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Ascites Module for Third-Year Medical Students: Group-Based Learning Workshop on the Diagnosis, Workup, and Management of Ascites

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Abstract

Introduction: As medical students transition from didactic courses to clinical rotations, they will frequently encounter patients with cirrhosis and ascites. It is paramount that they have a firm foundation of how to diagnose ascites and perform a proper diagnostic workup in order to understand the etiology and therefore the proper management. This module is designed as a group-based, interactive learning workshop for those transitioning students. **Methods:** The session begins with the students obtaining a pertinent history of a standardized patient case. The students are then divided into four groups and rotate through four stations: physical examination, diagnostic studies, paracentesis, and ascitic fluid analysis. Each station is designed for up to 10-12 students and typically lasts 20 minutes. After all of the students have rotated through each station, they reconvene to review ascites management, case conclusions, and summary. The total time allocated for this module is 125 minutes for 40-48 students. **Results:** Postmodule evaluations by the students showed a high level of satisfaction and improvement in the students' fund of knowledge and clinical skills. Evaluations completed by the students after each workshop revealed more than 95% either agreeing or strongly agreeing with the learning objectives being clear, the learning materials being effective, overall satisfaction with the learning material and teaching, and having a better understanding of the evaluation, diagnosis, and management of ascites. **Discussion:** Through this team-based interactive module, students obtain clinical and hands-on experience that better prepares them for their clinical rotations.

Keywords

Physical Exam, Cirrhosis, Fibrosis, Paracentesis, Ascites, Medical Student, Ascitic Fluid Analysis, Ascites Management, Diagnostic Workup, Ascites-Associated Pathology

Educational Objectives

By the end of this session, the learner will be better able to:

1. Understand how to obtain a pertinent history of a patient with cirrhosis and suspected ascites.
2. Understand how to perform a physical examination on a patient with cirrhosis, with an emphasis on physical examination findings of ascites.
3. Understand which diagnostic studies are warranted in a patient with newly diagnosed ascites and how to complete a workup.
4. Demonstrate how to perform an ultrasound-guided paracentesis.
5. Analyze ascitic fluid.
6. Manage ascites due to cirrhosis.

Introduction

Chronic liver disease, including cirrhosis, is currently the twelfth leading cause of death in the United States.¹ This burden of cirrhosis, in both number of patients affected and health care costs, is expected to rise in the next decade. In 2010, there were an estimated 10 million people in the U.S. with cirrhosis.² Every year, there are over 100,000 inpatient admissions in the U.S. for decompensated cirrhosis. Ascites is

Appendices

- A. Ascites Seminar Introduction and Overview .docx
- B. Ascites Introduction.pptx
- C. Ascites Case Presentation .pptx
- D. Station 1 Abdominal Examination in the Patient With Ascites.pptx
- E. Station 2 Diagnostic Studies.docx
- F. Station 2 Diagnostic Studies Student Worksheet .docx
- G. Station 2 Diagnostic Studies Answers.docx
- H. Station 3 Paracentesis Step-by-Step Tutorial.pptx
- I. Station 3 Paracentesis Self-Assessment Quiz.docx
- J. Station 3 Paracentesis Self-Assessment Quiz Answers .docx
- K. Station 4 Ascitic Fluid Analysis Cases.docx
- L. Station 4 Interpretation of Ascitic Fluid Handout.docx
- M. Station 4 Ascitic Fluid Analysis Case Answers .docx
- N. Ascites Management Presentation.pptx
- O. Ascites Case Conclusions Presentation.pptx
- P. End-of-Module Assessment Tool.docx

All appendices are peer reviewed as integral parts of the Original

a major complication of cirrhosis, occurring in 50% of patients. The development of ascites is an important landmark in the natural history of cirrhosis as it is associated with a 50% mortality rate over 2 years.³ The need to perform diagnostic and therapeutic paracentesis in the management of ascites has steadily climbed. There has been a 73% increase in inpatient paracentesis, a 240% increase in paracentesis performed in the emergency department, and a 359% increase in outpatient paracentesis from 1993 to 2008.⁴ Moreover, in patients with ascites, performing a paracentesis at the time of admission to the hospital has been shown to decrease mortality.⁵

In addition, multiple studies have demonstrated that ultrasound guidance improves the success rate and safety of invasive procedures, including paracentesis. Avoiding complications not only is good for patient care but also reduces the overall cost of care. A study presented at the 2011 National Patient Safety Foundation Annual Meeting found significant economic savings and fewer complications when ultrasound guidance was used. Furthermore, patients with complications had significantly longer hospital stays and increased health care costs.⁶ Thus, it can be concluded that cirrhosis and ascites are a significant health concern and that timely, well-performed ultrasound-guided paracentesis is becoming more prevalent and can reduce health care costs, length of stay, and mortality.

No matter what field they ultimately decide to enter, nearly all third-year medical students will take care of a patient with cirrhosis and ascites at some point during their career. In order to understand the etiology and therefore the proper management of said disease, students must be able to recognize ascites and perform a proper diagnostic workup of cirrhosis. However, many students do not feel confident in thoroughly analyzing ascitic fluid and are unable to properly incorporate said information into their assessment and plan. One reason for this is the time constraints placed on students to adequately develop the necessary skill sets. For example, while paracentesis is a common procedure used to obtain and subsequently analyze ascitic fluid, many medical students have limited education regarding the procedure or insufficient time to practice it. Additionally, a lack of available resources to refine the paracentesis procedure and interpret the subsequent fluid collection introduces uncertainty into the student's technique and thus suboptimizes patient care. We recognized that our core medical school curriculum did not meet the needs of students in this regard. In response, this workshop was created to address the students' technical and professional needs via a team-based interactive module. At the moment, there is no other similar model available; thus, this is a unique method of hands-on learning.

The module was designed to guide students through skill sets that the Department of Gastroenterology appreciated to be in need of refinement during the students' rotation, specifically, paracentesis and ascitic fluid analysis. However, due to the differing levels of mastery between individual students, we decided to allocate our resources to addressing all pertinent components of the medical exam. This format was selected to better address the individual needs of each student by encouraging professional interactions with seasoned physicians regarding the subject matter that would otherwise not be readily available during regular rotations. This session can be implemented at any time during the students' internal medicine clerkship.

To help ensure the efficacy of this session, as well as to fully employ the time of everyone involved, this module is to be implemented in a group setting with multiple stations. The session begins with a brief lecture, followed by focused areas of instruction. Specifically, this workshop is designed in a stepwise fashion to assist students in obtaining a proper patient history, performing a thorough physical examination, knowing which diagnostic studies should be obtained and why, knowing how to perform an ultrasound-guided paracentesis, knowing how to diagnose the etiology of ascites based on fluid analysis, and knowing how to manage ascites due to cirrhosis. The session concludes with a brief overview and students providing feedback by filling out the end-of-module assessment tool.

Methods

A review of the available literature revealed no previously implemented modules that could fit our needs. Thus, it was decided to create a module based on the available literature on how to diagnose and work up ascites, perform a paracentesis, and manage ascites.

It is up to the discretion of individual instructors to employ the available resources as they see best. However, the following guidelines are meant to optimize the learning experience and knowledge base of the participating students. First, we recommend opening the seminar with a general interactive overview of ascites and its presentation in the history of present illness following introduction to the case. Second, the body of this seminar has been divided into four stations, each charged with addressing one or more of the listed objectives, with each group of students rotating through the stations as time allows. The stations include conducting the physical exam, ordering diagnostic tests and images, practicing paracentesis technique, and interpreting fluid analysis studies. The stations were designed to encourage students to directly participate as much as possible, with the instructors providing information and stimulating thought as needed. During each station, students are assessed on the presented material and can be given access to answers. Finally, the seminar ends by addressing the findings of the case. At all times, instructors are encouraged to seek confirmation of knowledge from the students via questions or discussion. Additionally, the recommended student population for this seminar is 40-48, with 10-12 students per station after the initial group presentation.

Opening Presentation

The suggested time for this initial activity is no more than 30 minutes. First, a general overview of ascites (Appendix A) using the included presentation slides (Appendix B) is provided for the students. Second, students are introduced to the case (Appendix C) and are asked to decide what questions and pertinent findings should be focused on when taking a patient's history. Additionally, students can engage in discussion with the instructor regarding common etiologies of ascites and their typical associated clinical manifestations. Afterward, students are asked to divide into four groups, one for each of the following stations.

Station 1

The suggested time for this station is 20 minutes. Using the provided materials, students are walked through a brief presentation explaining the possible findings on a physical exam for ascites (Appendix D). The attending instructor, as necessary, then demonstrates the proper maneuvers. We encourage demonstrating the findings on a manikin if possible. These students should then move to Station 2.

Station 2

The suggested time for this station is 20 minutes. Students are provided with 20 possible laboratory tests to order for further evaluation of the case (Appendix E). Of the 20 laboratory and imaging studies, students are asked to discuss and select the five most appropriate tests for this case and to rank them in order of significance on a worksheet (Appendix F). This should not take more than 10 minutes. Afterward, students are provided with a master list (Appendix G) with the 10 most appropriate tests, as well as a brief explanation for each answer. This should not take more than 5 minutes. Discussion throughout this activity is encouraged. These students should then move to Station 3.

Station 3

The suggested time for this station is 20 minutes. In this station, students have the opportunity to become familiar with the materials needed to perform a paracentesis and subsequently perform an ultrasound-guided paracentesis on a manikin (Appendix H). Afterward, students should be prompted to take the paracentesis self-assessment quiz and then discuss their answers (Appendices I & J). The attending instructor provides necessary assistance and guidance. Once finished, these students can proceed to Station 4.

Station 4

The suggested time for this station is 20 minutes. In this station, students are asked to interpret ascitic fluid analysis results from different case scenarios (Appendix K). Students have to determine the possible etiology of ascites for each case according to the ascitic fluid analysis (Appendix L). Students are encouraged to discuss the cases with each other and to ask for guidance from one of the attending instructors when needed. Answers are provided at the end of the station (Appendix M). Once finished, these students can move on to Station 1 or return to the main group if all stations have been completed.

Closing Presentation

All the students are shown a brief series of summary slides pertaining to the past activities and original case. Afterward, therapeutic goals and optimal management for patients with ascites are discussed (Appendices N & O). Additionally, the end-of-module assessment tool (Appendix P) should be filled out by the students and collected by the instructors. Any remaining time can be used for questions and clarification of concepts.

The following list of the attached Appendices includes a brief summary of how and where each tool should be used.

- **Appendix A. Ascites Seminar Introduction and Overview:** This document provides an introduction to and overview of the interactive seminar on ascites. It briefly describes the seminar and outlines the learning objectives and methods for the instructors.
- **Appendix B. Ascites Introduction:** This introductory PowerPoint presentation provides a brief overview of the module to the students. The presentation should be given to the students by an instructor at the beginning of the module and usually takes 10 minutes.
- **Appendix C. Ascites Case Presentation:** This PowerPoint presentation introduces the students to a patient case. The presentation should be given to the students by an instructor. The students are introduced to a case presentation and are asked to provide questions in order to obtain a pertinent and relevant history of present illness. The suggested time for this activity is 10-15 minutes. After this section, the students are divided into four groups for the four stations.
- **Appendix D. Station 1 Abdominal Examination in the Patient With Ascites:** This PowerPoint presentation introduces the students to how to perform an abdominal physical exam on a patient with ascites. The presentation should be given to the students at Station 1 by an instructor. The students are introduced to key physical exam findings and how to perform a proper physical exam. The suggested time for this activity is 20 minutes. After this section, the students move on to Station 2.
- **Appendix E. Station 2 Diagnostic Studies:** This is a handout of potential diagnostic studies for Station 2. The instructor at Station 2 reviews the diagnostic studies for a patient with ascites with the students. The students then work as a group on the diagnostic studies student worksheet (Appendix F). Students are asked to discuss and select the five most appropriate tests for this case and to rank them in order of significance. The instructor next reviews the diagnostic studies worksheet answers (Appendix G). The suggested time for Station 2 is 20 minutes. After this section, the students move on to Station 3.
- **Appendix F. Station 2 Diagnostic Studies Student Worksheet:** This worksheet on the diagnostic studies is completed by the students at Station 2.
- **Appendix G. Station 2 Diagnostic Studies Answers:** This answer sheet is used by the instructor to review the student answers and explain the rationale for the best test choices.
- **Appendix H. Station 3 Paracentesis Step-by-Step Tutorial:** This PowerPoint presentation introduces the students to how to perform a paracentesis. The presentation should be given to the students at Station 3 by an instructor. A paracentesis demonstration is performed on a manikin by one of the instructors. The indications, complications, and contraindications of the procedure are discussed. The students then take turns performing an ultrasound-guided paracentesis on the manikin. Next, the students work as a group on the paracentesis self-assessment quiz worksheet (Appendix I), following which the instructor reviews the answers (Appendix J). The suggested time for this activity is 20

minutes. After this section, the students move on to Station 4.

- **Appendix I. Station 3 Paracentesis Self-Assessment Quiz:** This paracentesis self-assessment quiz worksheet is completed by the students at Station 3.
- **Appendix J. Station 3 Paracentesis Self-Assessment Quiz Answers:** These paracentesis self-assessment quiz answers are reviewed with the students by the instructor.
- **Appendix K. Station 4 Ascitic Fluid Analysis Cases:** This worksheet on ascitic fluid lab results of various patient cases is completed by the students at Station 4. The instructor at Station 4 reviews the patient cases with the students, who then work as a group on the worksheet with the assistance of the interpretation of ascitic fluid handout (Appendix L). The instructor reviews the students' responses using the answer sheet (Appendix M). The suggested time for Station 4 is 20 minutes. After this section, the students from the four stations reconvene to conclude the ascites module.
- **Appendix L. Station 4 Interpretation of Ascitic Fluid Handout:** This handout helps students to interpret ascitic fluid lab results for various patient cases at Station 4.
- **Appendix M. Station 4 Ascitic Fluid Analysis Case Answers:** This answer sheet for the various patient cases is used by the instructor to review the students' worksheet responses.
- **Appendix N. Ascites Management Presentation:** This PowerPoint presentation on the management of ascites due to cirrhosis is provided by an instructor and should be given to all of the students after the stations have been completed. The suggested time for this last activity is 15 minutes.
- **Appendix O. Ascites Case Conclusions Presentation:** This PowerPoint presentation concludes the ascites modules. The presentation is provided by an instructor and should be given to all of the students after the stations have been completed. Students are shown a brief series of summary slides pertaining to the past activities and original case. The suggested time for this activity is 5 minutes.
- **Appendix P. End-of-Module Assessment Tool:** This assessment tool should be given by the instructor to every student after all other activities have been completed. The assessment tool asks students to provide feedback on the module. All students should fill out the form and return it to the instructor. The suggested time for this final activity is 5 minutes.

For this module to be successful, we suggest the participation of four to five instructors. Also, it is up to the discretion of the instructors to decide how many students can participate at any one time; however, we recommend 10-12 students for each station, for a total of 40-48 students. Space is also an important factor to consider. We recommend one large room big enough to accommodate all the students and instructors for the length of the module in order to save time that would otherwise be spent transitioning between rooms. However, it is ultimately up to the instructors at each institution to determine what setting is most ideal. Overall, instructors are encouraged to ask questions and keep the students actively participating as much as possible.

Results

A board-certified internist and three gastroenterology fellows led this module; however, senior medical residents could also lead it. The internist and gastroenterology fellows gave the presentations and staffed the stations. Since the module's implementation, two internists and 13 gastroenterology fellows have taught it to approximately 320 third-year medical students. Postmodule evaluations by the students have shown a high level of satisfaction and improvement in the students' fund of knowledge and clinical skills. Evaluations completed by the students after each workshop revealed more than 95% (305 out of 320 students) either agreeing or strongly agreeing with statements about the learning objectives being clear, learning materials being effective (96%, 306 out of 320), overall satisfaction with the learning material and teaching (96%, 306 out of 320), and having a better understanding of the evaluation, diagnosis, and management of ascites (98%, 314 out of 320).

Moreover, the vast majority of the responses strongly agreed with statements about the learning objectives being clear (85%, 273 out of 320), learning materials being effective (87.5%, 280 out of 320), overall satisfaction with the learning material and teaching (88%, 281 out of 320), and having a better understanding of the evaluation, diagnosis, and management of ascites (90%, 288 out of 320). In regard to

these objectives, none of the students strongly disagreed or disagreed (0%, 0 out of 320). These effective rates were further supported by individual responses reporting enjoyment and learning from each station, interactive nature, hands-on components, and enhancement of students' understanding and knowledge of ascites.

Discussion

During the medical students' clinical rotations, they frequently encountered patients with cirrhosis and its complications, including ascites. The students requested further training on how to diagnose and work up ascites. The Department of Gastroenterology was subsequently asked to assist in providing further education and training to the students. Based on prior feedback, one of the key issues we focused on was the paracentesis procedure and highlighting the fact that ascites in patients is not always managed in the same manner. We aimed to accomplish this by guiding students through the procedure, followed by intermittent discussion regarding the possible complications of cirrhosis that can be elucidated from fluid analysis. This session was successfully completed in 2 hours. Although the module addresses third-year medical students, it can be used for fourth-year students or as continuing medical education for building upon procedural skills.

The curriculum was designed to be interactive, with student participation in focused stations where paracentesis and other modalities could be taught or expanded upon. The module was designed to focus around a patient encounter during which the students were guided through the history of present illness, physical exam, diagnostic workup, paracentesis, and analysis of ascitic fluid results to finalize an assessment and plan. The patient encounter was selected based on our clinical experience and to provide the students the chance to practice all related skills on a single case. This was also decided upon due to time constraints.

After completing the module, the students filled in evaluations, and we reviewed their feedback. The evaluations and feedback were positive, with students having a high level of satisfaction and improvement in their fund of knowledge and clinical skills. We recommend having students rotate through multiple stations as it may allow for a greater degree of individual interaction with instructors due to the limited number of students at each station. This may also allow physicians to provide more individualized support to students while allotting time to answer specific questions pertaining to the individual station's subject matter. This focused attention was especially helpful during the paracentesis demonstration, as students were able to clearly visualize proper technique before being offered the chance to perform the procedure themselves under guided supervision. Furthermore, the multiple stations demonstrated the ability to properly compartmentalize the varying teaching subjects we wanted the students to grasp in a manner that made them simpler to understand. That is, students were able to focus on the lesson of their particular station without needing to have experienced any of the other stations previously. The evaluations also reflected that the students had a better understanding of the evaluation, diagnosis, and management of ascites.

Additionally, the students provided feedback on areas of improvement. Specifically, it was noted that the module could be improved by more thorough demonstrations of physical exam techniques and ultrasound-guided paracentesis, especially in regard to how to use ultrasound techniques properly. Moreover, while all students were able to see a proper paracentesis procedure, not every student was able to adopt proper technique due to limited practice runs attributed to time constraints. Also, one of the limitations of this module is that not every cause of ascites could be addressed. Our future plans to improve the module and thus address the issues mentioned above include incorporating the use of a more sophisticated manikin and simulation lab that would grant a more detailed physical exam demonstration, as well as incorporating a brief overview on proper ultrasound technique. We can further enhance this module by the addition of a section pertaining to the common causes of cirrhosis and other complications, such as liver synthetic failure and portal hypertension. Furthermore, we wish to increase the level of diversity provided to the students by introducing more diverse patient cases. Consequently, the

duration of this module could be increased to accommodate the time needed to cover any additional sections and allow students to practice their paracentesis technique more. Finally, the students who participated were not followed after their clinical practice to assess for the usefulness of this module. Distributing an end-of-course evaluation to assess whether the concepts covered in this session were applied in the clinical setting by the students will help us to better evaluate the overall efficacy of this module.

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Ethical Approval

Reported as not applicable.

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