 - E. Diagnostic laparoscopy
5. Which of the following is true regarding omental torsion?
- A. Secondary torsion is more common than primary.
 - B. Treatment is usually observation and pain control.
 - C. If surgery is necessary, management consists of detorsion and omentopexy.
 - D. The pain is usually in the left lower quadrant of the abdomen.
 - E. It typically produces purulent-appearing peritoneal fluid.
6. The intrinsic hemostatic characteristics of the omentum are due to its:
- A. Ability to recruit platelets
 - B. Greater concentration of von Willebrand factor
 - C. Greater concentration of tissue factor
 - D. Ability to induce local vasoconstriction
 - E. Ability to activate the intrinsic coagulation pathway
7. The most common organism isolated from the infected peritoneal fluid of a patient with a peritoneal dialysis catheter is:
- A. Beta-hemolytic streptococcus
 - B. *Enterococcus*
 - C. *Escherichia coli*
 - D. Coagulase-negative staphylococcus
 - E. Coagulase-positive staphylococcus
8. A 70-year-old woman presents with progressive abdominal pain and abdominal distention with nonshifting dullness. A CT scan demonstrates loculated collections of fluid and scalloping of the intra-abdominal organs. At surgery, several liters of yellowish gray mucoid material are present on the omentum and peritoneal surfaces. Which of the following is true about this condition?
- A. There is no role for surgical resection.
 - B. It is unlikely to involve the appendix.
 - C. This most likely represents a primary peritoneal malignancy.
 - D. It is more common in males.
 - E. Cytoreductive surgery is indicated.
9. The most common cause of a retroperitoneal abscess is:
- A. Diverticulitis
 - B. Appendicitis
 - C. Renal disease
 - D. Tuberculosis of the spine
 - E. Hematogenous spread from a remote location
10. A 50-year-old male with cirrhotic ascites secondary to hepatitis C presents with fever, elevated white blood cell count, and abdominal pain. He has a history of esophageal varices. He has been on the liver transplant list for 6 months. Paracentesis was performed and cultures were sent. A single organism grows from the culture. Which of the following is true regarding this condition?
- A. He is currently eligible for a liver transplant.
 - B. Prophylactic use of fluoroquinolone can be used to prevent this condition.
 - C. In adults, nephrotic syndrome is the most common risk factor.
 - D. In children, *E. coli* is the most common isolate.
 - E. He will likely need an exploratory laparotomy.
11. Which of the following is true regarding a rectus sheath hematoma?
- A. If located above the umbilicus, it is more likely to resemble an acute intra-abdominal process.
 - B. If located below the umbilicus, it is more likely to cause severe bleeding.

- C. The majority are associated with a history of trauma.
 - D. Operative drainage is the treatment of choice in most cases.
 - E. Angiographic embolization is not useful.
12. A 35-year-old female presents with an enlarging mass in her right arm. After appropriate workup, she is diagnosed with a desmoid tumor. Which of the following is true about this condition?
- A. They have a high rate of metastasis without proper treatment.
 - B. The chance of local recurrence is low after appropriate intervention.
 - C. Oral contraceptive pills (OCP) have been shown to reduce their size and make them more resectable.
 - D. Colonoscopy is indicated.
 - E. These tumors arise from proliferative chondroblastic cells.
13. Which of the following is true regarding retroperitoneal fibrosis?
- A. The mainstay of treatment involves radiation therapy.
 - B. It occurs more commonly in women.
 - C. The erythrocyte sedimentation rate (ESR) is typically normal.
 - D. Intravenous pyelography (IVP) is the diagnostic study of choice.
 - E. Medial deviation of the ureters is characteristic.
14. Which of the following is true regarding retroperitoneal sarcomas?
- A. They are best managed by enucleation.
 - B. Prognosis is best determined by histologic grade.
 - C. Lymph node metastasis is common.
 - D. Fibrosarcomas are the most common type.
 - E. Radiation therapy is often curative for small sarcomas.
15. A 75-year-old female with recently diagnosed atrial fibrillation, for which she was given an anticoagulant, presents with sudden onset abdominal pain. It is not related to oral intake. Surgical history is remarkable for a total hip arthroplasty 3 years ago. Her physical exam is significant for a tender, palpable abdominal wall mass above the umbilicus that persists during flexion of abdominal wall muscles. The mass is most likely related to which of the following?
- A. Thrombocytopenia
 - B. Bleeding from the superior epigastric artery
 - C. Occult trauma
 - D. An intra-abdominal abscess
 - E. Bleeding from the inferior epigastric artery

Answers

1. **B.** Good communication between the cardiologist and surgeon is essential before performing coronary interventions in a patient who requires surgery. Coronary revascularization before elective surgery is not recommended if the patient has asymptomatic coronary artery disease (CAD). However, in the setting of an acute coronary syndrome (acute myocardial infarction [MI], unstable angina), a percutaneous coronary intervention (PCI) is recommended before surgery. The options are to perform balloon angioplasty alone or add a bare metal stent (BMS) or a drug-eluting stent (DES). The DES is the best long-term option, but it requires a longer delay to surgery. Thus the decision of which to use depends on the urgency of the subsequent operation (urgent, time sensitive, or elective) and the feasibility of operating with antiplatelet agents on board. If the operation is urgent (within 2 weeks), a PCI with balloon angioplasty may be best because the waiting period for surgery is 2 weeks (A). If the operation is time sensitive (2–6 weeks), a BMS is a better option because it is less likely to suddenly occlude as compared with angioplasty alone. However, one should wait 1 month before performing surgery (C). Because this patient has a relatively symptomatic hernia, the operation is time sensitive. Finally, if a DES is placed, the recommendation is to wait 6 months before performing surgery (D, E).

References: Fleisher, L. A., Fleischmann, K. E., Auerbach, A. D., et al. (2014). 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *Journal of the American College of Cardiology*, 64(22), e77–e137.

Guyatt, G. H., Akl, E. A., Crowther, M., et al. (2012). Executive summary: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines [published corrections appear in *Chest*. 141(4), 1129. Dosage error in article text. *Chest*, 2012;142(6):1698. Dosage error in article text]. *Chest*, 2012;141(2 suppl):7S–47S.

Livhits, M., de Virgilio, C., et al. (2011). Risk of surgery following recent myocardial infarction. *Annals of Surgery*, 253(5), 857–864.

2. **C.** The material and the surgical technique used to close an open abdomen are important determinants of the risk of developing an incisional hernia. The European Hernia Society has recently come out with guidelines recommending that small bite closure be performed using at least a 4:1 suture:wound length during closure (A). It has also been shown that running closure is superior to an interrupted closure (B). Prophylactic use of mesh during closure has been shown to be efficacious after open aortic aneurysm surgery because of the high rate of incisional hernia (D). A randomized control trial looking at small bites compared to large bites has recently been performed looking at 560 patients who received either small, 5-mm bites 5 mm apart or large, 1-cm bites 1 cm apart. They found a statistically significant reduced rate of hernia occurrence in the small bite group, which is now the recommended bite size and length (E). A slowly absorbable monofilament suture (polydioxanone suture [PDS]) has been shown to also be the recommended suture in abdominal closure.

References: Deerenberg, E. B., Harlaar, J. J., Steyerberg, E. W., et al. (2015). Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. *Lancet*, 386(10000), 1254–1260.

Muysoms, F. E., Antoniou, S. A., Bury, K., et al. (2015). European Hernia Society guidelines on the closure of abdominal wall incisions. *Hernia*, 19(1), 1–24.

3. **A.** The Surgical Care Improvement Project (SCIP) is a national quality partnership of organizations interested in improving surgical outcomes that began in 2006. Care is taken by all institutions to follow the recommendations by the Joint Commission because all these outcomes are documented and measured quarterly. The core measures include giving antibiotics within 1 hour of surgery (D) and discontinuing within 24 hours (E), Foley catheter removal by postoperative day 2, and hair removal by clipping on the day of surgery. Shaving the hair off has been shown to increase the risk of infection (B). Other beneficial measures include being on appropriate venous thromboembolism (VTE) prophylaxis within 24 hours after surgery and glucose control. The importance of glucose control and surgical outcomes has been well established; however, in 2009 the NICE-SUGAR trial demonstrated that strict glucose control was actually associated with worse outcomes. It is now widely accepted that the goal should be to keep glucose levels below 180 mg/dL (C).

Reference: NICE-SUGAR Study Investigators, Finfer, S., Chittock, D. R., et al. (2009). Intensive versus conventional glucose control in critically ill patients. *The New England Journal of Medicine*, 360(13), 1283–1297.

4. **B.** Fear of radiation exposure during pregnancy should not take precedence over quickly establishing the correct diagnosis and initiating treatment. Based on the patient's acute onset of symptoms and location, the presentation is concerning for peritonitis, potentially due to a perforated viscus, such as a peptic ulcer, or a closed loop bowel obstruction. In this situation, the best next step would be to perform a computed tomography (CT) scan of the abdomen (A, C–E). As a general rule, the care of the patient, not the fetus, should take first priority. Based on the National Guideline Clearinghouse, expeditious and accurate diagnosing should take precedent over risk of ionizing radiation. The effects of radiation exposure on the fetus depend on the gestational age and the amount of radiation. In general, the earlier the gestational age, the greater the risk is. High dose (>10 rads) exposure early in pregnancy (within the first 4 weeks) can lead to fetal demise. However, such a high exposure exceeds the dose of typical imaging (abdominal x-ray is 200 mrad while abdominal and pelvic CT is about 3–4 rads). Between 8 to 15 weeks' gestation, high-dose (>10 rads) radiation can lead to intrauterine growth retardation and central nervous defects. Beyond 15 weeks (as in the present case), there do not appear to be any deterministic effects (dose-dependent events such as fetal loss, congenital defects) on the fetus. Stochastic effects (those that are not dose

dependent), such as the subsequent risk of cancer or leukemia, are increased with exposure of 1 rad or more. The risk is about 1 cancer for every 500 exposures. Conversely, if the pregnant patient with an acute abdomen progresses to peritonitis and bowel perforation, the risk of fetal demise is very high. Thus the risk of fetal miscarriage is higher with visceral perforation than with radiation exposure, and therefore all measures should be taken for an accurate diagnosis. Magnetic resonance imaging (MRI) is considered a good imaging option in pregnancy; however, its use in the emergent setting may be limited by its availability. Ultrasound is also useful, but would be more useful if the patient presented with right upper quadrant pain (suspected biliary disease) or right lower quadrant pain (suspected appendicitis).

References: Guidelines for diagnosis, treatment, and use of laparoscopy for surgical problems during pregnancy. 1996 Feb (revised 2011). NGC:008496. Society of American Gastrointestinal and Endoscopic Surgeons—Medical Specialty Society. Retrieved from the U.S. Department of Health and Human Services website: <https://www.guideline.gov/summaries/summary/32671/guidelines-for-diagnosis-treatment-and-use-of-laparoscopy-for-surgical-problems-during-pregnancy>.

Khandelwal, A., Fasih, N., Kielar, A., et al. (2013). Imaging of acute abdomen in pregnancy. *Radiologic Clinics of North America*, 51(6), 1005–1022.

5. **A.** It is important to be aware of omental torsion because it readily mimics an intra-abdominal perforation. Because it is typically very difficult to diagnose preoperatively, the diagnosis is most often made at surgery. Torsion of the omentum describes a twisting of the omentum around its vascular pedicle along the long axis. Primary torsion, in which case there is no underlying pathology, is extremely rare. Secondary torsion is much more common, and the torsion is usually precipitated by a fixed point such as a tumor, an adhesion, a hernia sac, or an area of intra-abdominal inflammation. Omental torsion is much more common in adults in their fourth or fifth decade of life. Children with torsion are typically obese, likely contributing to a fatty omentum that predisposes to twisting. Other factors that predispose a patient to torsion include a bifid omentum and a narrowed omental pedicle. In primary omental torsion, the twisted omentum tends to be localized to the right side; thus it is most commonly confused with acute appendicitis, acute cholecystitis, and pelvic inflammatory disease (D). Complicating the diagnosis is the fact that the omentum itself tends to migrate and envelop areas of inflammation. Laparoscopy is ideal for establishing the diagnosis and to exclude other etiologies. Treatment is to resect the twisted omentum, which can often be infarcted at the time of surgery, and to correct any other related condition that may be identified (B, C). The finding of purulent fluid would suggest another diagnosis because it is not consistent with omental torsion. The fluid usually seen is serosanguinous (E).

References: Chew, D., Holgersen, L., & Friedman, D. (1995). Primary omental torsion in children. *Journal of Pediatric Surgery*, 30(6), 816–817.

Saber, A., & LaRaja, R. (2007). Omental torsion. Retrieved from the Medscape website: <http://emedicine.medscape.com>.

Sánchez, J., Rosado, R., Ramírez, D., et al. (2002). Torsion of the greater omentum: treatment by laparoscopy. *Surgical Laparoscopy, Endoscopy & Percutaneous Techniques*, 12(6), 443–445.

Young, T., Lee, H., & Tang, H. (2004). Primary torsion of the greater omentum. *International Surgery*, 89(2), 72–75.

6. **C.** Rutherford Morison originally described the omentum as the abdominal “policeman” as it walls off infections and prevents further peritoneal contamination. In fact, omental wrapping is still used by trauma surgeons to control bleeding around the liver and spleen. In an attempt to explain the omentum’s hemostatic properties, a 1996 study demonstrated that the concentration of tissue factor in omentum is more than twice the amount per gram of that found in muscle. This property facilitates the activation of the extrinsic pathway of coagulation in the settings of trauma, infection, or ischemia. This leads to the production of fibrin, which facilitates the adherence of the omentum to these areas. The remaining choices do not contribute to the omentum’s intrinsic hemostatic capability (A, B, D, E).

References: Logmans, A., Schoenmakers, C., Haensel, S., et al. (1996). High tissue factor concentration in the omentum, a possible cause of its hemostatic properties. *European Journal of Clinical Investigation*, 26(1):82–83.

Seymour, N. E., & Bell, R. L. (2014). Abdominal wall, omentum, mesentery, and retroperitoneum. In F. Brunicaudi, D. K. Andersen, T. R. Billiar, et al. (Eds.), *Schwartz’s principles of surgery* (10th ed.).

New York, NY: McGraw-Hill.

7. **D.** Coagulase-negative staphylococci (*Staphylococcus epidermidis*) is by far the most common cause of peritoneal catheter-related infections (A–C). *Staphylococcus aureus* is coagulase positive (E). Another defining feature of *S. aureus* is that it is catalase positive. The diagnosis is made by a combination of abdominal pain, development of cloudy peritoneal fluid, and an elevated peritoneal fluid white blood cell count greater than 100/mm³. Initial treatment consists of intraperitoneal antibiotics, which seem to be more effective than intravenous (IV) antibiotics for a total of 2 weeks. If the infection fails to clear, based on abdominal examination, clinical picture, or persistent peritoneal fluid leukocytosis, then the catheter needs to be removed and a temporary hemodialysis catheter will need to be inserted. *S. aureus* and gram-negative organism infections are less likely to respond to antibiotic management alone.
8. **E.** Pseudomyxoma peritonei is a rare process in which the peritoneum becomes covered with semisolid mucus and large loculated cystic masses. It is unclear whether it represents a true malignant process (C). A useful classification derived from a large series uses two categories: disseminated peritoneal adenomucinosis (DPAM) and peritoneal mucinous carcinomatosis (PMCA). DPAM is histologically a benign process and most often due to a ruptured appendix. In one large series, appendiceal mucinous adenoma was associated with approximately 60% of patients with DPAM. In patients classified as PMCA, the origin was either a well-differentiated appendiceal or intestinal mucinous adenocarcinoma (B). Pseudomyxoma peritonei is most common in women aged 50 to 70 years (D). It is often asymptomatic until late in its course. Symptoms are often nonspecific, but the most common symptom is increased abdominal girth. Physical examination may demonstrate a distended abdomen with nonshifting dullness. Management is surgical, with cytoreduction of the primary and secondary implants, including peritonectomy and omentectomy (A). If there is a clear origin at the appendix, a right colectomy should also be performed. If the origin appears to be the ovary, total abdominal hysterectomy with bilateral salpingo-oophorectomy is recommended. The recurrence rate is very high (76% in one series).
References: Gough, D., Donohue, J., Schutt, A. J., et al. (1994). Pseudomyxoma peritonei: long-term patient survival with an aggressive regional approach. *Annals of Surgery*, 219(2), 112–119.
Hinson, F., & Ambrose, N. (1998). Pseudomyxoma peritonei. *The British Journal of Surgery*, 85(10), 1332–1339.
Ronnett B., Zahn, C., Kurman, R., et al. (1995). Disseminated peritoneal adenomucinosis and peritoneal mucinous carcinomatosis: a clinicopathologic analysis of 109 cases with emphasis on distinguishing pathologic features, site of origin, prognosis, and relationship to “pseudomyxoma peritonei.” *The American Journal of Surgical Pathology*, 19(12), 1390–1408.
9. **C.** Primary retroperitoneal abscesses are secondary to hematogenous spread while secondary retroperitoneal abscesses are related to an infection in an adjacent organ. The most common source of retroperitoneal abscesses are secondary with renal infections accounting for nearly 50% of all cases. Hematogenous spread is not a significant contributing factor for secondary retroperitoneal abscesses (E). Other common causes include retrocecal appendicitis (B), perforated duodenal ulcers, pancreatitis, and diverticulitis (A). In rare cases, patients may have Pott’s disease, which is a disseminated form related to tuberculosis (D). Patients typically present with back, pelvic, flank, or thigh pain with associated fever and leukocytosis. Flank erythema may be present. Kidney infections often have gram-negative rods such as *Proteus* and *E. coli*. Treatment consists of broad-spectrum antibiotics and drainage, as well as identification of the source. If the abscess is simple and unilocular then CT-guided drainage is the treatment of choice. Operative drainage may be required for complex abscesses.
10. **B.** Spontaneous (primary) bacterial peritonitis (SBP) is defined as bacterial infection of ascitic fluid in the absence of any surgically treatable intra-abdominal infection. Patients usually present with fever, diarrhea, and abdominal pain but if severe enough, will also have altered mental status, hypotension, hypothermia, and a paralytic ileus. However, 13% of patients will be completely asymptomatic. Treatment is with antibiotics alone. Prophylactic antibiotics (with fluoroquinolones) to prevent SBP should be considered in high-risk patients with cirrhosis, ascites, and history of gastrointestinal bleeding (as in the present case). Patients with cirrhosis who have low ascitic fluid protein (<1.0 g/dL) and those with a serum bilirubin greater than 2.5 mg/dL should also be started on prophylactic antibiotics. Opsonic or bactericidal activity of ascitic fluid is related to protein

concentration. One of the key features of primary peritonitis is that the isolate is usually a single organism and that organism usually is not an anaerobe. Secondary peritonitis refers to peritonitis in the setting of a bowel perforation. Thus, polymicrobial or anaerobic cultures should raise suspicion for bowel perforation and secondary peritonitis (E). In adults, the most common pathogens in spontaneous bacterial peritonitis are the aerobic enteric flora *E. coli* and *Klebsiella* (C). In children with nephrogenic or hepatogenic ascites, group A *Streptococcus*, *S. aureus*, and *Streptococcus pneumoniae* are common isolates (D). The diagnosis is made by paracentesis demonstrating more than 250 neutrophils/mm³ of ascitic fluid in the presence of a correlating clinical presentation. This should be evaluated before initiating antibiotics because cultures will return falsely negative. An active infection is considered a contraindication for liver transplantation (A).

References: Bell, R. B., & Seymour, N. E. (2005). Abdominal wall, omentum, mesentery, and retroperitoneum. In F. C. Brunickardi, D. K. Andersen, T. Billiar, et al. (Eds.), *Schwartz's principles of surgery* (pp. 1317–1328) (8th ed.). New York, NY: McGraw-Hill.

Runyon, B. A. (1990). Monomicrobial nonneutrocytic bacterascites: a variant of spontaneous bacterial peritonitis. *Hepatology*, 12(4 Pt 1), 710.

Turnage, R. H., Li, B., & McDonald, J. C. (2004). Abdominal wall, umbilicus, peritoneum, mesenteries, omentum and retroperitoneum. In C. M. Townsend Jr, R. D. Beauchamp, B. M. Evers, & K. L. Mattox (Eds.), *Sabiston textbook of surgery: The biological basis of modern surgical practice* (pp. 1171–1198) (17th ed.). Philadelphia, PA: W. B. Saunders.

11. **B.** Rectus sheath hematomas are clinically significant because of the fact that they can easily be mistaken for an intra-abdominal inflammatory process. The etiology is an injury to an epigastric artery within the rectus sheath. In most cases, there is no clear history of trauma (C). Particularly in the elderly who are taking oral anticoagulants, they typically occur spontaneously. Patients frequently describe a sudden onset of unilateral abdominal pain, sometimes preceded by a coughing fit. In one series, 11 of 12 patients were women, and in another series, all 8 were women, with an average age in the sixth decade. Below the arcuate line, there is no aponeurotic posterior covering to the rectus muscle. Therefore, hematomas below this line can cross the midline, causing a larger hematoma to form, and cause bilateral lower quadrant pain resembling a perforated viscus. On physical examination, a mass is often palpable. The Fothergill sign is the finding of a palpable abdominal mass that remains unchanged with contraction of the rectus muscles. This helps distinguish it from an intra-abdominal abscess, which would not be palpable with rectus contraction. The diagnosis is best established with a CT scan, which will demonstrate a fluid collection in the rectus muscle. The hematocrit should be closely monitored. Once the diagnosis is established, management is primarily nonoperative and consists of resuscitation, monitoring of serial hemoglobin/hematocrit levels, and reversal of anticoagulation (D). However, one should be cautious with reversal of anticoagulation, as stable patients may benefit from continued anticoagulation (e.g., recent mechanical valve). On rare occasions, angiographic embolization may be necessary (E). Surgical management, while rarely necessary, would involve ligation of the bleeding vessel and evacuation of the hematoma.

References: Berná, J., Zuazu, I., Madrigal, M., et al. (2000). Conservative treatment of large rectus sheath hematoma in patients undergoing anticoagulant therapy. *Abdominal Imaging*, 25(3), 230–234.

Zainea, G., & Jordan, F. (1988). Rectus sheath hematomas: their pathogenesis, diagnosis, and management. *The American Surgeon*, 54(10), 630–633.

12. **D.** Desmoid tumors are unusual soft-tissue neoplasms that arise from fascial or fibro-aponeurotic tissue. They are proliferations of benign-appearing fibroblastic cells with abundant collagen and few mitoses (E). Desmoid tumors do not metastasize (A); however, they are locally aggressive and have a very high local recurrence rate reaching almost 50% (B). They have been associated with Gardner syndrome (intestinal polyposis, osteomas, fibromas, and epidermal or sebaceous cysts) and familial adenomatous polyposis (FAP), which is why patients should be scheduled for a colonoscopy soon after diagnosis. In sporadic cases, surgical trauma appears to be an important cause. Desmoid tumors may develop within or adjacent to surgical scars. Patients with FAP have a 1000-fold increased risk of the development of desmoid tumors. Desmoids are more common in women of childbearing age and may be linked to estrogen. OCPs have also been found to be associated with the occurrence of these tumors (C). Patients are typically in their third or fourth decade of life and present with pain, a mass, or both. They are classified as either extra-abdominal

(extremities, shoulder), abdominal wall, or intra-abdominal (mesenteric and pelvic). There are no typical radiographic findings, but MRI may delineate muscle or soft-tissue infiltration and is required in larger tumors to delineate anatomic relations before surgical intervention. Core needle biopsy often reveals collagen with diffuse spindle cells and abundant fibrous stroma, which may suggest a low-grade fibrosarcoma; however, the cells lack mitotic activity. An open incisional biopsy of lesions larger than 3 to 4 cm is often necessary. Wide local excision with negative margins is indicated for symptomatic desmoid tumors. Nonresectable or incidentally found, asymptomatic, intra-abdominal desmoid tumors (even if resectable) should be treated with nonsteroidal antiinflammatory agents (e.g., sulindac) and antiestrogens, which have met with objective response rates of 50%. In regards to adjuvant therapy, recent retrospective reviews have seen significant reductions in recurrence with radiation combined with surgery and even with radiation alone. More research is necessary for the use of chemotherapy agents, but it has been seen that when cytotoxic chemotherapy agents are used in inoperable desmoid tumors, there is a 20% to 40% positive response. The aggressive nature of these tumors and high rate of occurrence make desmoid tumors the second most common cause of death in patients with FAP, after colorectal carcinoma.

References: Ballo, M., Zagars, G., Pollack, A., et al. (1999). Desmoid tumor: prognostic factors and outcome after surgery, radiation therapy, or combined surgery and radiation therapy. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*, 17(1), 158–167.

Hansmann, A., Adolph, C., Vogel, T., et al. (2004). High dose tamoxifen and sulindac as first-line treatment for desmoid tumors. *Cancer*, 100(3), 612–620.

Janinis, J., Patriki, M., Vini, L., et al. (2003). The pharmacological treatment of aggressive fibromatosis: a systematic review. *Annals of oncology: Official Journal of the European Society for Medical Oncology / ESMO*, 14(2), 181–190.

Nuyttens, J. J., Rust, P. F., Thomas, C. R., Jr., et al. (2000). Surgery versus radiation therapy for patients with aggressive fibromatosis or desmoid tumors: a comparative review of 22 articles. *Cancer*, 88(7), 1517–1523.

13. E. Retroperitoneal fibrosis is characterized by a periaortic and retroperitoneal proliferation of fibrous tissue and chronic inflammation that extends laterally and often surrounds the ureters and leads to ureteral obstruction, flank pain, and, in some cases, acute renal failure. The disorder is idiopathic (also known as Ormond disease) in 70% of cases, with the other 30% being a secondary reaction to an inciting inflammatory process, malignancy, or medication (e.g., methysergide use). It occurs twice as often in men as women, with a mean age at presentation of 50 to 60 years (B). One theory is that it is related to an autoimmune response, having a similar allele (*HLA-DRB1*03*), to type I diabetes, myasthenia gravis, and systemic lupus erythematosus (SLE). There does not seem to be any support for an infectious etiology. The fibrotic process can eventually encase the ureters, inferior vena cava, aorta, mesenteric vessels, and/or sympathetic nerves. On physical examination, patients are often hypertensive and an abdominal or flank mass may be palpated. Compression of pelvic veins may lead to lower extremity edema and pelvic congestion. Laboratory evaluation often demonstrates elevated blood urea nitrogen and creatinine levels as the majority of these patients will have azotemia. Additionally, an elevation in ESR is a common finding (C). Ultrasound is often used as the initial study to evaluate extent of ureter involvement and hydronephrosis. IVP will also show hydronephrosis, as well as the extrinsic compression of the ureters. A noncontrast CT scan, though, is the most reliable study used for diagnosis, demonstrating a homogenous fibrous plaque surrounding the lower aorta and iliac arteries (D). Medial deviation of the ureters is characteristic for idiopathic retroperitoneal fibrosis but not pathognomonic. It tends to have a symmetric distribution. Malignant tumors conversely tend to deviate the ureters laterally (E). It is important to note that malignant tumors can induce retroperitoneal fibrosis. As such, CT-guided needle biopsy is essential. The mainstay of treatment is use of corticosteroids. Immunosuppressants have also been used in those refractory to steroid treatment.

References: Cronin, C., Lohan, D., Blake, M., et al. (2008). Retroperitoneal fibrosis: a review of clinical features and imaging findings. *American Journal of Roentgenol*, 191(2), 423–431.

Gilkeson, G., & Allen, N. (1996). Retroperitoneal fibrosis: a true connective tissue disease. *Rheumatic Diseases Clinics of North America*, 22(1), 23–38.

Martorana, D., Vaglio, A., Greco, P., et al. (2006). Chronic periaortitis and HLA-DRB1*03: another clue to an autoimmune origin. *Arthritis and Rheumatism*, 55(1), 126–130.

14. **B.** Most retroperitoneal tumors are malignant and comprise approximately half of all soft-tissue sarcomas. The most common sarcomas occurring in the retroperitoneum are liposarcomas, malignant fibrous histiocytomas, and leiomyosarcomas (D). Approximately 50% of patients will have a local recurrence and 20% to 30% will end up having distant metastases. Lymph node metastases are rare (C). Retroperitoneal sarcomas present as large masses because they do not typically produce symptoms until their mass effect creates compression or invasion of adjacent structures. Symptoms may include gastrointestinal hemorrhage, early satiety, nausea, vomiting, and lower extremity swelling. Retroperitoneal sarcomas have a worse prognosis than nonretroperitoneal sarcomas. The best chance for long-term survival is achieved with an en bloc, margin-negative resection. Tumor stage at presentation, high histologic grade, unresectability, and grossly positive resection margins are strongly associated with increased mortality rates. Tumor grade is the most significant predictor of outcome. Complete surgical resection is the most effective treatment for primary or recurrent retroperitoneal sarcomas (A, E). Surgical cure can be limited because the margins are often compromised by anatomic constraints. There is no difference in survival between those who had a resection with a grossly positive margin and those with inoperable tumors. Unlike extremity sarcomas, external beam radiation therapy is limited for retroperitoneal malignancies because there is a low tolerance for radiation to surrounding structures. Postoperative and intraoperative radiation therapy have been shown to reduce local recurrence, but further studies are needed to determine if this leads to improved survival.

Reference: Lewis, J. J., Leung, D., Woodruff, J. M., et al. (1998). Retroperitoneal soft-tissue sarcoma: analysis of 500 patients treated and followed at a single institution. *Annals of Surgery*, 228(3), 355–365.

15. **B.** This patient was recently diagnosed with atrial fibrillation and started on oral anticoagulants. One should suspect a rectus sheath hematoma in older patients taking anticoagulants who present with the clinical triad of acute abdominal pain, an abdominal wall mass, and anemia. The mass is palpable even during flexion of abdominal wall muscles helping differentiate this from an intraperitoneal process (Fothergill sign) (D). In a review of 126 patients by Mayo Clinic, anticoagulation was associated with 70%. Above the arcuate line, the etiology is often related to a lesion to the superior epigastric artery within the rectus sheath (E). In most cases, there is no clear history of trauma (C). In particular, in the elderly who are taking oral anticoagulants, they typically occur spontaneously. The most common treatment for patients with rectus sheath hematomas is rest, analgesics, and blood transfusions as necessary. In general, coagulopathies are corrected; however, continuing anticoagulation may be prudent in select patients (e.g., biomechanical valve, recent saddle embolus) (A). In extreme cases, angioembolization may be required.

References: Alla, V. M., Karnam, S. M., Jaushik, M., et al. (2010). Spontaneous rectus sheath hematoma. *Western Journal of Emergency Medicine*, 11(1), 76–79.

Cherry, W. B., & Mueller, P. S. (2006). Rectus sheath hematoma: review of 126 cases at a single institution. *Medicine (Baltimore)*, 85(2), 105–110.

Abdomen – Hernia

Patrick T. Delaplain, Areg Grigorian, and Christian de Virgilio

Questions

1. One hour after laparoscopic repair of a left inguinal hernia, the patient complains of severe burning groin pain. Which of the following is the most appropriate recommendation?
 - A. Immediate return to the operating room for laparoscopy
 - B. Nonsteroidal antiinflammatory drugs
 - C. Neurontin
 - D. Opioid analgesia
 - E. Inject groin region with local anesthetic
2. The most important component of surgical repair in an infant with ultrasound-confirmed unilateral inguinal hernia is:
 - A. A high ligation of the hernia sac
 - B. Obliterating the deep ring
 - C. Creating a tension-free repair with mesh
 - D. Releasing the anterior rectus sheath to allow a tension-free connection between the conjoint tendon and Cooper ligament
 - E. Identification of all nerves
3. Which of the following is true regarding femoral hernias?
 - A. They are the most common hernia in females.
 - B. Cooper's ligament is considered the anterior border of the femoral canal.
 - C. They are lateral to the femoral vein.
 - D. Repair involves approximating the iliopubic tract to Cooper's ligament.
 - E. Bassini operation is considered an appropriate surgical option.
4. A 42-year-old male presents to the emergency department (ED) with vague abdominal pain for the past month that has suddenly worsened over the past several hours. Computed tomography (CT) of the abdomen is performed and demonstrates mesenteric fat stranding between the rectus abdominis muscle and semilunar line. Which of the following is true regarding this condition?
 - A. Typically patients present with a palpable mass.
 - B. It mandates an open repair with incision directly over the affected area.
 - C. Patients with this condition are typically on anticoagulation.
 - D. There is a high risk of sepsis.
 - E. It is considered a clinical diagnosis and imaging is not typically needed.
5. Which of the following best describes umbilical hernias in children?
 - A. They are more common in white children than black children.
 - B. Repair is indicated once an umbilical hernia is diagnosed.
 - C. Repair should be performed if the hernia persists beyond 6 months of age.
 - D. Most close spontaneously.

- E. Repair should be performed only if the child is symptomatic.
6. Which of the following is true regarding umbilical hernias in adults?
- A. Most are congenital.
 - B. Repair is contraindicated in patients with cirrhosis.
 - C. Strangulation is less common than in children.
 - D. Small, asymptomatic hernias can be clinically observed.
 - E. Primary closure has recurrence rates similar to those of mesh repair.
7. The hernia bounded by the latissimus dorsi muscle, iliac crest, and external oblique muscle is known as:
- A. Grynfeltt hernia
 - B. Richter hernia
 - C. Petit hernia
 - D. Littre hernia
 - E. Obturator hernia
8. Ischemic orchitis after inguinal hernia repair is most often due to:
- A. Too tight a reconstruction of the inguinal ring
 - B. Preexisting testicular pathology
 - C. Inadvertent ligation of the testicular artery
 - D. Completely excising a large scrotal hernia sac
 - E. Anomalous blood supply to the testicle
9. The genital branch of the genitofemoral nerve:
- A. Is typically found anteriorly on top of the spermatic cord
 - B. Provides sensation to the base of the penis and inner thigh
 - C. Typically lies on the anterior surface of the internal oblique muscle
 - D. Provides sensation to the side of the scrotum and motor innervation to the cremaster muscle
 - E. Often intermingles with the iliohypogastric nerve
10. Four months after open inguinal hernia repair with mesh, a patient reports persistent burning pain at the incision site that radiates to the groin. On examination, there is no evidence of recurrent hernia. The patient experienced moderate improvement after ultrasound-guided nerve block immediately lateral to the spermatic cord near the pubic tubercle. Which of the following is true about this condition?
- A. Careful identification of all three sensory nerves will prevent this complication.
 - B. Initial management involves reexploring the wound.
 - C. Reoperation for failure of conservative therapy is best accomplished via a laparoscopic retroperitoneal approach.
 - D. Chronic pain after hernia repair is uncommon.
 - E. Intentional division of sensory nerves in the groin during the index operation would have effectively prevented this complication from occurring.
11. A 5-month-old previously full-term male infant presents with a tender left groin mass that has been present for the past several hours. There is slight erythema over the skin. He is afebrile and his labs are normal. Which of the following is the best next step?
- A. Attempt manual reduction, and if successful, schedule surgical repair when infant reaches 1 year of age.
 - B. Attempt manual reduction, and if successful, immediately take to the operating room for surgical repair.
 - C. Attempt manual reduction, and if successful, schedule repair in 2 days.
 - D. Attempt manual reduction, and if successful, schedule left-sided surgical repair with contralateral groin exploration in 2 days.
 - E. Take immediately to the operating room for operative repair.

12. Which of the following is true regarding hernia anatomy?
- Poupart ligament is formed from the anteroinferior portion of the external oblique aponeurosis.
 - The cremaster muscle arises from the transversus abdominis muscle.
 - The genital branch of the genitofemoral nerve passes through the superficial ring.
 - The femoral branch of the genitofemoral nerve innervates the cremasteric muscle.
 - Indirect hernias most often arise within the borders of the rectus muscle, inferior inguinal ligament, and inferior epigastric artery
13. Which of the following is true regarding the arcuate line?
- It is usually located a few centimeters above the umbilicus.
 - Below this line, the internal oblique aponeurosis splits.
 - Below this line, the rectus muscle lies on the transversalis fascia.
 - Below this line, the posterior rectus sheath is thinner.
 - Below this line, the external oblique muscle does not contribute to the anterior rectus sheath.
14. A 45-year-old man presents with an asymptomatic right inguinal hernia. It is easily reduced with gentle pressure. Which of the following is true about this condition?
- The likelihood of strangulation developing is high without surgery.
 - Without surgery, intractable pain will most likely develop.
 - Waiting until symptoms develop is a reasonable alternative to surgery.
 - Laparoscopic repair is the best option.
 - If the hernia is small, there is a lower chance of incarceration.
15. A 55-year-old male presents with a painful bulge in the left groin that first appeared several months ago. His surgical history includes a right-sided open inguinal hernia repair. Upon examination you also note a bulge in the right groin over his previous incision. Both masses are reducible. Which of the following is true regarding this patient's condition?
- Open repair is preferred.
 - In laparoscopic repair, failure to tack the mesh lateral to the inferior epigastric vessels can lead to recurrence through the internal ring.
 - Violation of the peritoneum during a totally extraperitoneal (TEP) repair requires conversion to an open or transabdominal preperitoneal (TAPP) approach.
 - Persistent numbness or pain of the lateral thigh is more common with open versus laparoscopic repair.
 - Laparoscopic repair will prevent him from developing a femoral hernia in the future.
16. A 28-year-old male patient is asking for advice on whether to pursue open mesh repair or TEP repair of a newly diagnosed, reducible right-sided inguinal hernia. What can you tell the patient about these two methods of repair?
- Chronic pain is reduced with an open mesh repair.
 - Operative time is not significantly different between the two.
 - TEP repair is associated with a quicker return to work and normal activities.
 - Open mesh repair is associated with a higher number of intraoperative complications.
 - Recurrence is relatively common (>25%) no matter which method is chosen.
17. A 45-year-old male presents with a reducible but intermittently painful incisional hernia about 5 cm above his umbilicus. He had a prior laparotomy for a gunshot wound about 10 years ago that was complicated by a surgical site infection. Physical exam reveals a defect that is approximately 6 cm in size. Which of the following is true regarding his condition?
- Incisional hernia occurs in about 1% of all laparotomies.
 - The total cost of a patient undergoing laparoscopic repair is more costly than open repair.
 - Repair of defects larger than 10 cm should not be attempted laparoscopically.
 - Surgical site infection likely contributed to this complication.
 - Use of an interposition mesh reduces recurrence rates compared with other methods of repair.