

Original Publication

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Difficulty Breathing With a Rash: A Pediatric Simulation Case for Residents and Fellows

Kelly Levasseur, DO*, Danielle Turner-Lawrence, MD

*Corresponding author: kelly.levasseur@beaumont.edu

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Abstract

Introduction: The purpose of the case is to teach health care professionals to recognize Henoch-Schönlein purpura (HSP), including rare and serious complications. The case includes a review of epidemiology, classification, clinical manifestations, and treatment of HSP. **Methods:** Utilizing an adolescent simulation mannequin, we present the case of an 11-year-old female who presents to a pediatric emergency department with HSP and respiratory symptoms requiring intubation. This case reinforces the appearance of the characteristic rash and helps learners develop an algorithm for HSP management that includes the identification and management of abdominal pain associated with HSP, as well as the rare and serious complication of pulmonary vasculitis. We focus learners on managing severe respiratory distress in the HSP patient. Learners are assessed using standardized forms, and the learner outcome measurements include the recognition of HSP and successful management of abdominal pain and respiratory failure in this unique setting. **Results:** This module has been used with pediatric residents, emergency medicine residents, pediatric emergency medicine fellows, and pediatric emergency medicine nurse practitioners. Approximately 30 learners have completed this module during seven separate sessions. All learners felt the case provided the opportunity to identify HSP as well as to manage a serious and rare complication of the disease. **Discussion:** Overall, we have had positive feedback from the learners about this case, and it provides them the opportunity to see more rare complications during their training period. Learners leave the session with enhanced knowledge of HSP, as well as a review of respiratory failure and intubation.

Keywords

Respiratory Failure, Rash, Pediatric, Henoch-Schönlein Purpura, Purpura, Schoenlein-Henoch, Difficulty Breathing

Appendices

- A. Simulation Case.docx
- B. History and Physical Exam .docx
- C. Triage Document.docx
- D. Imaging Studies.docx
- E. Laboratory Studies.docx
- F. Patient Pictures.docx
- G. Debriefing Questions.docx
- H. Learner Evaluation.docx
- I. PowerPoint Presentation .pptx

All appendices are peer reviewed as integral parts of the Original Publication.

Educational Objectives

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

1. Develop an approach to the evaluation of a patient with Henoch-Schönlein purpura (HSP).
2. Demonstrate an approach to managing HSP.
3. Understand the importance of recognizing additional HSP complications outside of abdominal pain and renal involvement.
4. Create an algorithm for managing severe respiratory distress in the setting of HSP.
5. Demonstrate a pediatric resuscitation based on Pediatric Advanced Life Support algorithms.

Introduction

Henoch-Schönlein purpura (HSP) is a small-vessel vasculitis, which is the most common form of systemic vasculitis in children. Its course is generally benign and usually self-limited. This is predominately a childhood disease with a peak age of 4-6 years.¹ While the exact cause of HSP remains unknown, many children have a preceding viral syndrome. Most, if not all, patients have the typical skin rash, and many have associated arthritis.² Occasionally, there is associated abdominal pain and renal involvement. In rare instances, patients can have scrotal, eye, nervous system, or pulmonary involvement. Lung involvement,

while often microscopically present, rarely causes clinical manifestations.³ When pulmonary involvement presents as diffuse pulmonary alveolar hemorrhage, it can cause serious respiratory distress occasionally leading to respiratory failure.

The use of real-life cases with actual data, in our experience, is most effective for learners. The target audience is pediatric emergency fellows, emergency medicine residents, and pediatric residents. Learners should have taken Basic Life Support and Pediatric Advanced Life Support. The case is run in an emergency department setting and closely resembles an actual case that presented to our pediatric emergency department. The patient presented in respiratory distress to the pediatric emergency department, having a characteristic rash and diffuse abdominal pain with the atypical complaint of difficulty breathing. The patient was identified as having HSP and admitted for difficulty breathing. The patient was placed on oxygen by non-rebreather mask with inadequate recognition of the need for closer monitoring and additional breathing support. Following admission, the patient ultimately went into respiratory failure. Earlier recognition of this rare complication of HSP is important for this type of patient's care, and identification of this gap in the knowledge of our learners was the nidus for case development.

Methods

This simulation is fully presented in the case file (Appendix A). The diagnosis of HSP is primarily made by clinical exam, making this an optimal case to learn in a simulation setting. This simulation teaches learners to recognize HSP and highlights the rare complication of diffuse pulmonary alveolar hemorrhage. The PowerPoint presentation (Appendix I) used during the debrief session reinforces the topics of HSP covered during the simulation case as well as expanding on topic knowledge.

The history and physical exam (Appendix B) should be provided to the learners at the beginning of the case and must include initial vital signs. Learners should request additional information regarding the patient's physical exam. Information regarding the history and physical exam is also provided to the parent and nurse to relay when prompted. The triage document (Appendix C) is handed to the learners when they enter the room to begin the case. The triage document gives the patient's location, age, and presenting vital signs. Radiographs (Appendix D) should be provided to learners only upon their specific request. An abdominal ultrasound report (no images) is given to the learners if asked for. Lab results (Appendix E) should be provided to learners upon their request. The lab results should be separated on different handouts so the learners can be provided only with what they have ordered (i.e., the complete blood count and the basic metabolic panel should not both be put on the same handout). Patient pictures (Appendix F) are also available upon request. Pictures of the rash include skin exam findings that should be in color and appropriately sized for the mannequin's body. These pictures can be affixed to the mannequin before the start of the case, in the appropriate areas, per the physical exam. Appropriate clothing or a blanket placed over the patient forces the learner to discover the pictures in the course of completing a full physical exam. Pictures of sputum can be shown by respiratory therapy following intubation if learners require prompting to broaden their differential in regard to respiratory distress. Laminating documents and photos that feature in the case can allow for their repeat use with multiple learner groups.

Equipment/Environment

The following equipment is utilized to optimize the case presentation and should be available:

- High-fidelity mannequin, preferably adolescent sized, clad in a gown and covered with a blanket. The mannequin should be placed on a gurney. Laerdal Sim Junior is used at our institution. Clothing can be left on the mannequin to make discovery of the rash more difficult for advanced learners.
- Intubation supplies: bag valve mask, suction, Macintosh and/or Miller laryngoscope blade (sizes 1 and 2), multiple pediatric cuffed endotracheal tubes (sizes 4.5, 5.0, 5.5), glidoscope, or other advanced airway devices if available.

- Adolescent non-rebreather mask and nasal cannula.
- Peripheral intravenous lines and tubing.
- Intravenous normal saline (500-cc bag).
- Medication vials: induction medications (midazolam, fentanyl, ketamine, or etomidate), paralytics (succinylcholine, vecuronium, or rocuronium).
- Broselow tape.
- Imaging studies and laboratory results.

Personnel

- Parent: The parent role can be played by a case instructor and functions to answer the participants' questions regarding the history as well as provide additional distraction. Parental inquiry often helps instructors understand why learners are performing certain actions in real time.
- Emergency department nurse: The nurse is typically played by a pediatric emergency department nurse but may also be played by a case instructor. The nurse functions in a typical nursing role and carries out actions per the learners.
- Consultants: The learners may ask for the aid of a consultant from any subspecialty. To place a consult, they may use a phone or verbalize whom they want to consult. At our institution, when a learner requests a consultant, the learner uses a working phone to call an instructor, who provides a scripted response. In some cases, the consultant may be unavailable in an effort to force the learner to make necessary decisions or perform necessary procedures.
- Case instructors: Ideally, two additional instructor are needed, one to manage the mannequin's response to treatment and one to answer questions regarding the physical exam. This second instructor should also take notes on the learners' progression through the case for the debriefing session.

Assessment

The case instructors should assess learners during the simulated case. It is helpful to take real-time notes for reference during the debrief session. Noting times and specific actions is often helpful when debriefing the learners. Special attention should be paid to learners' ability to form a team and communicate successfully. The learner evaluation (Appendix H) should be finished by the case instructors following the conclusion of the debrief session and should include peer-evaluation completion by senior fellows or residents, as the ACGME encourages coresident evaluation.

Debriefing

The recommended method for debriefing should include the debriefing questions (Appendix G) and PowerPoint presentation (Appendix I). The debriefing questions cover the most important learning elements for this case. Upon case completion, the learners and instructors should move to an area where they can comfortably discuss and evaluate case progression. Initial discussion should focus on eliciting learner opinion in regard to case discovery and overall management. Further debriefing questions can follow to prompt learners to discuss any additional learning objectives that were not explored. The didactic PowerPoint presentation (Appendix I) can be used following the debrief discussion and is designed to solidify the knowledge gained by participating in this case scenario.

Results

This module has been used with pediatric residents, emergency medicine residents, pediatric emergency medicine fellows, and pediatric emergency medicine nurse practitioners. Approximately 30 learners have completed this module during seven separate sessions.

Following debriefing, we collected both verbal and written feedback regarding this case. All learners felt the case provided the opportunity to identify HSP as well as to manage a serious and rare complication of the disease. Learners did not offer additional recommendations for improvements. All learners stated that

after participating in this case and going through the PowerPoint presentation, they were more comfortable recognizing HSP and its presenting symptoms as well as more aware of the myriad associated common and more rare complications. Additionally, learners benefited from a review of rapid sequence intubation. All learners felt this case was appropriate for their level of learning and that the debrief session added to their overall understanding of the case. All learners felt strongly that participating in this case increased their confidence, comfort level, and knowledge about HSP.

Every group had a simulation evaluation completed by at least the lead instructor. We observed the following deficits amongst learner groups:

- Failure to recognize rash: Two learner groups did not realize that this rash was consistent with HSP. During the debrief session, the learners expressed that they thought the rash looked petechial and therefore treated this patient for sepsis. Thus, the patient received a significant amount of IV fluid and deteriorated rapidly, requiring intubation for the wrong reason. In the event of misinterpretation of the patient's presenting symptoms, specifically, the rash, it is very important to discuss the appearance of the rash and abdominal pain to emphasize why this case is classic for HSP.
- Failure to form a team: Most groups did a good job forming a team and had appropriate management of the airway.
- Failure to fully provide disposition for the patient: Only about half of the groups created a disposition for the case, and almost all groups improved the patient's condition.

Discussion

All levels of learners have found this simulation interesting and helpful in achieving the goals set forth by the case. The design of the case required several reiterations from the actual patient's presentation. While the history, physical, and all lab results and radiographs come directly from the patient's chart, we had to alter the airway management from the actual case presentation so learners would progress to intubation during the initial presentation. We accomplished this by increasing the respiratory rate, verbalizing the work of breathing (if asked), and maintaining hypoxia.

Utilizing actual patient pictures from the emergency department makes this case unique. This patient had an uncommon presentation of a common pediatric illness. Learners realize that the rash associated with HSP does not always have to be flat; as in this case, it can be fluid filled. The diagnosis of HSP is made by recognition of a clinical pattern, which includes a characteristic. If a learner is unable to recognize HSP based on the rash and abdominal pain, the learner will not be able to treat the patient as effectively. The learner may fail to consider that a patient with HSP may have concurrent intussusception or pulmonary difficulties. In order to think about these associations, learners have to know the underlying diagnosis.

Another objective is for the learner to recognize respiratory failure and perform intubation. This case allows learners to perform an uncomplicated rapid sequence intubation. It also allows evaluators to gauge residents or fellows in regard to airway skills as set forth by the ACGME. Repetitive practice behaviors regarding intubation, especially on pediatric patients, increase skills to mastery.

One limitation for the session is that the postscenario evaluations are based on the learner's satisfaction. The evaluation form asks only six questions, all of which are based on learner feedback and interpretation of the case. The evaluations are anonymous, which helps reduce bias and provides more opportunity for giving negative feedback, but does not allow us to explore learners' thoughts in regard to their comments.

Overall, we have had positive feedback from the learners about this case, and it has provided them the opportunity to see more rare complications during their training period. No changes are currently planned. Learners leave the session with enhanced knowledge of HSP as well as a review of respiratory failure and intubation.

Kelly Levasseur, DO: Associate Professor, Department of Emergency Medicine, Oakland University William Beaumont School of Medicine

Danielle Turner-Lawrence, MD: Associate Professor, Department of Emergency Medicine, Oakland University William Beaumont School of Medicine

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Ethical Approval

Reported as not applicable.

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